

EXERCISE IN GHANAIAN, POSTMENOPAUSAL WOMEN WITH AN INCREASED BODY
MASS INDEX (BMI), ABOVE 25 KG/M²

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WITWATERSRAND,
JOHANNESBURG



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DECLARATION

I, Isaac Mensah Bonsu, declare that this Thesis is my own, unaided work.

It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination at any other University.

I confirm the first lead authorship of the published articles included in this Thesis.



Isaac Mensah Bonsu

On the 15th day of August 2023

DEDICATION

To God Almighty and my parents: Mr and Mrs Mensah Bonsu. My wife (Matilda Mensah Bonsu) and daughter (Ingrid Mensah Bonsu).

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ACRONYMS AND ABBREVIATIONS

BMI	Body mass index
CDC	Centers for Disease Control and Prevention
CVD	Cardiovascular disease
FGD	Focus group discussion
GSS	Ghana statistical service
HBM	Health Belief Model
HC	Hip circumference
HDL	High-density lipoprotein
LDL	Low-density lipoprotein
NCDs	Noncommunicable diseases
OPD	Outpatient department
PA	Physical activity
PMW	Postmenopausal women
RCT	Randomized controlled trials
SHBG	Sex hormone binding globulin
WC	Waist circumference
WHO	World Health Organization
WHtR	Waist-to-height ratio
WHR	Waist-to-hip ratio

OPERATIONAL DEFINITIONS

Menopause: is one point in a continuum of life stages for women and is deemed to have occurred after 12 consecutive months without menstruation and marks the end of their reproductive years (WHO, 2000)

Postmenopausal: Post menopause is the phase that occurs after menopause and continues for the rest of a woman's life (Lurati, 2017).

Excess weight: A combination of overweight and obesity is an abnormal or excessive fat accumulation that presents a health risk. A body mass index (BMI) over 25 is considered overweight, and over 30 is obese (WHO, 2000)

PUBLICATIONS AND CONFERENCE PRESENTATIONS ARISING FROM THIS STUDY

Published manuscripts

1. Mensah Bonsu, I., Myezwa, H., Brandt, C., Ajidahun, A.T., Moses, M.O. and Asamoah, B., 2023. An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana. Plos one, 2023, 18(1), p.e02789352023. <https://doi.org/10.1371/journal.pone.0278935>
2. Bonsu, I.M., Brandt, C., Ajidahun, A.T., Moses, M.O. and Myezwa, H., 2023. Prevalence of excess weight and associated socio-demographic factors among postmenopausal women: A population-based study in Ghana. African Journal of Primary Health Care & Family Medicine, 2023, 15(1), p.7. <https://doi.org/10.4102/phcfm.v15i1.3781>

Manuscripts under review

Manuscripts titles	Submitted	Post-review corrections
Physical activity, lifestyle, sociocultural factors and prevalence of excess weight gain among postmenopausal women; a cross-sectional study.	Women's health SAGA publication.	√
A culturally adapted exercise program for postmenopausal women with excess weight gain: A modified international/local Delphi study	BMC Women's Health	√
Effect of a culturally adapted exercise program on the anthropometrics and body composition of postmenopausal women with excess weight gain: A randomized controlled trial	International Journal of Public Health (IJPH)	√

Conference presentation

1. SASP congress 2022 – “Physiotherapy in the 21st Century: A Metamorphosis” (Oral presentation): An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana. 16-18 September, 2022, Stellenbosch

ABSTRACT

Postmenopausal women frequently experience weight gain in addition to an increased tendency for central fat distribution. The development of metabolic syndrome and systemic inflammation caused by excess body weight (overweight and obesity), particularly in the form of visceral fat deposition in postmenopausal women, increases the risk of cardiovascular disease, diabetes, and mortality. The reported high prevalence of excess weight among Ghanaian postmenopausal women generated an inquiry into the experiences of postmenopausal women with excess weight gain. This study aimed to develop and test the effect of a culturally adapted exercise-based programme for weight loss in Ghanaian postmenopausal women. The study used a mixed-method approach with five studies to address the study's aim. A quantitative study was conducted to determine the prevalence of excess weight gain and associated socio-demographic risk factors among postmenopausal women. The results showed a high prevalence of excess weight gain of 73.2%, 91.8%, and 91.0% using body mass index (BMI), waist-to-height ratio (WHtR) and waist-to-hip ratio (WHR) respectively among 378 women. Education and ethnicity were the predictors of excess weight gain (WHR) among the participants. Despite the extensive body of research on an exercise program for weight loss, these results suggest gaps in weight management. Physical activity, lifestyle, and sociocultural levels of the women were investigated quantitatively to determine contributing factors associated with the high prevalence of excess weight gain. The results showed that the majority (55.2%) of the participants had 1 to 2 days per week of moderate physical activities for 1 to 20 minutes per day during the last 7 days. This finding showed that participants are not meeting the physical activity recommendation of 150-300 minutes of moderate-intensity per week for older adults by World Health Organization (WHO) guidelines on physical activity and sedentary behaviour. Housewives and unemployed participants had a higher risk of weight gain, especially when assessed with WHR

and WHtR. Most participants (59.7%) had poor eating habits and cultural beliefs regarding body size impacts their decisions regarding weight loss

A qualitative study was conducted with the study group of postmenopausal women with excess weight, twenty-four participants, and four focus group discussions (FGD), to explore their current weight management approaches or practices. From the analysis of FGD, three major themes emerged from the study namely, (i) perception of body weight, (ii) measures to reduce body weight, and (iii) support for adherence to the weight management program. Sub-theme under the perception of body weight revealed that weight gained was viewed as the presence of diseases and admired by society as a culturally accepted body image. Diet-related changes, a combination of diet modification and physical activity, and weight management supplements emerged as measures to reduce excess weight. Support for adherence to the weight program included health education, access, affordable exercise facilities, and social support.

Based on literature reviews and findings from the three studies conducted as part of the project, a culturally appropriate exercise programme for weight loss was developed and validated by the Delphi study. A Delphi consists of three rounds among international (twelve) and local (twenty-one) experts with a high participation rate of 33 (80.5%) of the 41 participants was conducted. A consensus was reached on all the thirty-two (32) items related to health assessment, pre-exercise parameters, exercise dosage and physician referral after the third round.

The developed culturally informed exercise-based weight loss programme was tested using a single-blind randomized controlled trial. A total of 226 postmenopausal women were randomized into exercise (113) and control (113). Anthropometrics (BMI, WHR, WHtR WC, HC and body weight) and body composition (body fat, visceral fat, muscle mass) were measured pre and post-12-week intervention. Using a repeated-measures linear mixed model, the evidence from the analysis

demonstrates that except for waist-to-hip ratio (WHR), there were statistically significant reduction in body weight, BMI, WHtR, visceral fat, and total body fat in the exercise and control groups. Muscle mass increased significantly (+0.21 kg), whereas hip circumference (-2.46 cm) and waist circumference (-1.39 cm) decreased significantly compared with the control group. Within the exercise group when stratified by BMI, there were higher reductions in BMI (1.01kg/m² vs. 0.46kg/m²), WC (2.18cm vs. 0.22cm), body weight (2.12kg vs. 1.17kg) and body fat (1.84% vs 1.6%) in obese women compared to overweight women. Weight loss programmes should be traditionally induced within the specific setting to encourage full participation and reduce the dropout rate. Implication for health professionals to prescribe physical activity in postmenopausal women's treatment plan.

In conclusion, the findings resulting from this research may improve health providers' cultural awareness and knowledge. This project is expected to help healthcare professionals improve the care given to postmenopausal women with weight excess to decrease the incidence of morbidity and mortality. It is anticipated that this initiative could direct the development of a modified culturally-sensitive weight loss programme for women in different stage in life and use with other ethnic groups.

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To my God, Creator and Helper. Thank you for your mercy grace and favour throughout this journey.

FORMAT OF THE THESIS

The Thesis structure follows the integrated format outlined in the University of the Witwatersrand's Faculty of Health Sciences guide for PhD thesis formats.

Chapter 1: The introduction chapter will outline the background information of the study, the study conceptual framework, the rationale for the study, presents the study objectives, and the study's significance.

Chapter 2: The literature review chapter describes the epidemiology of excess weight in postmenopausal women, and outlines the related concepts, namely weight gain in post-menopause (Definition of postmenopausal women, predictors of weight gain, pathophysiology, and risk factors of weight gain) and weight loss interventions (lifestyle modification, exercise program)

Chapter 3: This chapter presents the study methodology.

Chapter 4: This chapter is presented as a published paper titled “Prevalence of excess weight and associated socio-demographic factors among postmenopausal women: a population-based study in Bono East (Techiman) region of Ghana”. This paper is in press in the *African Journal of Primary Health Care & Family Medicine*.

Chapter 5: This chapter presents the physical activity, lifestyle, sociocultural factors and prevalence of excess weight gain among postmenopausal women; a cross-sectional study. This paper was submitted to the *Women's health SAGA publication* and is currently under review.

Chapter 6: This chapter is presented as a published paper titled “An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana”. This paper was published in *PLOS ONE Women's health*.

Chapter 7: This chapter presents a culturally adapted exercise program for postmenopausal women with excess weight gain: A modified international/local Delphi study. This paper was submitted to the *BMC Women's health Journal* and is currently under review

Chapter 8: Chapter 7 presents a manuscript on the effect of a culturally adapted exercise programme on the anthropometrics and body composition of postmenopausal women with excess weight gain: A randomized controlled trial submitted to the *International Journal of Public Health (IJPH)* and is currently under review.

Chapter 9: In this chapter, the study findings are discussed based on the health belief model.

Chapter 10: The conclusion and study implications are outlined. The study limitations and strengths of the study are outlined.

1. CHAPTER ONE: BACKGROUND OF THE STUDY

This chapter describes the need and the justification for this study. The theme of excess weight gain among postmenopausal women is highlighted. The need for research to be done to understand the culturally specific perceptions about weight gain and its important implications for the design and success of weight management programmes for an ethnically diverse country like Ghana is also outlined. The chapter outlines the background of the research, problem statement, research question, aim, objectives, and significance of the study, a theoretical and conceptual framework of the research as well as the methodological process of the research.

1.1.Introduction

Women's body weight tends to steadily increase from 20 to 60 years of age with the greatest increase in weight occurring shortly after menopause or during the fifth decade (Peterson and Ward-Smith, 2012). Menopause is the cessation of menstruation and reproduction which is a recognized physiological event in women's lives. It is considered the most important phase of a woman's life according to Im et al., (2010). A woman who has not experienced a menstrual period within at least 12 months retrospectively is deemed to have entered the phase of menopause which also indicates the start of the postmenopausal period (Vandenakker and Glass, 2001; Croarkin, 2001, Siegel, 1998). Due to the improvement in life expectancy, there is a significantly increased number of postmenopausal women presently (Park et al., 2014), thus the postmenopausal period has attracted special attention (Sharifi et al., 2020). As the proportion of postmenopausal women within the general population keeps increasing (Al-Safi et al., 2015), there is a need to investigate, the physiological changes associated with the menopausal transition.

The World Health Organization (WHO) defines excess weight as an abnormal or excessive fat accumulation that may have negative health effects (WHO, 2016). Sudden estrogen deprivation at

menopause is characterized by increased abdominal subcutaneous and visceral fat without a commensurate change in physical activity or total body weight (Franklin et al., 2009). Postmenopausal women experience fat redistribution among different fat depots in the body: from subcutaneous to intra-abdominal visceral depots (Tchkonina et al., 2010), increasing abdominal circumference (Koutsari et al., 2009). Menopause-associated change in body composition is seen across ethnicities, in non-obese as well as obese women (Abdulnour et al., 2012). The development of metabolic syndrome and systemic inflammation caused by excess body weight, particularly visceral fat deposition in postmenopausal women, increases the risk of cardiovascular disease, diabetes, and mortality (Stachowiak et al., 2015). Although more than half of women try to lose weight after menopause, the majority of individuals gain 30–50% of the weight lost over the following years, increasing their risk of contracting diseases associated with obesity (Mann et al., 2007, Beavers et al., 2013). According to literature, successful weight maintenance remains difficult for obese postmenopausal women and other obese people who are trying to maintain their weight loss after dieting (Bajerska et al., 2020). Numerous compensatory mechanisms make maintaining a new, lower weight difficult (Blomain et al., 2013, Greenway, 2015, Ochner, et al., 2013). The challenges associated with weight management undermine interventions for successful weight loss approaches (Bajerska et al., 2020).

The majority of the research to date supports the idea that weight gain in postmenopausal women is mainly due to ageing and lifestyle alteration, and the menopause does not lead to substantial weight gain after adjustment for ageing (Karvonen-Gutierrez & Kim, 2016). Leeners et al. (2017) documented that there is a minimal net effect on weight linked to menopause alone because estrogen loss after menopause causes a decrease in lean body mass in addition to an increase in total body fat.

In postmenopausal women, the circulating estradiol (E2, or 17 β -estradiol) levels drop significantly to 10 pg/mL (Cervellati and Bergamini, 2016) with an average level of total estrogen of 100-250 pg/mL (Dewailly et al., 2016) contributing to these changes in body composition. Additionally, various studies have shown that women tend to put on weight as they age, irrespective of their menopausal status (Karvonen-Gutierrez & Kim, 2016, Wang et al., 1994, Demerath et al., 2011). An increase in weight is driven by physiological changes that occur with ageing and lifestyle changes (Kapoor et al., 2017). Lean body mass declines with age, which decreases the resting metabolic rate (Poehlman et al., 1995). Between the ages of 20 and 75, muscle mass and strength might decrease by as much as 30% (Fleg & Lakatta, 1988, Janssen et al., 2000). Most of the latter changes occur after menopause (Lindle et al., 1997, Calmels et al., 1995). Adiposity increases and bone mass declines in addition to a reduction in muscle mass (Franklin et al., 2009, Flegal et al., 2012, Hughes et al., 2002, Sehl & Eugene Yates, 2001). Additionally, ageing is linked to a decline in physical activity (PA), which may be gradual and difficult for an individual to perceive (Lovre et al., 2017). The decrease in physical activity level according to literature further compounds the decrease in lean body mass (Douchi et al., 2002). A study by McTiernan et al. (1998) among women aged 50 to 64 years revealed that only half of the participants engage in regular physical activity, and only one-fourth reported high-intensity physical activity. Age-related decreases in basal and total energy expenditure can lead to a situation of positive energy balance, which is associated with weight gain unless a woman modifies her caloric intake and/or actively increases her PA level (Kapoor et al., 2017). Despite empirical evidence on weight gain in the postmenopausal stage, there is limited research on appropriate intervention within a cultural context.

1.2.Problem Statement

Weight gain accompanied by an increased tendency for central fat distribution is common among women in midlife (Franklin et al., 2009). Many studies among different population groups have revealed that personal views and perceptions of body size influence decisions about weight gain (Sotoudeh et al., 2008; Okop et al., 2016). In some cultural settings, body size and weight could be associated with norms and expectations of appearance (Caradas et al., 2001). According to Aryeetey (2016), there is a sturdy positive perception of weight gain originating from factors such as personal interest, and societal and marital partners' expectations that also influence women's perception of their weight. Individual and community perceptions have been noted to influence the choices about physical inactivity and diets (Dawkins et al., 2010), which are significant determinants of excess weight.

The opinion of weight gain is culturally influenced by means of stating that increased body weight is socially admirable and presentable (Aryeetey, 2016). Therefore, in a society where having a large physical size is valued, women who become overweight or obese would generally not be dissatisfied with their weight status (Rguibiet and Belahsen, 2003). Additionally, the traditional demand for large body size may create an environment where obesity is more likely to increase (Afriyie Appiah, 2016).

According to the American College of Sports Medicine, deteriorating lipid profiles and overall glucose tolerance increase the risk of developing chronic illnesses (ACSM, 2013). The ACSM emphasizes that blood pressure increases with age, although the resting heart rates are often stable, while the maximum heart rates and aerobic capacity decline. Despite the possibility that ageing has major physiological impacts, exercise is extremely beneficial for older women, especially those who are obese or overweight (Davenport et al., 2016). To date, there is no structured framework specific to guide postmenopausal women with excess weight regarding the prevention and control of weight

gain; especially frameworks that account for contextual factors and are population specific. The absence of a control framework has allowed the proliferation of an unregulated industry that is marketing untested and unapproved medicines for weight reduction in Ghana (Aryeetey, 2016). Unfortunately, the efficacy of these medicines has poor success rates and, thus, does not deliver the promised outcomes regarding excess weight control.

Although different guidelines have been established for older individuals and adults with weight gain (ACSM, 2013), to our knowledge exercise recommendations that are culturally adapted to address specifically the needs of postmenopausal women with excess weight gain have not yet been published. Therefore, a better understanding of Ghanaian women's perceptions of exercise and health can help direct effective, culturally-relevant exercise programmes to reduce body weight and improve the health status of postmenopausal women. In Ghana, there are responsibilities on women to support the family financially even at the postmenopausal stage, hence programme to improve the health status is imperative. Strong evidence, however, indicates that higher levels of physical exercise is needed, compared to current practices for adults to result in greater health benefits (Friedenreich et al., 2015, Kroemeke et al., 2014, Seguin et al., 2014)

1.3. Study aim

This study aimed to develop and test the effect of a culturally adapted exercise-based programme for weight loss in Ghanaian postmenopausal women with excess weight gain.

1.4. Research Questions

- What is the prevalence of excess weight among postmenopausal women in Ghana?
- What are the lifestyle, physical activity levels and sociocultural factors of postmenopausal women with excess weight gain in Ghana?
- What are the current weight management practices among postmenopausal women in Ghana?
- What is the content and agreement of a culturally adapted exercise-based intervention programme for weight loss among postmenopausal women with excess weight in Ghana?
- What is the effect of the culturally developed exercise programme on anthropometrics and body composition of postmenopausal women with excess weight?

1.5. Objectives of the Study

- To determine the prevalence of excess weight among postmenopausal women in Ghana.
- To determine the lifestyle, sociocultural and physical activity level of postmenopausal women in Ghana with excess weight gain.
- To explore current weight management practices among postmenopausal women in Ghana.
- To develop and achieve consensus on culturally-informed exercise-based intervention programme for weight loss among postmenopausal women with excess weight in Ghana
- To test the effectiveness of the culturally developed exercise-based intervention programme using the randomized controlled trial (RCT)

1.5.1 Significance of the Study

The study aimed to develop and test the effectiveness of a culturally developed exercise-based intervention programme for weight loss among Ghanaian postmenopausal women. To achieve this

aim, the study was conducted in three phases. The first phase of the study determined the prevalence of excess weight gain, physical activity, lifestyle levels and sociocultural characteristics of postmenopausal women and an exploratory study on current weight management practices among postmenopausal women with excess weight gain. The prevalence of obesity and overweight in women has been studied in low- to mid-income and high-income countries. Before this cross-sectional study, there was no literature to provide data on the prevalence of excess weight gain among postmenopausal women in Ghana. The North American Menopause Society (Shifren and Gassy, 2014) noted that by 2025 the number of postmenopausal women is projected to increase substantially, and those who are overweight and obese will presumably need additional clinical care and weight intervention. A report by Ofori-Asenso et al. (2016) on the overweight and obesity epidemic in Ghana documented a high prevalence of overweight (25.4%) and obesity (17.1%) among Ghanaian adults in Greater Accra which largely has the Ga tribe to be its inhabitants. Other studies in Ghana have explored older Ghanaian adults' perceptions of physical activity and body weight (Balis et al., 2019, Nii & Aryeetey, 2016, Tuakli-Wosornu et al., 2014). However, there is a dearth of literature on the prevalence and the levels of physical activity, lifestyle and sociocultural aspects among Ghanaian postmenopausal women with excess weight gain. Additionally, many different remedies or modalities are being used by females in their attempt to reduce their body weight (Nii & Aryeetey, 2016), nevertheless, weight management of postmenopausal women in Ghana has not been studied. Phase two of the study aimed to develop and reach consensus on culturally appropriate exercise-based intervention programme using the Delphi Technique for weight loss among postmenopausal women with excess weight in Ghana. Phase three of the study aimed to test the effectiveness of a culturally developed exercise-based intervention programme using a randomized controlled trial (RCT) among postmenopausal women. It is postulated that an exercise-based intervention programme would go a long way towards reducing the body weight of postmenopausal

women and mitigating the development of chronic diseases, including cardiovascular diseases and economically the costs of hospitalization. This is the first study in this field to develop a culturally appropriate exercise-based programme, achieved consensus on the content of the programme as well as use randomized controlled trials to test its efficacy. Future weight management programmes could employ evaluating changes in bone mass when developing an exercise-based intervention. This study provides a baseline for such an approach going forward.

In Ghana, given the devastating effects of excess weight, as well as the enormous economic burden to society, any intervention that is effective in addressing the problem of excess weight in women in the menopause transition could have a major impact (Lady Gwendoline et al., 2017).

1.6. Theoretical Framework of the Study

The theoretical framework for the study was based on the Health Belief Model (Rosenstock et al., 1994). The study was informed by the key components of the Health Belief Model. The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviours. It focuses on the attitudes and beliefs of individuals. The HBM has evolved to include six constructs: (i) perceived susceptibility; (ii) perceived severity, collectively known as a perceived threat; (iii) perceived benefits; (iv) perceived barriers; (v) cues to action; and (vi) self-efficacy. The scope of this study was to develop a culturally appropriate exercise-based program and test the effectiveness of the intervention for weight loss in Ghanaian postmenopausal women. All the stages of the Health Belief Model were used to guide the development of the culturally adapted exercise-based intervention programme (Figure 1).

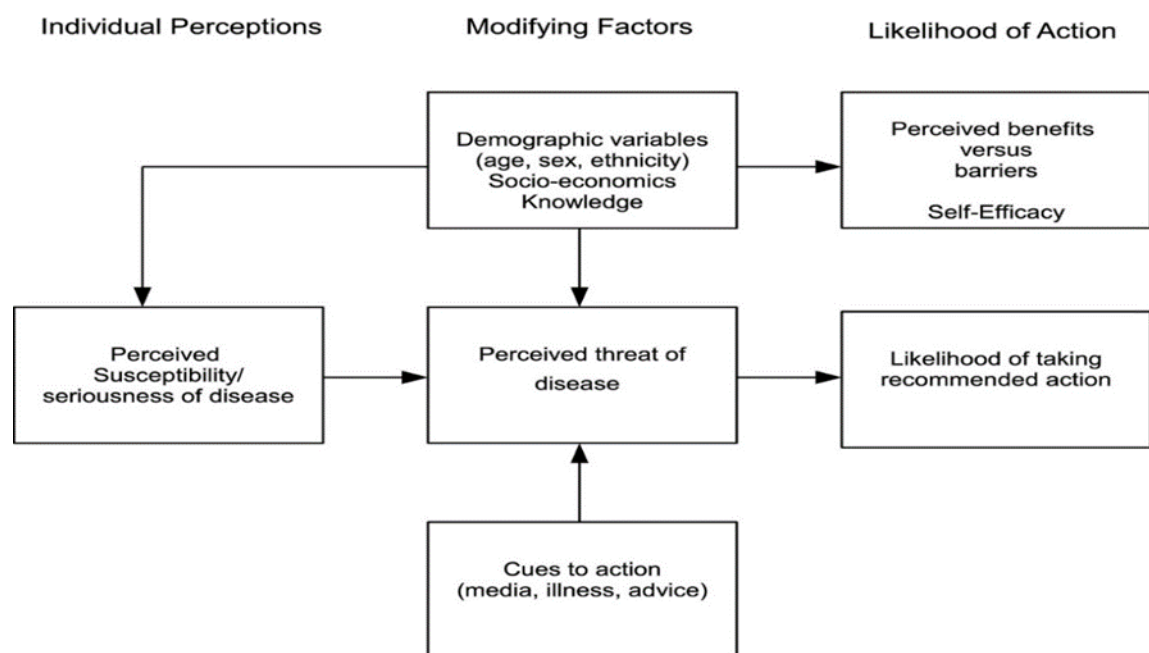


Figure 1.1 Illustrates the process of the HBM used in this study.

1.7. Conceptual Framework of the Study

The conceptual framework of this study was based on the collaboration between the first three aims of this study which included a prevalence study, lifestyle, sociocultural and physical activity audit and an exploratory study of weight management practices of postmenopausal women with excess weight gain. A focus on all three studies justified the need and the relevance of specific traditional exercise programmes targeted at reducing the body weight of postmenopausal women with excess weight.

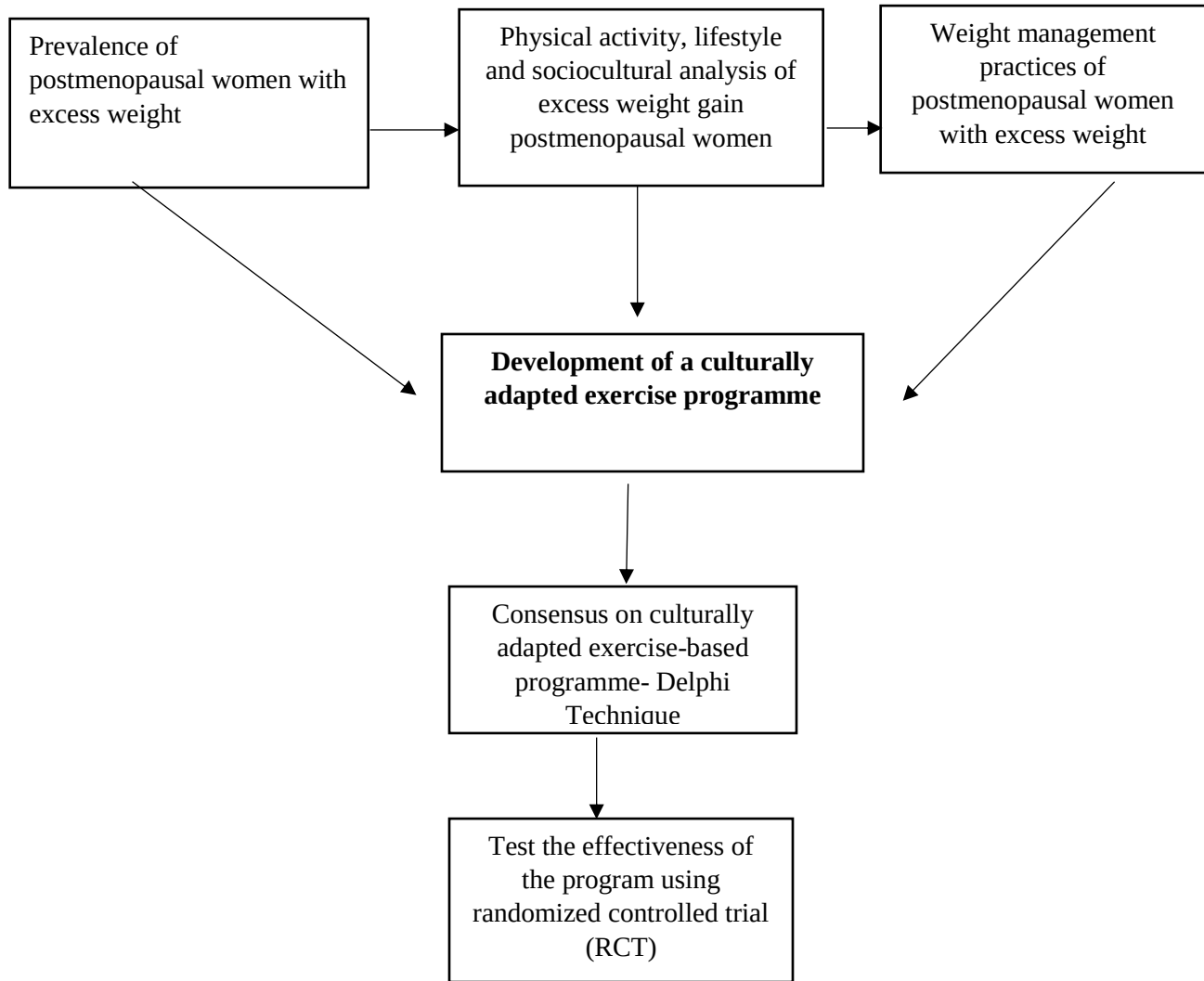


Figure 1.2: Conceptual framework of the culturally adapted exercise development process

1.8. Methodological Outline of Study

This study was divided into three phases. The first phase included the prevalence study among postmenopausal women with excess weight gain, investigating their lifestyle, sociocultural and physical activity aspects and a second exploratory study to establish current weight management

practices. The second phase was programme development using the Delphi Technique to develop and reach consensus on the content of the intervention. The third phase was a randomized controlled trial (RCT) to test the intervention programme.

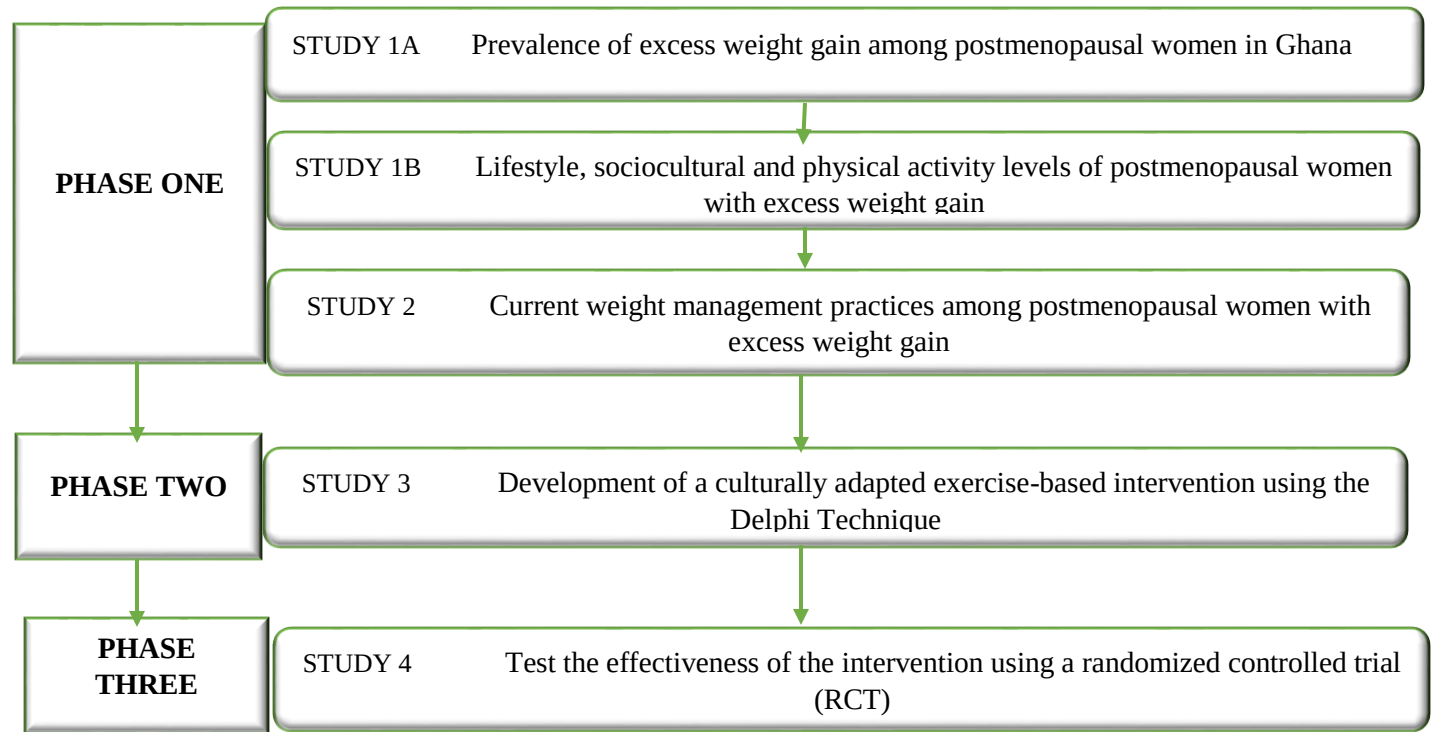


Figure 1. 3: Outlines the process of the overall study

This thesis employed five studies conducted as part of this research as well as literature to develop an exercise-based intervention programme for postmenopausal women. Before this study, exercise-based interventions for postmenopausal women were focused mainly on improving lipid profile, cardiorespiratory function and quality of life.

1.9. Conclusion

This chapter outlined the overview of excess weight and challenges in postmenopausal women. The conceptual framework for the justification of the research was outlined in this chapter. The overall

methodological process of the research and the outline of the whole thesis were also summarised. Chapter Two will discuss the current literature on excess weight in postmenopausal women, risk factors and interventions available to manage excess weight gain.

2. CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The development of metabolic syndrome and systemic inflammation due to excess body weight, particularly in the form of visceral fat deposition in postmenopausal women increases the risk of cardiovascular disease, diabetes, and mortality (Stachowiak et al., 2015). Although more than 50% of women try to reduce weight after menopause, the majority of them gain 30–50% of the weight over the subsequent years, increasing their risk of contracting diseases associated with obesity or overweight (Beavers et al., 2013, Mann et al., 2007). The high prevalence of excess weight gain amongst postmenopausal women shows the need for research. Factors associated with weight gain and developing interventions for weight loss in this population need to be investigated. The ultimate goal of the studies is to develop and test the effect of a culturally adapted exercise-based program for weight loss in Ghanaian postmenopausal women. The literature review consists of three sections covering the epidemiology of excess weight gain, weight gain in the post-menopausal period including the contextualized definition of postmenopausal women, predictors of weight gain, pathophysiology, and risk factors of weight gain) and weight loss interventions (lifestyle modification, exercise program) (Figure, 2.1)

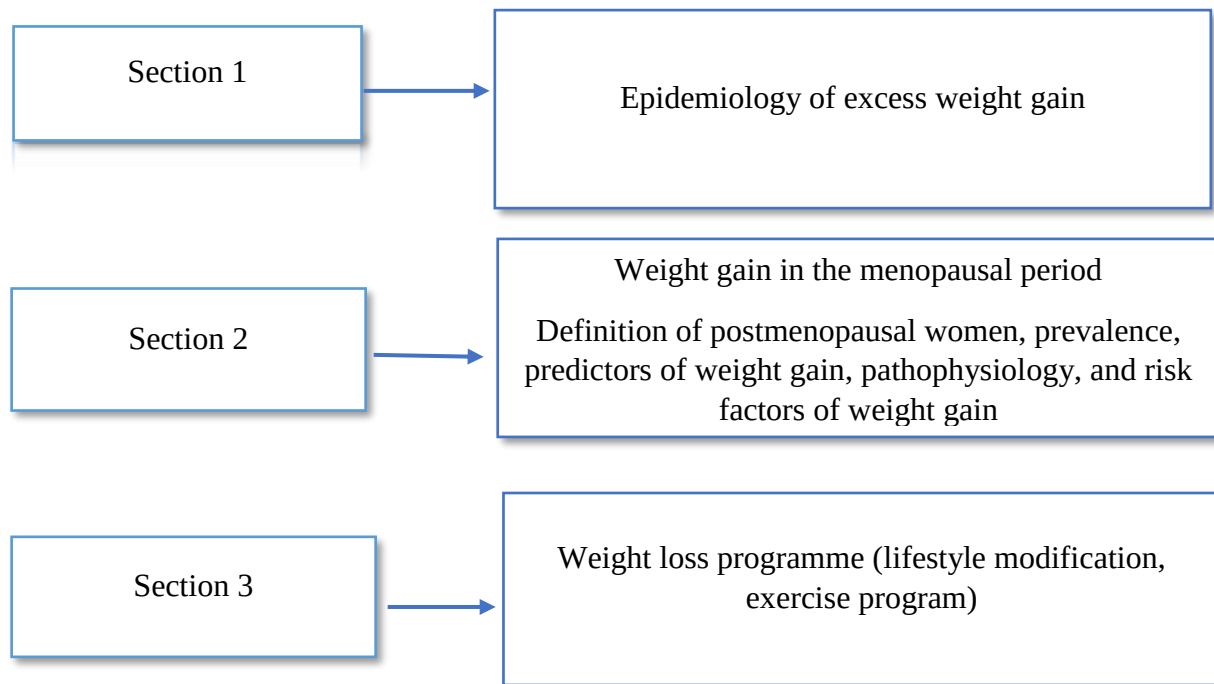


Figure 2: 1: Schematic diagram outlining the sections in the literature review

The English-language publications included in this review date from 1991 to 2022. The following keywords were utilized weight gain, postmenopausal women, pathophysiology, predictors of weight gain, and weight loss approaches. Databases such as PubMed, Google Scholar, Scopus, and Science Direct were searched.

SECTION ONE

2.2. Epidemiology of excess weight in the postmenopausal period

Epidemiological data on postmenopausal women with excess weight gain (obesity and overweight) in Ghana is scarce. The WHO estimates that there are about 300 million obese adults globally, with 115 million of this population living in developing countries (WHO, 2002). The prevalence of overweight and obesity in Ghana is estimated as 25.4% (95% CI 22.2–28.7%) and 17.1% (95% CI =14.7–19.5%), respectively. Amugsi and colleagues (2017) analysed the prevalence of excess weight gain (overweight and obesity) among non-pregnant women aged 15–49 years in 24 African countries

from 1991 to 2014. The survey concluded that apart from Egypt with the highest prevalence of overweight (44%) and obesity (39%), Ghana is second highest with an overweight prevalence of 30% and an obesity prevalence of 22%. (Amugsi et al., 2017). A systematic review by Ofori-Asenso et al. (2016) and Commodore-Mensah et al. (2014) showed similar results. The studies reported overweight/obesity prevalence in Ghanaian adults as 43% and within the range of 20-62% respectively. Ofori-Asenso and the authors (2016) also observed increases in the prevalence of overweight and obesity between 1998 and 2016 in Ghana. Ghana Statistical Service (GSS) (2015) contributed to the understanding of the emerging prevalence of overweight and obesity in Ghana. The service revealed that the burden of overweight and obesity falls mostly on women as the prevalence of overweight and obesity increased from 25% in 2003 to 40% in 2014 among women of reproductive age (Ghana Statistical Service, 2015). In all the previous studies, the prevalence rates did not fully describe the adult population. Women of reproductive age were included in the studies without emphasis on postmenopausal women. Therefore, there is an urgent need to strengthen the surveillance of weight gain in postmenopausal women and develop public health intervention measures that are culturally sensitive in the Ghanaian context.

There are diverse views about the contributing factors to an increase in postmenopausal adiposity. Jung, et al. (2015) suggested that the factors associated with an increase in weight gain encompass physiologic, metabolic, psychosocial, genetic and behavioural characteristics. A study by Hill et al. (1998) revealed that the increasing prevalence of weight gain is not due to genetic variation but to the effects of environmental factors impacting genetic susceptibility. Other previous studies have also linked weight gain in the menopausal stage to medications used to manage hormonal and physical changes, such as antidepressants and hormone treatments (Stanford et al., 2020, Reid et al.,

2014, Serretti et al., 2010). However, while two studies conducted in Africa (Urban Ghana and Kenya and forty Sub-Saharan Africa) attributed the overweight/obesity prevalence to globalization, urbanization, and the nutrition transition (Abrahams et al., 2011; Rousham et al., 2020), some studies in Ghana and other African countries have demonstrated an association of the high overweight/obesity prevalence among women to sociocultural beliefs and socioeconomic status. (Aryeetey, 2016; Tuoyire et al., 2018, Pradeilles et al., 2021 and Asosega et al., 2021). Besides the social-cultural perceptions linked to an increase in the prevalence of body weight, there is an established association between wealth, parity and overweight or obese status among women (Kim et al., 2007). Studies (Price et al. 2018, Diendéré et al. (2019) and Kim et al. (2007) observed a significant positive association between overweight and parity in wealthy women in developed countries. However, in the same study, a negative relationship was also observed between poor women and overweight and accounted for the wasting effect on women. The different views of the reported contributing factors that increase the overweight/obesity prevalence remain inconsistent. These diverse views could be due to differences in study designs, analysis, or varying control of confounding variables that contribute to inconsistent findings. Studies have not documented the exact causative factors leading to the rapid rise in the overweight/obesity prevalence in postmenopausal women. Given the emerging health challenges associated with excess weight gain (Ofori-Asenso et al., 2016; Steyn & Mchiza, 2014), future studies will need to explore the actual factors contributing to the increased prevalence of weight gain in postmenopausal women.

2.3. The Postmenopausal phase

One of the most important concerns women are facing is ageing, which is defined by a variety of changes that have an impact on their health (Akwa et al., 2017). Among all the changes women experience during their reproductive years, the menopausal phase has long been acknowledged as having the most severe and varied set of symptoms (Nikpour & Haghani, 2014). According to Lurati (2017), menstruation may become irregular and fertility declines during perimenopause, which comes before menopause. Women are said to have entered the menopausal phase when their ovarian main function and hormone production (estrogen and progesterone) permanently stop after twelve consecutive months of amenorrhea. (Lurati, 2017, Avis et al., 2015, Borud et al., 2010; Staessen et al., 2001). Post-menopause is the period that follows menopause and remains for the rest of a woman's life (Lurati (2017). Although studies illuminate that the majority of women experience menopause at a mean age of 51 years (Perry et al., 2015, Broekmans et al., 2007, Skrzypczak et al., 2007, Velde and Peter, 2002), a study by Kwawukume et al., (1993) concluded that the mean age of menopause for women in Ghana is 48 years. Therefore, Ghanaian women may experience menopause in the early stage of their life. Menopause is an extremely relevant period throughout every woman's life when a variety of changes to metabolism, physiology, and mental and general physical health take place (Bălan et al., 2020, Dmitruk et al., 2018). These changes in the menopausal stage are a consequence of a reduction in estrogen or a prolonged estrogen deficiency which can lead to physical and psychological disability (Brzezinski, 2019). The postmenopausal stage is associated with chronic conditions such as cardiovascular diseases, osteoporosis, abnormalities in lipid profiles, vasomotor symptoms (hot flushes, night sweats) and weight gain due to lack of estrogen (Al-Safi & Polotsky, 2015, Rebbeck et al., 2010). The experience of the early menopausal period among Ghanaian women emphasizes the need to evaluate health status and develop health care management interventions for this population.

2.4. Pathophysiology of weight gain

Several hormonal changes are linked to menopausal conditions (Knight et al., 2021). The most significant of them is the reduction in estrogen levels in the blood, which causes several physiological changes including vaginal atrophy, loss of urogenital tissue support, and bone loss (Knight et al., 2021). Estradiol (E2) and estrone (E1) levels decrease substantially, which facilitated these changes (Lentz et al., 2012). Peripheral aromatization continues to produce estrone as the ovary's production of estradiol decreases. However, androstenedione and testosterone are still made by the ovary. Higher amounts of free androgens result from a decline in ovary function and the amount of sex hormone-binding globulin (SHBG) (Lentz et al., 2012). In postmenopausal women, an increase in the prevalence of type 2 diabetes and cardiovascular disease is associated with a decline in SHBG. Increased central adiposity and a low SHBG are risk factors for metabolic illness. The rapid rise in total cholesterol in this population is accounted for by a rise in low-density lipoprotein cholesterol (LDL-C) (Lentz et al., 2012). High-density lipoprotein (HDL) cholesterol levels also tend to decline throughout this time (Lentz et al., 2012). In postmenopausal women, these alterations have harmful cardiovascular implications (Lentz et al., 2012). Additionally, linked to postmenopausal conditions are increases in total body weight (Lentz et al., 2012). Women gain an average of 0.5kg per year throughout the menopausal transition, according to Kapoor et al. (2017). Although average weight gain varies considerably, 20% of women during this transitional period gain 4.5kg or more (Wing et al., 1991). Although it has not been demonstrated that the overall rise in body weight is related to hormonal status changes, it does seem to be linked to ageing and a decline in energy expenditure (Davis et al., 2012, Al-Safi & Polotsky, 2015). Additionally, menopause is linked to increased visceral and subcutaneous adipose tissue deposition in the abdomen (Lovejoy et al., 2008). Estrogens cause subcutaneous adipose tissue deposition to build up in the gluteal and femoral regions of premenopausal women (Lovejoy et al., 2008). It has been demonstrated that this gynoid distribution

has benefits and cardio metabolic consequences, including reduced insulin resistance (Lentz et al., 2012). Androgens are responsible for the buildup of subcutaneous fat in the abdomen, a metabolically unfavourable area. This central fat accumulation is related to more metabolic and cardiovascular conditions, less physical activity, and lower quality of life (Davis et al., 2012). Relative hyperandrogenemia develops after menopause due to an increase in circulating follicle-stimulating hormone (FSH) and a reduction in circulating estradiol while androgen levels are maintained (Kozakowski et al., 2017). The levels of bio-available androgens also rise during the menopausal transition due to the decrease in SHBG synthesis (Donato et al., 2006). With adipose tissue accumulating mostly in the abdominal region, this component causes a change in body composition that is characterized by an android fat distribution (Lentz et al., 2012). It has been demonstrated that the relationship between estrogens and central adiposity in postmenopausal women is bidirectional, indicating that increasing central adiposity may also result in rising estrogen levels (Lentz et al., 2012). Furthermore, postmenopausal women who have gained weight had estrogen levels higher than non-obese women but lower than pre-menopausal women (Lentz et al., 2012, Kapoor et al., 2017). However, no evidence suggests that these peripherally produced estrogens have any beneficial cardio metabolic benefits, such as lowering insulin resistance and the risk of developing diabetes and cardiovascular disease (Kozakowski et al., 2017, Leeners et al., 2017). This association also changes as the menopausal transition progresses, with higher future estradiol levels seen in late menopause as opposed to earlier menopause's lower levels (Wildman et al., 2012). Various authors have shown that antidepressants such as selective serotonin reuptake inhibitors (SSRIs) and serotonin and norepinephrine reuptake inhibitors (SNRIs), as well as hormone therapies, have been demonstrated to significantly increase weight gain in addition to these physiological and hormonal alterations (Stanford et al., 2020, Reid et al., 2014, Serretti et al., 2010). Outlining the pathophysiology of weight

gain in postmenopausal women highlights the need for strategic prevention and management interventions in this population.

2.5. Risk factors for weight gain

The World Health Organization (WHO) defines excess weight (overweight and obesity) as an abnormal or excessive fat deposition that may have negative health effects (Kozakowski et al., 2017). Abdulnour et al. (2012) reported that the major cause of death in postmenopausal women is cardiovascular disease, which is linked to excess weight and increased central body fat, particularly visceral fat. Previous studies have shown that weight gain in post-menopausal women contributes to several diseases, including diabetes, cardiovascular disease, and several types of cancer (Colombel & Charbonnel, 1997, Krueger et al., 2014). A study by Lobo and the authors (2014) documented that the development of insulin resistance and type 2 diabetes in postmenopausal women appeared to be particularly affected by the accumulation of abdominal fat. An abnormal lipid profile with an increase in low-density lipoprotein cholesterol and a decrease in the ratio of total cholesterol to high-density lipoprotein cholesterol is frequently one of the adverse consequences in this group (Al-Safi & Polotsky, 2015). According to the literature, the level of BMI has a substantial impact on the number of adverse effects it has on one's health (WHO, 2016). For instance, those with a BMI of 25.0 to 29.9kg/m² (described as overweight) have an elevated risk of comorbidities, and those with a BMI of greater than 30kg/m² have a moderate to severe risk of comorbidities (WHO, 2016, Abdulnour et al., 2012). Most of the studies that highlighted the risk factors associated with weight gain in the postmenopausal stage were cross-sectional, making it challenging to make a causal inference. A longitudinal mixed study approach is needed to track the development of weight gain in postmenopausal women, identify factors influencing the development of weight gain and understand

the experiences over time. A better understanding and identification of the risk can inform preventive strategies.

2.6. Weight loss interventions/program

Given that cardiovascular disease is the leading cause of death in postmenopausal women, the importance of weight management in midlife cannot be overemphasized (Kapoor et al., 2017).

The literature will focus on the ‘lifestyle modification’ measure of weight reduction. Dietary changes, physical activity, behavioural adjustments and support are the three elements of a successful weight loss program (McGuire et al., 1999).

2.6.1. Dietary Modification

It has been debatable whether a low-fat, low-carbohydrate, or high-protein diet is effective for losing weight (Thom & Lean 2017). At this stage, there do not seem to be significant differences between diet plans for maintaining weight loss (Sacks et al., 2009). Two studies reported that as long as individuals follow the hypocaloric dietary plan, they can lose weight with a variety of calorie-restricted diets, regardless of the macronutrient composition. (Dansinger et al., 2005, Nordmann et al., 2006). Thom & Lean (2017) conclusively demonstrated that calorie restriction is essential for weight loss. However, when making dietary recommendations for weight loss, Thom & Lean (2017) added that it is important to take into consideration the variation of an individual’s capacity for adhering to a certain diet. The Obesity Society and the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Jensen et al., 2014) suggest a daily caloric deficit of 500 to 750 kcal, which corresponds to a caloric intake of 1200 to 1500 kcal/d for the majority of women to result in an average weight loss of 0.5 to 0.75 kg/week (Alamuddin et al., 2016). The same study concluded that the macronutrient composition of weight reduction diets may

have an impact on cardio metabolic risk even though it has no bearing on weight loss (Alamuddin et al., 2016). A previous study commented that low-carbohydrate diets may result in higher improvements in triglyceride and high-density lipoprotein cholesterol levels compared to low-fat diets for low-density lipoprotein cholesterol (Thom & Lean 2017). However, the differences are negligible, and the health benefits primarily come from weight loss induced by calorie restriction. (Thom & Lean 2017). Furthermore, the Mediterranean diet deserves special notice because it is suitable for weight loss and has been conclusively proven to lower the risk of cardiovascular disease (Mancini et al., 2016). This diet has an emphasis on plant-based foods, such as fruits, vegetables, whole grains, nuts, and legumes, as well as modest fat consumption (Thom & Lean 2017). Emerging evidence indicates that any long-term weight loss and weight control plan must reduce calorie consumption from baseline, irrespective of the specific dietary method (Thompson et al., 2007). This may be implemented by decreased consumption of fat and processed food, smaller food sizes, and increased energy density (Thompson et al., 2007). Several studies have provided evidence to illuminate that combining diet with exercise-induced weight loss will provide a more favourable body composition (BMI, waist circumference and body fat levels) (Asikainen et al., 2004, van Gemert et al., 2015, Andreou et al., 2011, Curioni & Lourenco, 2005). Results of a randomized controlled trial conducted by Blumenthal et al. (2010) showed that for a person with excess weight gain with unstable blood pressure, a diet with exercise-driven weight loss led to substantially larger blood pressure declines, better vascular and autonomic function improvements, and decreased left ventricular mass. Therefore, further research is required to determine the ideal macronutrient composition for postmenopausal women with weight gain.

2.6.2. Behavioral support and changes

A lifelong commitment to healthy lifestyle practices is the goal of weight control, which involves modifying behavior (Kapoor et al., 2017). Kapoor and colleagues (2017) emphasized that a key element of weight loss programs is psychological support that focuses on identifying barriers to change, monitoring habits, problem-solving, planning, and reinforcing. Depending on the individual's requirements, choices, and resources available, this counselling may be pursued in individual or group sessions. Additionally, it's essential to address psychological problems like depression and anxiety, which can make it difficult for a patient to maintain a healthy lifestyle (Kapoor et al., 2017). Similarly, women should undergo screening for stress and sleep disorders, and suitable management techniques should be provided. Health professionals in the clinical psychology unit can provide support for successful weight loss.

It is necessary to adjust some habits for the rest of one's life because obesity/overweight cannot be treated, only managed (Dubnov et al., 2003). While temporary weight loss is very simple to achieve, behavior plays a major role in maintaining the newly reduced body weight (McGuire et al., 1999). In essence, modifying daily behaviour include decreased food intake and increased physical activity thus assisting the two other arms of lifestyle modification (McGuire et al., 1999). Regular physical activity, a spouse, social support, feeling in control of one's eating behaviour, and refraining from eating when under emotional stress all appear to play significant roles when examining the behavioural patterns of people who have successfully maintained their decreased weight (Lavery et al., 1993). This could be an indication of increasing health awareness among this population

2.6.3. Physical Activity

According to studies, women who increase their physical activity (PA) after menopause had a lower tendency to increase weight compared to their fewer active colleagues. (Sternfeld et al., 2004, Williamson et al., 1993). Dubnov et al. (2003) describe the physical activity as a key to weight loss and weight maintenance. The study further commented that the majority of obesity-related problems can be reduced by PA; a conclusion that is usually established to be accurate independent of weight loss. The Obesity Society and obesity guidelines from the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Jensen et al., 2013) recommend 150 to 175 minutes of physical activity such as brisk walking or similar aerobic exercise per week for weight loss (Alamuddin et al., 2016). Furthermore, data from the Kapoor et al. (2017) study show that women with weight gain should be informed that increasing physical activity without also reducing calories is unlikely to result in initial substantial weight loss and vice versa (Kapoor et al., 2017). The same study mentioned that persistent caloric deprivation results in reduced energy expenditure and basal metabolic rate, thus contradicting the benefits of lower calorie intake (Kapoor et al., 2017). As a result, maintaining body weight requires a rigorous exercise program (Sternfeld et al., 2004). Resistance training is most beneficial since it increases lean body mass, which raises basal metabolic rate and energy expenditure (Kapoor et al., 2017). Independent of its consequence on weight reduction, resistance exercise enhances body composition by preserving lean body mass and modifying the central fat distribution profile (Kohrt et al., 1992). Even in the absence of actual weight loss, regular physical activity generally helps in the improvement of weight-related conditions. For instance, regular exercise enhances glycemic management and insulin sensitivity, lowers blood pressure and cholesterol, and reduces the risk of cardiovascular disease and all-cause mortality (Dubnov et al., 2003).

2.6.4. Exercise program

Postmenopausal women may be most susceptible to the negative effects of increased body weight on physical function due to the loss of muscle mass and strength that comes with ageing (Roubenoff 2004). There is an extensive body of research and clinical trials that indicate the efficacy of exercise programs on the body weight of older women (Davidson et al., 2009, Chomentowski et al., 2009, Frimel et al., 2008, Galbreath et al., 2018, Kemmler et al., 2010, Bouchonville et al., 2014). For instance, Witham et al. (2010) extracted nine eligible trials in their systematic review and concluded that weight loss programs show a modest but significant reduction in weight in older obese people. Nicklas et al. (2009) found similar amount of total weight loss among 95 postmenopausal women who completed their study. The women were assigned to one of three 20-week interventions of equal energy deficit: calorie restriction only, calorie restriction plus moderate-intensity aerobic exercise or calorie restriction plus vigorous-intensity exercise. While lean mass was preserved in the same study, the results showed that there was not a preferential loss of abdominal fat when either moderate- or vigorous-intensity aerobic exercise was performed during caloric restriction (Nicklas et al., 2009). Friedenreich et al. (2015) randomized clinical trial compared the effects of 300 vs 150 min/wk of moderate to vigorous aerobic exercise on body fat in postmenopausal women. Even though participants were asked not to change their usual diet, they concluded that a 1-year prescription of moderate to vigorous exercise for 300 min/wk was superior to 150 min/wk for reducing total fat and other adiposity measures, especially in obese postmenopausal women (Friedenreich et al., 2015)

Weight reduction programmes however are associated with substantially higher drop-out rates (King et al., 1995, Chiu et al., 2020). Ogwumike et al. (2011) noticed the rising drop-out rates in their twelve-week endurance exercise program on central and abdominal obesity of premenopausal and postmenopausal Nigerian women. Ogwumike et al. (2011) commented that the participants withdrew

from the exercise program due to a busy work schedule, increased chores and varied other reasons. Time-effective exercise sessions may be important given that one of the biggest barriers to exercise participation is a lack of time and motivation (Reichert et al., 2007, Stutts 2002, Trost et al., 2002). As such, it is necessary to develop a time-efficient exercise program that will be accepted by the participants and culturally adapted to minimize the drop-out rate.

2.7. Conclusion

This chapter reviewed literature related to the prevalence of excess weight/obesity in postmenopausal women, pathophysiology, risk factors and weight loss interventions. The evidence presented shows excess weight gain is prevalent and has adverse effects on the health of women in the postmenopausal period. Although there are many ways to lose weight, changing one's lifestyle is essential for reducing postmenopausal obesity and overweight (Dubnov et al., 2003). While dietary and behavioural adjustments are necessary, regular physical activity is a key component of this modification since it lowers obesity-related morbidity and death (Dubnov et al., 2003, Doucet et al., 2011, Kapoor et al., 2017). There are gaps in the literature related to the prevalence of excess weight gain among postmenopausal women in Ghana, factors contributing to weight gain and exercise programs that are traditionally induced. Therefore, there is a need to develop an indigenous exercise program that is culturally accepted to encourage full participation. Chapter three provides the outline for the methodology followed to address the study's aim.

3. CHAPTER THREE. METHODOLOGY

3.1. Introduction to Chapter

The outcome measures, instruments and the study methodology used for data collection are discussed in this chapter. The research methodology was divided into five studies. The study design, aim and outcome measures of each study are outlined below.

3.2. Overall Methodology

In this thesis, an explanatory design, mixed-method approach was used in achieving the overall aim of the study. This type of mixed-method was selected based on its straightforwardness and the ability to explore the quantitative data in considerable detail. The research was conducted in four studies, however, study one had two sub-studies making it five studies. The aim and methodology used for each study are explained in detail in the following chapter.

3.2.1. Ethical considerations

This research was approved by the University of the Witwatersrand Human Research Ethics Committee, South Africa (Ref no. M190467) and the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology, Ghana (Ref No. 596/19, 621/21) (Appendix A). Written permission (Appendix B) to approach postmenopausal women in Bono regional capital, Techiman was received. Written project information was explained to the participants and they consented to participate in the study. Attached are the information documents and the informed consent forms (Appendix C-G). Participants were allowed to drop out of the study at any stage of the data collection process without any negative consequences on them. The authors adhered to Declaration of Helsinki by explaining the risks, burdens and benefits of the studies. Participants personal information were treated as confidential and only available to principal investigator, and supervisors.

3.3. Study 1

The aim of the first study was to determine the prevalence of excess weight among postmenopausal women in Ghana.

The objectives for this aim were

Aim 1A: To establish the occurrence of excess weight in Ghanaian postmenopausal women by measuring anthropometrics parameters (BMI, WHR and WHtR).

Aim 1B: To determine the physical activity, lifestyle levels and sociocultural factors of postmenopausal women in Ghana

3.3.1. Study design

A cross-sectional study design method was used to collect information from participants. A cross-sectional study design involves the description of a population at a particular point in time (Levin, 2006) and it was most appropriate for this study.

3.3.2. Population and sampling

The population consisted of three geopolitical zones in Ghana: coastal, forest, and savannah (figure 3.1). The principal investigator assigned numbers to the zones, regions and district and random numbers were identified. Sequentially, a zone, region and district were selected by simple random sampling. The study participants were recruited via public invitation (such as information centres, and announcements at churches and mosques). Women's fellowships, women's groups, churches and mosques were randomly selected throughout the district. Participants who responded to the invitations were recruited from their households, churches, mosques, and within communities.



Figure 3. 1: A map of Ghana showing three zone

3.3.3. Sample size

Using Ghana's 2010 population and housing census, the sample frame consisted of postmenopausal women aged 45 and older (Ghana Statistical Service, 2009). Using the sample size formula for cross-sectional studies in an unknown population, a sample size of 358 was estimated (Charan and Biswas, 2013). The final sample size was 393 including a 10% fall-out rate. The figure was derived from the rate of obesity among Ghanaian postmenopausal women (37.1%, $p=0.37$) (Benkeser et al., 2012), with a margin of error of 0.05 and a confidence interval of 95%. The sample size formula for cross-

sectional studies was:
$$\frac{\left(\frac{Z}{2}\right)^2 P(1-P)}{d^2}$$

3.3.4. Aim 1A

To determine the prevalence of excess weight among Ghanaian postmenopausal women

3.3.4.1. Outcome measures

An analogue balance (SECA) and a stadiometer were used to assess body weight and height (to the nearest 0.5 kg and 0.5 cm, respectively) (Appendix H). The participants' posture was measured to ensure that essential postural points were constantly positioned, such as the feet being together, knees touching, buttocks, scapulae, and head in contact with the vertical backboard, the back against the board and heels at the base of the vertical board. The arms of the participant hang freely by the sides of the trunk with palms towards the thighs. The ratio of body weight to height squared was used to calculate BMI. Using the WHO criteria, BMI < 18.5kg/m² underweight; BMI 18.5 – 24.9kg/m² normal weight; BMI 25.0 – 29.9kg/m² overweight; and > 30.0kg/m² obese (WHO, 1998). Excess weight was defined as a participant with a BMI > 25.0 kg/m².

3.3.5. Aim 1B

To evaluate the lifestyle, physical activity levels and sociocultural factors among postmenopausal women,

3.3.5.1. Outcome measures

A modified questionnaire was self-administered to participant who are literate, however, participants who are illiterate were interviewed (Appendix I) after study 1A. The questionnaire was divided into four sections. The sections included socio-demographics, sociocultural, physical activity and lifestyle.

3.3.6. Physical activity assessment

Physical activity level was assessed through the International Physical Activity Questionnaire (IPAQ) Short Form. Participants indicate time and the number of days within the previous seven days they spent walking, doing a moderate-intensity activity and/or doing vigorous-intensity

activities (Helou et al., 2018). Globally, this questionnaire is used to evaluate physical activity (indicated as low moderate and high) over seven days (Helou et al., 2018).

3.3.6.1. Lifestyle factors

The questionnaire included questions related to lifestyle, health-related habits (alcohol consumption and smoking status), leisure time activity and time spent watching television. According to smoking status, participants were classified as never smokers, past smokers, or current smokers. Marital status was categorized as single, married, widowed or divorced. Participants were asked to describe their lifestyle as very sedentary, sedentary, moderately active, or very active. Seven specific questions were designed to assess the frequency of certain dietary habits during a usual week based on 7-day 24-h dietary recalls. The participants were asked to state how often they consume breakfast, lunch and dinner, water and high-content foods (carbohydrate, protein, fat, vegetables). The high-content carbohydrate foods in this regard included some examples of Ghanaian local foods, such as “banku, fufu, kenkey, tuozafo and yam”. The questions covered some healthy and unhealthy dietary habits. The beverages were categorized into four levels of intake: fruit juice, mineral water, soft drink and alcoholic drink.

3.3.6.2. Sociocultural factors

The questions on sociocultural factors were designed to assess how traditional customs and cultural background influence the body weight of the participants. Social variables including employment status were assessed. Participants were asked about society’s influences on their body weight and whether cultural background and beliefs may prevent them from losing weight

3.3.7. Data collection procedure

Anthropometrics parameters (Height, weight, waist and hip circumferences) were measured, and BMI, waist-to-hip ratio and waist-to-height ratio were calculated to determine the prevalence of

excess weight among participants. Participants answer the questionnaire after the measurement of anthropometrics indices. Table 3.1 shows the outline of the instruments and outcome measures in studies 1A, B.

Table 3.1: Outline of the instruments, outcome measures and the relationship with the specific objectives.

Study	Aim	Instruments	Variables
1A	To determine the prevalence of excess weight and associated demographic risks factors among postmenopausal women in Ghana	Weighing scale, tape measure, stadiometer,	Independent: Weight, height, waist circumference, hip circumference, Body mass index (BMI), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR)
1B	To determine the physical activity, lifestyle levels and sociocultural factors of postmenopausal women in Ghana	Modified self-administered questionnaire	Responses of lifestyle, physical activity and sociocultural aspects from participants will be an outcome measure.

3.3.8. Data analysis

Data were analyzed using IBM SPSS (version 25.0). All variables were summarized using descriptive statistics, namely frequencies, percentages for data in graphic presentations, means, and standard deviation. Multivariate logistic regression was used to assess the association between demographic variables and the various indexes of weight gain. Statistical significance was set at $p < 0.05$ for all comparisons. Missing data were treated as missing.

3.3.9. Inclusion and exclusion

Postmenopausal Ghanaian women, aged 45-65 years with a BMI of 25 and above and not on any weight management therapy will be included in the study. Women outside age bracket, not Ghanaian, and who have not lived in Ghana for the past 3 years after study enrolment and mentally ill were excluded.

3.4. Study 2: Current weight management practices

3.4.1. Aim

This study aimed to explore current weight management practices among Ghanaian postmenopausal women with excess weight gain.

3.4.2. Study design

An exploratory, descriptive qualitative research design using focus group discussion (FGD) was used to explore the experiences of postmenopausal women with excess weight.

3.4.3. Sampling and population

A purposive sampling method was used to recruit participants who satisfied the inclusion criteria. The participants were recruited through public invitation (such as information centres,

announcements at churches, Techiman main markets and mosques) where their anthropometric measurements [body mass index (BMI), waist-to-height ratio (WHtR) and waist-to-hip ratio (WHR)] were measured, and those who have excess weight (obesity or overweight) were purposively selected to be part of FGDs after endorsing the informed consent form. The sample frame comprised post-menopausal women in Techiman municipality in the Bono East Region of Ghana, aged 45 years and above and with a BMI > 25kg/m² included twenty-four participants (n = 24) assembled into four focus groups with an average of six members per group

3.4.4. Outcome measure

Moderator's guide (Appendix B) for the focus group discussion was used as the data collection tool. The guiding questions were developed based on the study objective and available literature. During the interview information on their thoughts regarding their current weight, things they do to manage their weight and type of assistance to adhere to weight management programmes were gathered. Additional probes were used to gain a further understanding of the participants' experiences of weight gain. The validity of the information to be gathered was determined by an expert in women's health.

3.4.5. Data collection procedure

After studies 1A and B, participants who had excess weight were purposively selected to participate in a focus group discussion (FGD). Pre-interview demographic data (age, religion, marital status, ethnic origin and educational background) were collected using a self-administered questionnaire for each session of the focus group before the discussion. The FGDs were facilitated by a trained moderator who was aided by a research assistant. The average duration for each FGD was about 1 hour. The FGDs were all scheduled on a date other than the recruitment date at their convenient time and place. Dieticians and exercise scientists were consulted to offer nutritional and exercise counselling services for participants who needed support after sharing their experiences. Almost all

the participants used these services. The discussion was audio-taped with the participants' consent. The researcher obtained the recording and listened to the discussion immediately after each focus group session. Inconsistent comments were probed for understanding. The audio recordings from the discussion were transcribed by an independent translator fluent in both the Ghanaian language, Twi and English languages. Transcribed focus group discussions were provided to two randomly selected participants from each group to read through their responses for validation. The transcripts were independently read repeatedly by supervisors to make sense of the experiences of postmenopausal women with excess weight gain. Field notes were used for each session to capture the participants' non-verbal cues, apprehensions, and the author's reflections that gave context to the data. The field notes were reviewed, and reports were prepared for each focus group session.

3.4.6. Data analysis

A thematic analysis process was done in three phases namely pre-analysis, exploration, treatment and interpretation to analyze the data (Bierhals et al., 2017). To generate data that directly relate to the experiences of postmenopausal women with excess weight gain, important frequent phrases or statements were extracted from transcripts as codes. Related or similar codes were bundled into categories to help organize the data effectively. Formulated meanings were then generated from the significant phrases or statements. Subsequently, themes, sub-themes and categories that emerged were noted based on the multiple statements that conveyed similar meanings. We explored individual themes and attempted to determine possible interrelatedness between themes

3.5. Study 3: Delphi technique

3.5.1. Aim

The aim of this study was to develop and achieve consensus on the content of a culturally adopted exercise-based intervention programme for weight loss among postmenopausal women with excess weight in Ghana.

3.5.2. Study design

A Delphi survey was used for the study.

3.5.3. Sample size

One hundred and two (102) invitations to participate were emailed to potential participants by the principal researcher (IMB). Three potential participants e-mailed to decline to participate in the study, as they are on sabbatical leave, and two showed interest, however, declined due to their busy schedules. Forty-one experts who met the selection criteria provided informed consent to participate.

3.5.4. Population and sampling

The area of expertise was defined as the “development of exercise programs.” and exercise physiology. Consequently, exercise development experts in exercise prescription with an interest in women’s health possessed the expertise to determine the composition of the programme and were purposively sampled. For this reason, physiotherapists, exercise physiologists, exercise scientists, human kinetics and health educationalists were considered eligible to participate in the Delphi process.

3.5.5. Data collection Procedure

3.5.5.1. Round one

The questionnaire was sent via email when the invitation to participate was received with a positive response. Demographic data for the expert panel was gathered using multiple-choice questions

(MCQs). The first questionnaire mostly included open-ended questions to let participants express their ideas without being given any leading information. This method reduces response bias (Choi and Pak, 2005). Respondents were asked three main questions in this round. Firstly, they were asked to list and provide examples of all the dosage variables they consider important when prescribing low-impact cardiovascular and strength/resistance exercises for the management of excess weight among postmenopausal women. Secondly, participants were asked to list and provide examples of exercise prescription variables other than dosage they consider important when prescribing exercises (low-impact cardiovascular and strength/resistance exercises). Finally, participants were also questioned to indicate patient (postmenopausal women) and other factors they consider important that may change the exercise variables they identified. Participants were also allowed to provide comments. Responses to open-ended questions in the first questionnaire were analysed thematically to provide a qualitative summary. Three researchers were involved in this process to ensure the validity and consistency of the approach. Themes identified from participant responses then were translated into application statements. The development of the second questionnaire utilized these statements.

3.5.5.2. Round two

All respondents who participated in the first round of the survey were invited to participate in the second iteration. Based on themes found in responses to the first questionnaire, the second survey was developed. A 5-point Likert response scale was used to determine the level of agreement (“strongly agree,” “agree,” “undecided” “disagree,” and “strongly disagree”). The consensus was determined when panel members strongly agreed or agreed with an item. If the percentage of agreement was less than 60% to a question, however, it was concluded that a consensus had not been reached. Open-ended questions also were provided to ensure participants were able to express any further thoughts or opinions.

3.5.5.3. Round three

In this round, any questions that did not reach consensus during the second round were removed in the final round. Participants were asked to view the results in round two and confirm the answer to the same question. Each item that achieved 80% or greater of expert votes was considered important for the exercise program. Additional themes identified in open-ended questions in the second round were included to ensure a thorough exploration of participant opinions.

3.5.6. Outcome measure

The study process consisted of three Delphi rounds among international and local experts. Participants were recruited via purposive sampling based on their interests and knowledge. The content of the exercise program was developed based on literature review findings and three previous studies that were undertaken. In round 1, answers to open-ended questions were analysed thematically and translated into statements. In round 2, experts rated their level of agreement on application questions using a 5-point Likert scale and provided comments. The consensus was considered reached if at least 60% of the panel strongly agree/disagree that an item should be included or excluded. In round 3, participants viewed the results in round 2 and confirm the answer to the same question. The consensus was set at 80%.

3.5.7. Data Analysis

Descriptive statistics were used to determine the frequency of each response. To determine the status of the agreement, the frequencies of “strongly agree” and “agree” were combined.

Responses to open-ended questions were summarized qualitatively using thematic analysis. The number of identified themes was noted, and these themes were used to generate questions for subsequent rounds.

3.6. Study 4: Randomised controlled trial

3.6.1. Aim

The aim of this study was to test the effectiveness of a culturally adapted exercise-based programme for weight loss in Ghanaian postmenopausal women with excess weight.

3.6.2. Study design

A single-blind randomized controlled trial in which participants randomly received 12 weeks of culturally-adapted exercise programme.

3.6.3. Sampling and population

Participants within the Bono-East regional capital, Techiman were recruited through local advertisements in the markets, churches, mosques and community. An announcement was made in the women's association, churches and mosque meetings one week before the recruitment while the queen mothers (tubers, fish, second-hand cloth) in the markets announced the study to the women through information centers three days before recruitment. Postmenopausal women were enrolled based on the following criteria: 1) BMI ≥ 25 kg/m² 2) age 48– 70 years, 3) postmenopausal status (no menses for .1 year), 4) not engaged in weight management programs and sedentary lifestyle (15 min exercise 2 times/week and not adherent to the WHO physical activity recommendation). Participants were excluded if they had a medical condition that might be adversely affected by increasing their physical activity, as determined by the physical activity readiness questionnaire (PAR-Q) (Lawton et al., 2008). Three researchers who were trained by the principal investigator carried out the recruitment process. A total of 1002 women were initially screened from ten (10) different study sites (churches, women's organizations, markets, mosques and the communities) (Figure 3.1). Of those women, 301 were medically screened and underwent an exercise test (step tests) to determine

their aerobic fitness on each study site. Out of the population of 301, 226 were enrolled on the study and randomized into the control and intervention.

3.6.4. Outcome measure

At baseline and after 12 weeks of intervention, participants' anthropometrics and body composition were obtained. Height was determined by a stadiometer (Ghaziabad, Scorpia India Medicare Pvt. Ltd. | ID: 4076377262) and an Omron Body Composition Monitor with Scale (Omron BF-511 T – rozbaleno) was used to measure weight, skeletal muscle mass, visceral fat area body fat percentage as well as BMI while the participants wore light clothes and no shoes. With the participant in a standing position (with feet together), an inelastic tape was used to measure waist and hip circumference (to the nearest 0.1 cm) as the smallest girth around the waist and the region of maximum girth around the buttocks– (the trochanteric region) for hip circumference (McArdle and Jackson, 2000). The waist-hip ratio (WHR) and waist-to-height ratio (WHtR) were determined. All these parameters were measured pre-and post-intervention.

3.6.5. Data collection procedure

Participants who have excess weight were randomized to exercise and control group using blocks of 4, 8 and 12 chosen with equal probability. We maintained allocation concealment in the study until after we obtained written consent, demographics and completed baseline measures. Following baseline measurement, several opaque envelopes containing the allocated group (exercise or control) were opened sequentially and showed the allocation to the participant. Consort guidelines of reporting were used for the study as shown in figure 3.1. Anthropometrics (BMI, WHR, WHtR WC, HC and body weight) and body composition (body fat, visceral fat, muscle mass) were determined pre and post-the 12-week intervention.

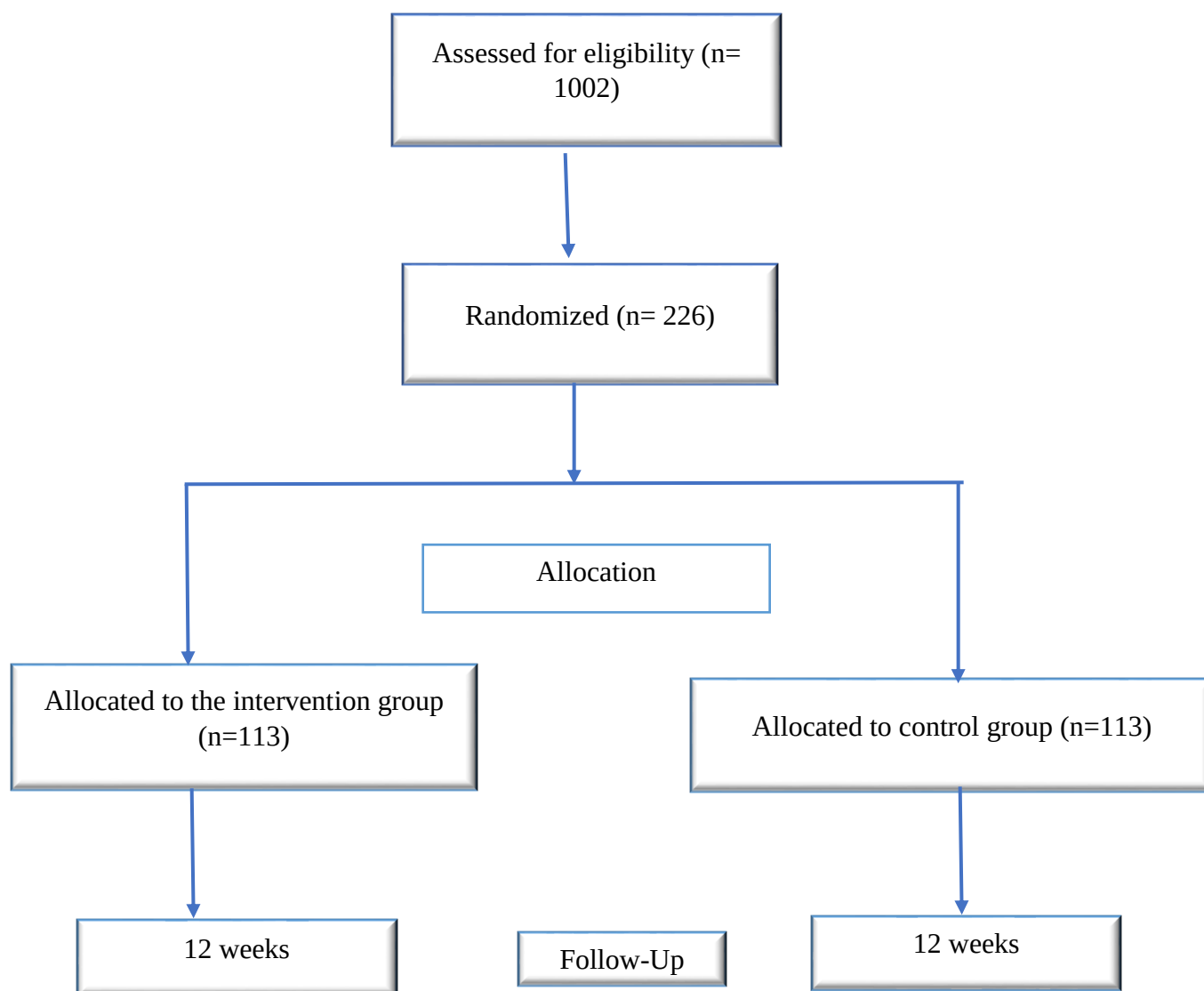


Figure 3. 2: Outline of the flow diagram

3.6.6. Data analysis

Baseline characteristics were reported as means $\pm$ SD or as percentages of the study groups. An independent t-test was used to compare the baseline anthropometric and body composition measures between the intervention and control groups. Additionally, we performed stratified analyses to investigate variations in body composition and anthropometric changes within the exercise group (overweight vs. obese women) classified by baseline age (48-58 and 58+) using a repeated-measures linear mixed model. Statistical analyses were performed using SPSS software, version 26.

3.7. Conclusion

This chapter explains the study design, outcome measures and the instruments used in collecting information. Method for data analysis, and methodology used for data collection in each phase of the study were outlined.

4. CHAPTER FOUR: PREVALENCE OF EXCESS WEIGHT AND ASSOCIATED SOCIO-DEMOGRAPHIC FACTORS

4.1. Manuscript details

Chapter four is presented as a manuscript structured according to the journal guideline African Journal of Primary Health Care & Family Medicine where it was accepted for publication (In press). The paper aimed to identify the prevalence of excess weight and associated socio-demographic factors. The paper was submitted to the African Journal of Primary Health Care & Family Medicine and has been accepted for publication. In conducting this study, we aimed to better understand the epidemiology of excess weight in postmenopausal women and the associated socio-demographic factors in the Ghanaian context. The findings of the study informed the development of a tailored exercise-based management programme (Chapter 7).

The manuscript's title is “Prevalence of excess weight and associated socio-demographic factors among postmenopausal women: a population-based study in Bono East (Techiman) region of Ghana”.

Journal: *African Journal of Primary Health Care & Family Medicine*

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4.2. Details of the author's contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix H.

Table 4: 1: Details of the author's contribution

	Mensah Bonsu	Myezwa	Brandt	Ajidahun	Monday
Conceptualization	√	√	√	√	
Method	√	√	√	√	√
Resources	√				√
Manuscript writing draft	√				
Manuscript writing review and editing	√	√	√	√	√
Supervision		√	√	√	√

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4.4. Published article: 'Prevalence of excess weight and associated socio-demographic factors among postmenopausal women: A population-based study in Ghana

Prevalence of excess weight and associated socio-demographic factors among postmenopausal women: A population-based study in Ghana



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Background: Excess weight (obesity and overweight) is a pervasive condition that is considered a global epidemic and a threat to public health. Furthermore, numerous changes in fat deposits occur with the advent of menopause, leading to a change in the distribution of body fat. Knowledge of sociodemographic factors and prevalence can inform the effective management of these women.

Aim: This study aimed to investigate the prevalence of excess weight among postmenopausal women in Ghana's Bono East (Techiman) region.

Setting: This study was conducted in Bono East regional capital, Techiman, Ghana.

Methods: This is a cross-sectional study conducted over 5 months at Bono East regional capital, Techiman in Ghana. Anthropometric parameters such as body mass index (BMI), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) were obtained using physical measurements while socio-demographic data were gathered using questionnaires. Data analysis was performed using IBM SPSS 25.

Results: The mean age of the 378 women who participated in the study was 60.09 ± 6.24 years. Body mass index, WHtR and WHR indicated excess weight of 73.2%, 91.8% and 91.0%, respectively. Education and ethnicity were predictors of excess weight (WHR). Women of the Ga tribe with high school education have 4.7- and 8.6-times increased odds of having excess weight.

Conclusions: There are higher prevalence rates of excess weight (obesity and overweight) among postmenopausal women using BMI, WHtR and WHR. Education and ethnicity are predictors of excess weight.

Contribution: The study's findings can be used to develop interventions that focus on addressing excess weight in postmenopausal women within the Ghanaian context.

Keywords: desirable weight; body mass index; obesity; postmenopausal; waist-to-height ratio; waist-to-hip ratio; prevalence.

Introduction

One of the major factors of poor health is excess weight (obesity and overweight),¹ exceeding other causes such as undernutrition and infectious diseases.² Obesity has been more widespread over the world in the last 50 years,³ and the incidence of excess body weight among women has reached epidemic proportions.⁴ The onset of menopause in middle age is linked to an increased tendency to gain weight.^{5,6} It is projected that middle-aged (40–59) women have a greater obesity rate, (42.1%) than women aged 20–39 (34.4%).⁷ In Ghana, a survey by Agbeko and Akwasi⁸ found that the rates of excess weight were shown to be positively linked with age and ranged from 14% for women aged 15–24 to 43% for persons aged 35–44 years old.

Excess weight is the outcome of a complex interaction of different genetic factors derived from a person's eating behaviours, energy expenditure factors and physical activity.³ Also, with the onset of menopause, multiple changes in fat deposition occur, resulting in a shift in body fat distribution. Oestrogen deficiency has a deleterious influence on fat metabolism, resulting in abdominal obesity.^{9,10} Weight gain in menopause is intimately linked to age, lifestyle and behavioural variables such as physical inactivity and an increase in food consumption.³

Obesity is a key public health problem that significantly raises the risk of osteoarthritis, cardiovascular disease, dementia and several cancers among other diseases, thereby contributing to a decline in both quality of life and life expectancy.¹¹ Obesity is also associated with unemployment, social disadvantages and decreased socioeconomic production, putting the economy under pressure.³ Several studies have tried to interpret the factors related to weight gain during menopause,^{12,13} but few population-based studies have examined the demographical factors associated with the prevalence of obesity and overweight in postmenopausal women, particularly in sub-Saharan African countries such as Ghana.

Multiple measures are required to decrease the burden of excess weight, including individual interventions as well as changes in the society and environment.¹⁴ As a result, gaining a better understanding of regional disparities in obesity prevalence and trends could aid in identifying societal causes of obesity and advising on the most viable intervention techniques. Given this, the study sought to investigate the prevalence of excess weight among postmenopausal women in Ghana's Bono East (Techiman) region, as well as the socio-demographic factors that influence it.

Research methods and design

Study site and design

A 5-month cross-sectional study was undertaken in Ghana's Bono East regional capital, Techiman, from October 2019 to February 2020.

Study population and sampling strategy

The population consisted of three geopolitical zones in Ghana: northern, middle and southern. Sequentially, a zone, region and district were selected by simple random sampling. The study participants were recruited via public invitation (such as information centres and announcements at churches and mosques). Women's fellowships, women's groups, churches and mosques were randomly selected throughout the district. Participants who responded to the invitations were recruited from their households, churches, mosques and communities. Using Ghana's 2010 population and housing census, the sample frame consisted of postmenopausal women aged 45 and older.¹⁵ Using the sample size formula for cross-sectional studies in an unknown population, a sample size of 358 was estimated.¹⁶ The final sample size was 393 including a 10% fall-out rate. The figure was derived from the rate of obesity among Ghanaian postmenopausal women (37.1%, $p = 0.37$),¹⁷ with a margin of error of 0.05 and a confidence interval of 95%. The sample size formula for cross-sectional studies was:

$$\frac{\left(\frac{Z}{2}\right)^2 P(1-P)}{d^2} \quad [\text{Eqn 1}]$$

Criteria for inclusion and exclusion

The study included postmenopausal Ghanaian women over the age of 45 who were not on any weight-loss therapy

and did not have any physical or mental disabilities. Women who are not Ghanaian and had not resided in Ghana for the previous three years before the study were not eligible.

Data collection

Questionnaire

The self-developed questionnaire obtained demographic information such as age, educational background, ethnic origin, marital status, parity and religion. Information regarding participants' last menstrual period was also obtained (Table 1). The last menstrual period was defined as the final menstrual period and is confirmed when a participant has not had her period for 12 consecutive months.

Measurement of weight, height and body mass index measurement

An analogue balance stadiometer (SECA 285) was used to assess body weight and height (to the nearest 0.5 kg and 0.5 cm, respectively). The participants' posture was measured to ensure that essential postural points were constantly positioned, such as the feet being together, knees touching, buttocks, scapulae and head in contact with the

TABLE 1: Demographic characteristics of the participants ($N = 378$).

Demographics	Mean	s.d.	<i>n</i>	%
Age in years	60.09	6.24	-	-
†Age group (years), $N = 369$				
≤ 50	-	-	24	6.5
51–60	-	-	180	48.8
61–70	-	-	150	40.7
> 70	-	-	15	4.2
†Religion, $N = 368$				
Christian	-	-	192	52.2
Muslim	-	-	151	41
Others	-	-	25	6.8
†Marital status, $N = 369$				
Married	-	-	130	35.2
Widowed	-	-	153	41.5
Single	-	-	34	9.2
Divorced	-	-	52	14.1
†Ethnic origin, $N = 366$				
Northern people	-	-	137	37.4
Akan people	-	-	148	40.4
Ga people	-	-	42	11.5
Voltarian people	-	-	34	9.3
Others	-	-	5	1.4
†Educational background, $N = 363$				
Primary	-	-	155	42.7
High school	-	-	97	26.7
Tertiary	-	-	68	18.8
Others	-	-	43	11.8
†Parity, $N = 292$				
< 3	-	-	41	14
4–7	-	-	174	59.6
> 7	-	-	77	26.4

s.d., standard deviation.

†, Missing data.

vertical backboard, the back against the board and heels at the base of the vertical board. The arms of the participant hang freely by the sides of the trunk with palms towards the thighs. The ratio of body weight to height squared was used to calculate body mass index (BMI). Using the World Health Organization (WHO) criteria, BMI < 18.5 kg/m² underweight; BMI 18.5 kg/m²–24.9 kg/m² normal weight; BMI 25.0 kg/m²–29.9 kg/m² overweight; and > 30.0 kg/m² obese.¹⁸ Excess weight was defined as a participant with a BMI ≥ 25.0 kg/m².

Measurement of waist circumference, hip circumference, waist-to-hip ratio and waist-to-height ratio

With the participant in a standing position (with feet together), the inelastic tape was used to measure waist and hip circumference (to the nearest 0.1 cm) as the smallest girth around the waist and the region of maximum girth around the buttocks – (the trochanteric region) for hip circumference.¹⁹ The waist-hip ratio (Eqn 2) and the waist-to-height ratio (WHtR) (Eqn 1) were determined using the waist-to-hip circumference equations:

$$\text{Waist-to-hip ratio} = \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}} \quad [\text{Eqn 2}]$$

$$\text{Waist-to-height ratio} = \frac{\text{Waist circumference (cm)}}{\text{Height circumference (cm)}} \quad [\text{Eqn 3}]$$

Waist circumference (WC) >88 cm and waist-to-hip ratio (WHR) > 0.8²⁰ were used to indicate abdominal obesity (WHR), while WHtR was defined as normal: < 0.4, overweight: 0.4–0.5, obese: 0.5–0.6 and morbidly obese: > 0.6.^{21,22}

Data analysis

Microsoft Excel was used to enter and clean the data, then it was exported to IBM SPSS (version 25.0) for analysis. In order to minimize measurement inconsistencies, the authors double-checked the data that were captured on an Excel spreadsheet. The descriptive statistics included frequencies, percentages, means and standard deviation to summarize all variables. The K-test was used to determine the differences between proportions. Multivariate logistic regression with the Enter method was used to assess the

association between demographics and the various indexes of weight gain. The dependent variable was obesity, and the independent variables were socio-demographic and clinical characteristics. The multivariate logistic regression model was adjusted for age. Statistical significance was set at $p < 0.05$ for all comparisons. Missing data were treated as missing.

Ethical considerations

Ethical approval for this study was obtained from the Human Research Ethics Committee at the University of the Witwatersrand, South Africa (Ref no. M190467). In Ghana, permission was also obtained from the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology, Kumasi (Ref No. 596/19).

Results

A total of 378 postmenopausal women who participated in this study ranged in age from 45 to 80 years old, with a mean age of 60.09 ± 6.24 years.

Prevalence of excess weight among participants

Excess weight is described as overweight and obese on all three indices (BMI, WHR and WHtR), whereas desirable weight is defined as those with normal body weight using all three indices. Using the WHO cut-offs of excess weight as a reference, 37.8% of the participants were obese, 35.4% overweight, 22.8% had normal weight and 4.0% were underweight (Figure 1a). Figure 1b shows that 70.1% of the participants were obese, while 8.2% had a normal WHtR. According to the WHR, 82.0% were obese, and 9.0% were overweight (Figure 1c).

Although there was no significant difference ($p = 0.999$) between the proportion of study participants with a desirable weight for WHtR and WHR, the BMI, WHtR and WHR findings revealed that 26.8%, 8.2% and 9.0% of the sample had a desirable weight (Figure 2a). The distribution of study participants with desirable weight categorized by BMI was significantly higher than that of WHtR ($p = 0.0031$) and WHR ($p = 0.0063$). Results indicated that 73.2%, 91.8% and 91.0% of the participants had excess

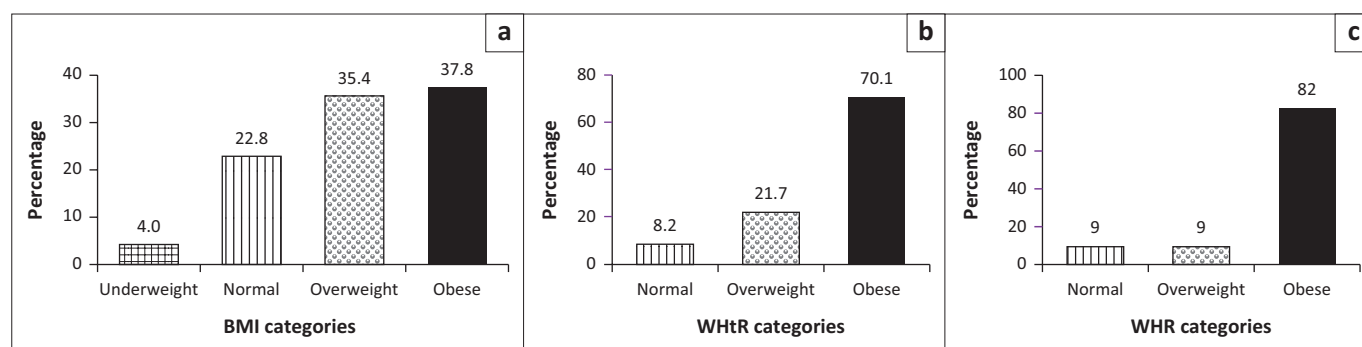


FIGURE 1: Prevalence of excess weight among study participants stratified by (a) body mass index categories, (b) waist-to-height ratio categories (c) waist-to-hip ratio categories.

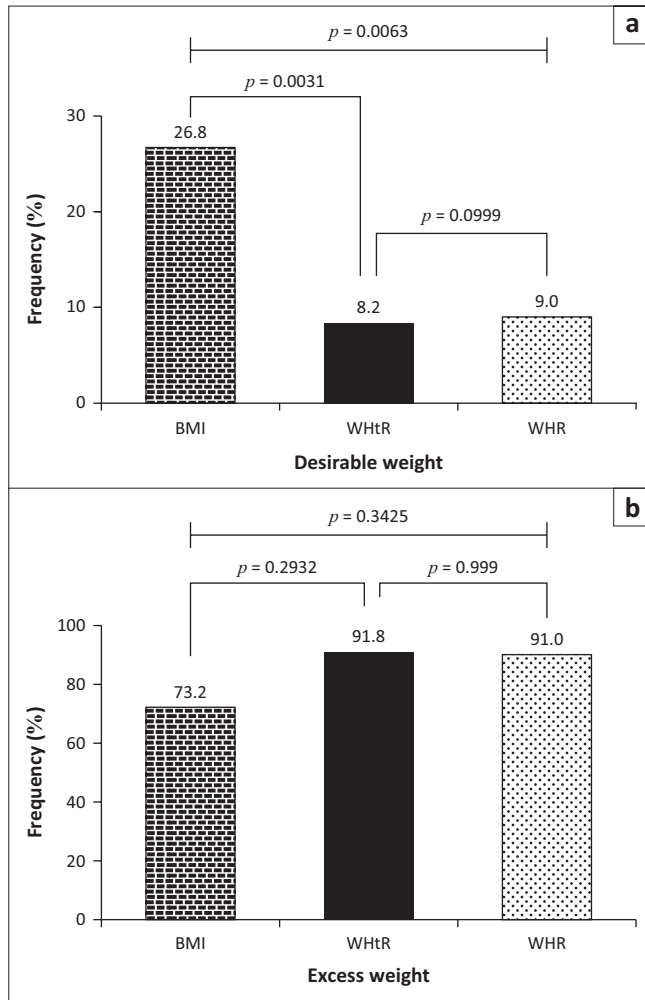


FIGURE 2: Distribution of body mass index, waist-to-height ratio and waist-to-hip ratio by desirable (A) and excess weight (B).

weight using BMI, WHtR and WHR, respectively, and there was no substantial difference in excess weight among the anthropometric indices (BMI, WHtR or WHR) measured (Figure 2b).

Table 2 shows a multivariate binary logistic regression analysis of socio-demographic factors for the odds ratio of developing obesity among study participants. Postmenopausal women of the Ga tribe compared with the northern tribe had 4.7 times increased odds of obesity characterized by the WHR criterion. Also, postmenopausal women who were high school graduates compared with those who only had primary school education, had 8.6 times increased odds of being obese characterized by the WHR criterion. Conversely, participants who have given birth 4–7 times were at 20% decreased odds of obesity. Age group, marital status and postmenopausal stage were independent factors that were not associated with excess weight.

Discussion

Using BMI, WHtR and WHR, the study found a high prevalence rate of excess weight among the participants of 73.2%, 91.8% and 91.0%, respectively. The stratified study participants using the anthropometric indices (BMI, WHtR

TABLE 2: Multivariate binary logistic regression analysis, indicating the odds ratio for demographic risk factors for obesity among study participants.

Demographics	BMI-obesity		WHR-obesity		WHtR-obesity	
	aOR	95%CI	aOR	95%CI	aOR	95%CI
Age group (years)						
≤ 50	1		1	-	1	-
51–60	0.4	0.1–2.0	-	-	0.6	0.1–3.3
61–70	0.3	0.1–1.9	-	-	0.5	0.1–3.3
> 70	-	-	0.8	0.2–1.6	0.2	0.0–7.2
Religion						
Christian	1	-	1	-	1	-
Muslim	1.8	0.8–4.3	0.9	0.2–3.0	1.1	0.5–2.7
Others	-	-	0.2	0.0–1.7	1.1	0.2–6.9
Marital						
Married	1	-	1	-	1	-
Widow	1.1	0.4–2.8	1.1	0.3–3.7	1.4	0.6–3.4
Single	1.1	0.2–5.0	3.5	0.4–32.7	0.7	0.2–2.9
Divorced	2.3	0.7–7.5	2.5	0.4–15.5	2.7	0.7–10.7
Ethnic origin						
Northern people	1	-	1	-	1	-
Akan people	1.4	0.6–3.6	0.1	0.0–0.7	3.2	1.2–8.51
Ga people	3.1	0.8–12.4	4.7	1.1–20.6*	2.0	0.5–7.9
Voltarian people	1.0	0.2–4.6	0.6	0.1–4.4	1.2	0.3–4.8
Others	-	-	-	-	-	-
Educational background						
Primary	1	-	1	-	1	-
High school	0.8	0.3–1.8	8.6	2.0–36.9*	1.3	0.5–3.2
Tertiary	0.4	0.1–1.3	1.0	0.3–2.7	1.8	0.5–6.1
Others	0.1	0.0–0.6	1.9	0.4–8.9	1.2	0.4–4.0
Gravidity						
< 3	1	-	1	-	1	-
4–7	0.8	0.3–2.0	0.2	0.0–0.9	0.8	0.3–2.2
> 7	1.5	0.4–5.5	0.5	0.1–3.5	1.9	0.5–7.7
Postmenopausal stage (years)						
≤ 5	1	-	1	-	1	-
6–10	1.0	0.4–2.4	0.7	0.2–2.4	0.8	0.3–2.0
11–15	0.9	0.2–5.1	0.5	0.1–3.2	0.9	0.2–5.2
> 15	4.0	0.3–61.0	0.2	0–4.4	1.5	0.1–23.1

aOR, age adjusted odds ratio; CI, confidence interval; BMI, body mass index; WHR, waist-to-hip ratio; WHtR, waist-to-height ratio.

Prevalence of excess weight.

* $p < 0.05$ = statistically significant.

or WHR) showed no significant differences. Postmenopausal women of the Ga tribe compared with the northern tribe had 4.7 times increased odds of excess weight indicated by WHR criterion. Women from the northern tribe are known to engage in non-mechanized farming, which is the major occupation compared with the other ethnic groups. Again, cultural settings in the northern tribe are such that women are mostly responsible for all household activities such as washing, cooking sweeping and these are forms of physical activities that prevent excess weight to thrive. Women from this tribe are mostly stout, which shows an inverse BMI–height association.²³ In addition, the standard of living of most people from the north is low; they eat what they grow. Their diet is free from chunks of canned, junk and fatty foods, which are a major contributor to excess weight.

Furthermore, participants who were high school graduates compared with primary school had 8.6 times increased odds of being obese indicated by the WHR criterion.

Conversely, participants who have given birth 4–7 times had 20% decreased odds of excess weight. Age group, religion, marital status and postmenopausal stage were not independent factors associated with excess weight.

The postmenopausal stage (years) was not significantly associated with excess weight among participants. Menopause is often a source of anxiety for women.²⁴ One of the most significant is the dread of gaining weight.²⁵ Obesity and metabolic syndrome are three times more common in women throughout this stage of their lives than they are before menopause.²⁶ The body composition of postmenopausal women alters to more fat and less muscle, which slows the rate at which the body metabolizes biomolecules.²⁷ The changes in body composition are associated with weight gain, particularly around the abdominal region, which contributes to metabolic abnormalities and a higher prevalence of metabolic syndrome.²⁷

Weight gain was found to be prevalent among participants. According to the BMI, 37.8% of the participants were obese, followed by overweight (35.4%), normal (22.8%) and underweight (4.0%). Gravena and Brischiliari²⁸ found a similar prevalence rate of obesity (35.5%) in postmenopausal Brazilian women using BMI in their investigation of excess weight and abdominal obesity. Abdominal obesity (63.3%) was observed in the same study using WC.²⁸ However, they reported a greater prevalence rate of overweight (72.6%) than this study, which could be because of the age difference, because the mean age was 58.7 ± 5.7 years compared with 60.09 ± 6.24 years for this study.

The natural history of the menopausal transition was explored by the Study of Women's Health Across the Nation (SWAN), which found that WC increased with age and accelerated after menopause.²⁹ According to Stevens and Katz³⁰ WC and WHR are controlled by body weight, body composition and fat distribution and have relationships and increase with age. This could be because of hormonal and behavioural factors in their bodies, both of which contribute to their excessive weight gain.^{9,10}

According to WHR findings, 82.0% were obese, 9.0% were overweight and 9.0% were normal. Also, 70.1% were obese and 8.2% were normal according to the WHtR. This trend is evident in similar populations elsewhere,³¹ which established 5.6% overweight and 93.5% obese according to WHR among postmenopausal Ghanaian women. Furthermore, using the WHtR, 19.8% of women in Arthur et al.'s study were normal, while 83.2% were obese.³¹ Although Kow Nanse Arthur et al.,³¹ reported greater prevalence rates than this study, there is positive congruence between the two investigations, suggesting that WHR may be a suitable anthropometric indicator for assessing obesity in women.^{31,32}

In addition, Kissebah and Krakowah found that WHR presents significant indices of abdominal fat accumulation

and has a better link with a higher risk of diseases than BMI alone.³³ The WHO acknowledges that BMI can be used to estimate the prevalence of obesity in a population, but it does not account for the wide range of body fat distribution.³⁴

There was no significant difference in proportions for WHtR and WHR with a desirable weight gain, which was an interesting finding. Waist-to-height ratio and WHR, on the other hand, had a much larger distribution among study participants with a desirable weight based on their BMI than WHtR and WHR. Body mass index, WHtR and WHR recorded percentages of excess weight of 73.2%, 91.8% and 91.0%, respectively, among the general study participants, and there was no significant difference among the stratified study participants. Al-Safi and Polotsky³⁵ observed considerably high excess weight gain in most postmenopausal women, which is not similar to the higher proportion of BMI, WHtR and WHR in this study.

Excess weight prevalence rates in this study differed from those in previous studies, which could be attributable to age variations. The average age of the participants in this study was 60.09 ± 6.24 years, which was slightly higher than the average age (57.25 ± 0.80) of participants in the study conducted by Kow Nanse Arthur et al.³¹ The increases in WC with age, particularly during the postmenopausal stage, were because of weight gain, although WC increases have also been documented in the absence of weight gain.^{36,37} Participants aged ≤ 50 had a higher probability of being obese in all anthropometric parameters, although not substantially higher than other age groups.

Study participants who acquired high school education compared with primary school had 8.6 times increased odds of being obese, as characterized by WHR criterion. Changing nutritional trends and exposure to Western lifestyles might be contributing factors to these trends, which have health complications. Examples could include following a Western diet, a sedentary lifestyle and physical inactivity. The finding of this study is consistent with a survey conducted by Ziraba et al.,³⁸ which revealed that women with secondary or higher education were 60% more likely to gain excess weight (overweight or obese) compared with a similar population with no education ($p < 0.01$). Ofori-Asenso³⁹ substantiate the claim that, when compared with less educated and illiterate people, Ghanaians with tertiary education have the highest prevalence of obesity. This may conclude the idea that larger body sizes may be sensitive and affluence in many Ghanaian communities¹⁷; nevertheless, it may also affirm the fact that increasing affluence may be associated with an increase in larger portion sizes.³⁹

The WHR revealed that postmenopausal Ga women were more likely to be obese. This could be driven by the societal acceptability of weight gain in women in this tribe. The earlier study of women's perceptions and experiences of body weight in the Ga East District by Aryeetey⁴⁰ described weight gain as socially admired and presentable, and it is expected when individuals or families experience improved livelihoods.

Again, most women from the Ga tribe are traders and they have access to unlimited food resources in the market that are energy dense with a consequent reduction in energy expenditure.⁴¹ Polygamous marriage is accepted among the Ga tribe. As a result of this, women who find themselves in this marriage mostly exhibit to their co-wives their comfortability and happiness in the marriage by being fat to demonstrate that the husband is taking good care of them.⁴² This could be contributing to the tribe's growing excess weight gain pandemic. This finding is consistent with the outcomes of a study by Ofori-Asenso,⁴² which found that overweight and obesity are prevalent in Greater Accra, which largely has Ga tribe as inhabitants and the variations in excess weight prevalence among the ethnic groups are thought to mostly reflect differences in social behaviours including meal preparation, work patterns and perception of body size.

Although the results of this study are comparable to those of prior investigations, the cross-sectional design prevents causality from being established. The lack of evaluation of the participants' nutritional status as part of the factors of nutritional state in older age³⁴ could be a study limitation. As the anthropometric measurements were limited to women who had lived in Ghana for the previous 3 years, the female population included in this study may not be typical of the postmenopausal women population.

Conclusion

Excess weight was common among postmenopausal Ghanaian women in this study. These results may have important implications for women's health because excess weight can lead to a risk of chronic diseases, higher healthcare costs, and a reduction in quality of life and overall well-being. However, factors that influence excess weight, including social influences, lifestyle, and levels of physical activity, should be studied and evaluated. Furthermore, it will be useful to explore weight management practices among postmenopausal women. Exploring indigenous practices may be useful for the future management of weight gain.

Contributions to research

This study confirms a high prevalence of postmenopausal women with excess weight using BMI, WHtR and WHR. The higher prevalence of excess weight based on BMI, WHR and WtHR is associated with vascular and metabolic risk and this reinforces the importance of strategies to address overweight and obesity issues to prevent complications. Postmenopausal women from the Ga tribe and high school graduates have a higher chance of being overweight or obese characterized by WHR criterion. This study found that the prevalences of excess weight were higher for postmenopausal women who had four to seven children. Future research should focus on developing intervention programmes for postmenopausal women to lose body weight and improve health.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

All authors worked closely together to plan and execute the study. I.M.B conceived the study, data collection, data analysis and prepared the manuscript, H.M., C.B. and A.T.A. supervised study design and study tools, analysed data. M.M.O. and A.T.A. participated in coordination and helped with the literature search. All authors read and approved the final manuscript. This article is part of the author's thesis on the degree of PhD in physiotherapy at the University of the Witwatersrand South Africa, with supervisors Prof. H. Myezwa, Dr C. Brandt, and Dr A.T. Ajidahun.

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Data availability

The datasets analysed in this study are accessible from the corresponding author, I.M.B., upon reasonable request.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

References

- Teede H, Lombard C, Deeks A. Obesity, metabolic complications and the menopause: An opportunity for prevention. *Climacteric*. 2010;13(3):203–209. <https://doi.org/10.3109/13697130903296909>
- Lau DC, Douketis JD, Morrison KM, Hramiak IM, Sharma AM, Ur E. 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children. *Can Med Assoc J*. 2007;176(8):S1–S13. <https://doi.org/10.1503/cmaj.061409>
- Blüher M. Obesity: Global epidemiology and pathogenesis. *Nat Rev Endocrinol*. 2019;15(5):288–298. <https://doi.org/10.1038/s41574-019-0176-8>
- Wang YC, Colditz GA, Kuntz KM. Forecasting the obesity epidemic in the aging US population. *Obesity*. 2007;15(11):2855–2865. <https://doi.org/10.1038/oby.2007.339>
- Dubnov-Raz G, Pines A, Berry E. Diet and lifestyle in managing postmenopausal obesity. *Climacteric*. 2007;10(sup2):38–41. <https://doi.org/10.1080/13697130701586428>
- Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999–2008. *JAMA*. 2010;303(3):235–241. <https://doi.org/10.1001/jama.2009.2014>
- Ogden CL, Carroll MD, Fryar CD, Flegal KM. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS data brief, no 219. Hyattsville, MD: National Center for Health Statistics; 2015.

8. Agbeko MP, Akwasi K-K, Andrews DA, Gifty OB. Predictors of overweight and obesity among women in Ghana. *Open Obes J.* 2013;5(1):72–81. <https://doi.org/10.2174/1876823701305010072>
9. Douchi T, Kosha S, Uto H, et al. Precedence of bone loss over changes in body composition and body fat distribution within a few years after menopause. *Maturitas.* 2003;46(2):133–138. [https://doi.org/10.1016/S0378-5122\(03\)00162-2](https://doi.org/10.1016/S0378-5122(03)00162-2)
10. Sowers M, Zheng H, Toney K, et al. Changes in body composition in women over six years at midlife: Ovarian and chronological aging. *J Clin Endocrinol Metab.* 2007;92(3):895–901. <https://doi.org/10.1210/jc.2006-1393>
11. Cuadros JL, Fernández-Alonso AM, Cuadros AM, Chedraui P, Pérez-López FR. Body mass index and its correlation to metabolic and hormone parameters in postmenopausal Spanish women. *Gynecol Endocrinol.* 2011;27(9):678–684. <https://doi.org/10.3109/09513590.2010.521269>
12. Lizcano F, Guzmán G. Estrogen deficiency and the origin of obesity during menopause. *BioMed Res Int.* 2014;2014:757461. <https://doi.org/10.1155/2014/757461>
13. Ikram MA, Brusselle GG, Murad SD, et al. The Rotterdam Study: 2018 update on objectives, design and main results. *Eur J Epidemiol.* 2017;32(9):807–850. <https://doi.org/10.1007/s10654-017-0321-4>
14. Gortmaker SL, Swinburn BA, Levy D, et al. Changing the future of obesity: Science, policy, and action. *Lancet.* 2011;378(9793):838–847. [https://doi.org/10.1016/S0140-6736\(11\)60815-5](https://doi.org/10.1016/S0140-6736(11)60815-5)
15. GSS G. Ghana statistical service (GSS), Ghana health service (GHS), and ICF macro. Accra: Ghana Demogr Health Surv. 2009;2008:79–96.
16. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med.* 2013;35(2):121. <https://doi.org/10.4103/0253-7176.116232>
17. Benkeser RM, Biritwum R, Hill AG. Prevalence of overweight and obesity and perception of healthy and desirable body size in urban, Ghanaian women. *Ghana Med J.* 2012;46(2):66–75.
18. World Health Organization (WHO). The World health report 1998 : Life in the 21st century : A vision for all. [homepage on the Internet]. c1998 [cited No date]. Available from <https://apps.who.int/iris/handle/10665/42065>
19. McArdle AN, Jackson MJ. Exercise, oxidative stress and ageing. *J Anat.* 2000;197(4):539–541. <https://doi.org/10.1046/j.1469-7580.2000.19740539.x>
20. WHO Waist Circumference. Waist-hip ratio report of a WHO expert consultation. Geneva: Data WLCIP; 2008.
21. Ashwell M, Gunn P, Gibson S. Waist-to-height ratio is a better screening tool than waist circumference and BMI for adult cardiometabolic risk factors: Systematic review and meta-analysis. *Obes Rev.* 2012;13(3):275–286. <https://doi.org/10.1111/j.1467-789X.2011.00952.x>
22. World Health Organization Consultation. Obesity: Preventing and managing the global epidemic. Geneva: World Health Organization technical report series 894. 2000, p. 1–253.
23. Sperrin M, Marshall AD, Higgins V, Renehan AG, Buchan IE. Body mass index relates weight to height differently in women and older adults: Serial cross-sectional surveys in England (1992–2011). *J Public Health.* 2016;38(3):607–613. <https://doi.org/10.1093/pubmed/fdv067>
24. Graziottin A. Menopause and sexuality: Key issues in premature menopause and beyond. *Ann N Y Acad Sci.* 2010;1205(1):254–261. <https://doi.org/10.1111/j.1749-6632.2010.05680.x>
25. Kapoor E, Collazo-Clavell ML, Faubion SS. Weight gain in women at midlife: A concise review of the pathophysiology and strategies for management. *Mayo Clin Proc.* 2017;92(10):1552–1558. <https://doi.org/10.1016/j.mayocp.2017.08.004>
26. Kozakowski J, Gietka-Czernel M, Leszczyńska D, Majos A. Obesity in menopause—our negligence or an unfortunate inevitability? *Prz Menopauzalny Menopause Rev.* 2017;16(2):61. <https://doi.org/10.5114/pm.2017.68594>
27. Shikora S, Toouli J, Herrera MF, et al. Vagal blocking improves glycemic control and elevated blood pressure in obese subjects with type 2 diabetes mellitus. *J Obes.* 2013;2013:245683. <https://doi.org/10.1155/2013/245683>
28. Gravena AA, Brischiliari SC, Lopes TC, Agnolo CM, Carvalho MD, Pelloso SM. Excess weight and abdominal obesity in postmenopausal Brazilian women: A population-based study. *BMC Women's Health.* 2013;13(1):1–7. <https://doi.org/10.1186/1472-6874-13-46>
29. Callahan JL. Constructing a manuscript: Distinguishing integrative literature reviews and conceptual and theory articles. *Hum Resour Dev Rev.* 2010;9(3):300–304. <https://doi.org/10.1177/1534484310371492>
30. Stevens J, Katz EG, Huxley RR. Associations between gender, age and waist circumference. *Eur J Clin Nutr.* 2010;64(1):6–15. <https://doi.org/10.1038/ejcn.2009.101>
31. Kow Nanse Arthur F, Adu-Frimpong M, Osei-Yeboah J, Obu Mensah F, Owusu L. The prevalence of metabolic syndrome and its predominant components among pre- and postmenopausal Ghanaian women. *BMC Res Notes.* 2013;6(1):1–2. <https://doi.org/10.1186/1756-0500-6-446>
32. Cao Q, Yu S, Xiong W, et al. Waist-hip ratio as a predictor of myocardial infarction risk: A systematic review and meta-analysis. *Medicine.* 2018;97(30):e11639. <https://doi.org/10.1097/MD.00000000000011639>
33. Kissebah AH, Krakower GR. Regional adiposity and morbidity. *Physiol Rev.* 1994;74(4):761–811. <https://doi.org/10.1152/physrev.1994.74.4.761>
34. World Health Organization (WHO). The world health report 2002: Reducing risks, promoting healthy life. Geneva: World Health Organization; 2002.
35. Al-Safi ZA, Polotsky AJ. Obesity and menopause. *Best Pract Res Clin Obstet Gynaecol.* 2015;29(4):548–553. <https://doi.org/10.1016/j.bpobgyn.2014.12.002>
36. Matthews KA, Abrams B, Crawford S, et al. Body mass index in mid-life women: Relative influence of menopause, hormone use, and ethnicity. *Int J Obes.* 2001;25(6):863–873. <https://doi.org/10.1038/sj.ijo.0801618>
37. Bener A, Yousafzai MT, Darwish S, Al-Hamaq AO, Nasralla EA, Abdul-Ghani M. Obesity index that better predict metabolic syndrome: Body mass index, waist circumference, waist hip ratio, or waist height ratio. *J Obes.* 2013;2013:269038. <https://doi.org/10.1155/2013/269038>
38. Ziraba AK, Fotso JC, Ochoa R. Overweight and obesity in urban Africa: A problem of the rich or the poor? *BMC Public Health.* 2009;9(1):1–9. <https://doi.org/10.1186/1471-2458-9-465>
39. Amoah A. Obesity in adult residents of Accra, Ghana. *Ethn Dis.* 2003;13(2 Suppl 2):S97–S101.
40. Aryeetey RNO. Perceptions and experiences of overweight among women in the Ga East District, Ghana. *Front Nutr.* 2016;3:13. <https://doi.org/10.3389/fnut.2016.00013>
41. Biritwum RB, Gyapong J, Mensah G. The epidemiology of obesity in Ghana. *Ghana Med J.* 2005;39(3):82.
42. Ofori-Asenso R, Agyeman AA, Laar A, Boateng D. Overweight and obesity epidemic in Ghana – A systematic review and meta-analysis. *BMC Public Health.* 2016;16(1):1–18. <https://doi.org/10.1186/s12889-016-3901-4>

4.4. Summary of chapter

This chapter described the prevalence of excess weight and associated socio-demographic factors in Ghanaian postmenopausal women. We found a high prevalence of excess weight using BMI (73.2%), WHtR (91.8%) and WHR (91.0%). The results showed that education and ethnicity are predictors of excess weight. These findings point to the need for an appropriate intervention program to manage excess weight in postmenopausal women in the Ghanaian context.

The next chapter will present the levels of physical activity, lifestyles and sociocultural factors of postmenopausal women with excess weight in Ghana.

5. CHAPTER FIVE: PHYSICAL ACTIVITY, LIFESTYLE, SOCIOCULTURAL FACTORS AND PREVALENCE OF EXCESS WEIGHT GAIN AMONG POSTMENOPAUSAL WOMEN; A CROSS-SECTIONAL STUDY

5.1. Manuscript details

Chapter five is presented as a manuscript structured according to the journal of Women's Health. The paper aims to determine physical activity, lifestyle, sociocultural factors and the prevalence of excess weight gain among postmenopausal women. The key finding was that the cultural perception of beauty influences Ghanaian postmenopausal women's physical activity level and dietary habits.

The manuscript's title is "Physical activity, lifestyle, sociocultural factors and prevalence of excess weight gain among postmenopausal women; a cross-sectional study".

Journal: *Women's health SAGA publication*

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5.2. Details of the author's contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix H.

Table 5: 1: Details of the author's contribution

	Mensah Bonsu	Myezwa	Brandt	Ajidahun	Monday
Conceptualization	√	√	√	√	
Method	√	√	√	√	√
Resources	√				√
Manuscript writing draft	√				
Manuscript writing review and editing	√	√	√	√	√
Supervision		√	√	√	√

5.3. Abstract

Background: The present study assessed the physical activity, lifestyle and sociocultural levels-associated prevalence of excess weight (overweight and obesity) among postmenopausal women (PW) in Bono East (Techiman) region, Ghana

Method: This was a cross-sectional study conducted at Bono-East regional capital, Techiman in Ghana over five months. Self-administered questionnaires were used to obtain socio-demographic data, physical activity, lifestyle, and sociocultural associated prevalence of excess weight. Anthropometric indices including [(body mass index (BMI), waist-to-height ratio (WHtR), and waist-to-hip ratio (WHR))] were assessed.

Results: The mean age of study participants was 60.09 ± 6.24 years. A total of 378 postmenopausal women were recruited. When reporting prevalence, obesity and being overweight were distinguished. Using the anthropometric parameters (BMI, WHtR, and WHR) as measured for being overweight, the prevalent rates were 35.7%, 21.7%, and 9.0% respectively. Also, when using obesity, the prevalence rate was 37.8%, 70.1%, and 82.0% using BMI, WHtR, and WHR respectively. Over 55 (55.2%) of the study participants engaged in moderate physical activities, 23.1% were low and 21.7% with high physical activities. Housewives and unemployed participants are shown to have a higher risk of gaining weight (obese) especially when assessed with WHR and WHtR. Most participants responded that cultural beliefs prevent them from losing weight. Most participants had a poor attitude towards their eating habits.

Conclusion: According to the findings, postmenopausal Ghanaian women showed a high level of obesity and a moderate level of being overweight. The cultural perception of beauty influences Ghanaian postmenopausal women's physical activity level and dietary habits.

Keywords: Weight-gained, post-menopausal women, Physical activities, Socio-cultural aspect, Ghanaian

5.4. Introduction

Menopause is a cycle that happens spontaneously or is medically induced in women to mark the end of their ability to reproduce [1]. In comparison to medically induced menopause, natural menopause is a progressive cycle with permanent cessation of menstruation which is determined 12 months after the last menstrual period, which occurs in most women between 47 and 55 years of age [2]. For women aged 55 – 65 years, weight gain is one of their major health concerns during this period [3]. Menopause is a time when physical activity decreases and intra-abdominal fat increases [6]. A recent longitudinal study of African American and white middle-aged women found reduced physical activity, decreased energy expenditure levels and fat oxidation before and during menopause [7]. The menopause transition is characterized by androidal fat distribution especially during and after middle age [8]. Fat is redistributed among different fat depots in the body from subcutaneous to intra-abdominal visceral depots [8], increasing abdominal circumference in adult women [9].

The most important cause of the accumulation of fat is a lack of physical activity, consuming excess energy-dense foods high in fat, and sociocultural factors such as body image beliefs [10]. The World Health Organization [11] claims that lack of physical activity, for example, has been recognized as the fourth major cause of global death, accounting for 27% of diabetes cases, and about 30% of ischemic heart disease cases. In Ghana, 94 400 (43%) of the total deaths in 2016 were a result of non-communicable diseases (NCDs) such as cardiovascular diseases (CVDs), diabetes, chronic obstructive pulmonary diseases (COPDs), and cancers [12]. Many non-communicable diseases, such as cardiovascular disease and diabetes, have also been linked to sedentary behaviour [13–15].

A study by Rguibi and Belahsen, [16] highlighted the role of sociocultural factors in the maintenance of traditional values about the desirability of body weight. The same study revealed that most Saharawi women desired to gain weight during their life because of its association with beauty [16].

Walker has reported that in African cultures, obesity in women is regarded with far less disfavor than in industrialized countries and accordingly, there is only a limited incentive for obese African women to reduce their weight [17]. Gaining body weight at the postmenopausal stage is associated with good health, wealth and beauty within the Ghanaian cultural context and represents a desirable body image [18]. It is also reported that in the Tahiti and Nauru Pacific societies, where fattening is associated with beauty and fertility, the women eat excessive quantities and undertake little activity to increase fat [19]. Women who become overweight/obese are unlikely to be displeased with their weight status in a cultural environment that sanctioned large body sizes [20]. These could limit attempts to follow interventions against excessive fat accumulation. However, in a society where 'plumpness' is traditionally valued, understanding the sociocultural associated effect of body size/weight would inform interventions against obesity as a problem [21].

Numerous studies have assessed excess weight problems solely from a nutrition and health perspective [22], however, there is a dearth of literature evaluating the holistic multifaceted factors involving physical activity, lifestyle and socio-cultural influence in weight gain among postmenopausal women in Ghana. This cross-sectional study aimed to evaluate the physical activity, lifestyle, sociocultural factors and prevalence of excess weight gain among postmenopausal women in Ghana.

5.5. Methods and materials

5.5.1. Study site and design

A cross-sectional study was performed to determine the physical activity, lifestyle and sociocultural-associated prevalence of excess weight among postmenopausal women in Ghana. Data were collected between October 2019 and February 2020. Anthropometric measurements were performed on eligible women of selected women organizations and fellowships, mosques, churches, and

outpatient departments (OPD) of the hospitals at Bono-East regional capital, Techiman in Ghana. Participation in the study was voluntary and participants also consented by appending their signatures on the consent forms.

5.5.2. Population, Sampling and sample size

The study population was selected by stratifying the country -Ghana into three geographical zones: northern, middle and southern zones. Sequentially, a zone, region and district were selected by simple random sampling. Consecutive convenience sampling was used to select churches, mosques, hospitals, women's fellowships and women's organizations from the district. The study site is the most diverse and well-populated city in the Bono-East region. Site selection was based on the high number of participants who matched the study's selection criteria and the similarities between the sample and the general population. The sample frame comprised postmenopausal women in the Bono-East region, aged 45 years or older using the 2010 population and housing census in Ghana [23]. A sample size of 358 was estimated using the sample size (Formula 1) for cross-sectional studies in an unknown population [24]. The final sample size was 393 with a 10% fall-out rate considered. The calculation was based on the prevalence of obesity among post-menopausal women in Ghana (37.1%, $p=0.37$), [25] a margin of error set at 0.05 and a 95% confidence interval.

Formula 1: Sample size formula for cross-sectional studies:
$$\frac{\left(\frac{Z}{2}\right)^2 P(1-P)}{d^2}$$

5.5.3. Inclusion and exclusion criteria

Based on our predefined criteria, postmenopausal Ghanaian women, aged older than 45 years, not on any weight management therapy, and not living with any physical or mental disability were included in the study. Women outside the age bracket, suffering from major illnesses, not Ghanaian

and not living in Ghana for the past three years were excluded. The women were classified as post-menopause if they had no menstrual bleeding ≥ 1 year

5.5.4. Outcome measures

Self-administered questionnaires included socio-demographics, physical activity, lifestyle and sociocultural factors.

5.5.5. Physical activity assessment

Physical activity level among participants was assessed through the International Physical Activity Questionnaire (IPAQ) Short Form. Participants indicate time and the number of days within the previous seven (7) days they spent walking, doing a moderate-intensity activity and/or doing vigorous-intensity activities [26]. Globally, this questionnaire is used to evaluate physical activity (indicated as low moderate and high) over seven days [26].

5.5.5.1. Lifestyle factors

The questionnaire included different questions related to lifestyle, including health-related habits (alcohol consumption and smoking status), leisure time activity and time spent watching television. According to smoking status, participants were classified as never smokers, past smokers, or current smokers. Marital status was categorized as single, married, widowed or divorced. Participants were asked to describe their lifestyle as very sedentary, sedentary, moderately active, or very active. Seven (7) specific questions were designed to assess the frequency of certain dietary habits during a usual week based on 7-day 24-h dietary recalls. The participants were asked to state how often they consume breakfast, lunch and dinner, water and high-content foods (carbohydrate, protein, fat, vegetables). The high-content carbohydrate foods in this regard included some examples from Ghanaian local foods, such as “banku, fufu, kenkey, tuozafo and yam”. The questions covered some

healthy and unhealthy dietary habits. The beverages were categorized into four levels of intake: fruit juice, mineral water, soft drink and alcoholic drink.

5.5.5.2. Sociocultural factors

The questions on sociocultural factors were designed to assess how traditional customs and cultural background influence the body weight of the participants. Social variables including employment status were assessed. Participants were asked about society's influences on their body weight and whether cultural background and beliefs may prevent them from losing weight.

5.5.5.3. Anthropometric measurements

Participants' body weight and height were determined to the nearest 0.5 kg and 0.5cm respectively using a Seca weighing scale (Seca weighing scale: Seca gmbh and co. kg; 22,089 Hamburg, Germany; Model: 8741321009; designed in China) and stadiometer (Ghaziabad, Scorpio India Medicare Pvt. Ltd. | ID: 4076377262). Body mass index was assessed as the ratio of body weight to height squared after ensuring standardized method measurement [27]. $BMI \geq 25.0 \text{ kg/m}^2$ is considered excess weight [27]. The waist circumference (WC) was measured based on World Health Organization guidelines to the nearest 0.1 cm. It was measured between the lower border of the rib cage and the iliac crest using a non-stretchable fiberglass measuring tape. Participants with a WC 80 cm and above were considered as having abdominal obesity, as defined by the International Diabetes Federation [28]. To define the waist-to-hip ratio (WHR), WC was divided by the hip circumference, measured at the widest location of the hips. According to the WHO reference values, results higher than 0.85 were considered a benchmark for metabolic syndrome [29]. We calculated WHtR by dividing WC (cm) by the measured height (cm) and $WHtR \geq 0.5$ is adopted as excess weight [30]. Body mass index (BMI), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) were calculated and categorized according to the WHO reference values [31].

5.5.6. Data Analysis

Data were analyzed using IBM SPSS (version 25.0). All variables were summarized using descriptive statistics, namely frequencies, percentages for data in graphic presentations, means, and standard deviation. Multivariate logistic regression was used to assess the association between demographic variables and the various indexes of weight gain. Statistical significance was set at $p < 0.05$ for all comparisons. Missing data were treated as missing.

5.5.7. Ethical clearance

Ethical approval for this study was obtained from the Human Research Ethics Committee at the University of the Witwatersrand, South Africa (Ref no. M190467). In Ghana, approval was also obtained from the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology, Kumasi (Ref No. 596/19). Participation was voluntary and written informed consent was obtained from each participant according to the Helsinki declaration.

5.6. Results

The age range of the 393 postmenopausal women enrolled in this study was from 45 to 80 years with a mean age of 60.09 ± 6.24 years. The highest proportion was in the age band 51-60 years contributing 48.8% of all participants. The socio-cultural information showed that most of the participants 45.2%, ($n=164$) were employed and less than half of the participants (41.6%, $n=155$) considered themselves to be overweight. Cultural background and beliefs were considered by 50.8% ($n=188$) of the total cohort as preventing them from losing weight. Half of the participants responded that society views their current weight as attractive. (Table 1).

Table 5: 2: Demographic and sociocultural characteristics of the participants (N= 393)

Demographics	Number of respondent, n (%)
Age in years, Mean (SD)	60.09(6.24)
*Age group (years), n = 369(%)	
≤50	24(6.5)
51-60	180(48.8)
61-70	150(40.7)
>70	15(4.2)
*Employment status, n=363(%)	
Employed	164(45.2)
Retired	67(18.4)
Housewives	24(6.6)
Unemployed	102(28.1)
Others	6(1.7)
*Are you overweight, n =373(%)	
Yes	155(41.6)
No	130(34.8)
Not sure	88(23.6)
*Perception and understanding of overweight, n =365(%)	
Absence of disease	82(22.4)
Presence of disease	159(43.6)

Not sure	124(34.0)
*In your customs, do you think an overweight woman will be recognized, n =372(%)	
Yes	193(51.9)
No	118(31.7)
Not sure	61(16.4)
*Cultural background and beliefs may prevent me from losing weight, n =370 (%)	
Yes	188(50.8)
No	182(49.2)
*Society's view and perception of current body weight, n=372(%)	
Yes	186(50.0)
No	121(32.5)
Not sure	65(17.5)

Note: missing data (*).

5.6.1. Physical activity

Table 2 shows vigorous activities like heavy lifting, digging, aerobics, and fast bicycling as activities in which study participants engaged. They often participate in vigorous physical activity from 1 to 2 times per week (mean value of 2.1) for at least 1 to 10 minutes (mean value of 1.3). During the last 7 days, participants responded that they had 1 to 2 days per week of moderate physical activities (mean value of 1.3) with a duration of 1 to 20 minutes per day (mean value of 1.5). Study participants walked 1 to 3 days per week (mean value of 2.4) and on a day they spend walking 1 to 20 minutes per day (mean value of 1.5). Participants spend about 30 to 60 minutes per day sitting on weekdays.

From figure 2, 55.2% of the study participants engaged in moderate physical activities 23.1% in low-level activities, and 21.7% in high physical activity.

Table 5: 3: Assessment of physical activity pattern among study participants N (393).

Physical activity	Mean (n)	SE	Minimum	Maximum
Vigorous activities				
How often during the last 7 days	2.1	0.05	1	3
Duration of the activities	1.3	0.05	0	3
Moderate activities				
How often during the last 7 days	1.3	0.03	0	2
Duration of the activities	1.5	0.04	0	3
Time spent walking				
Walking/day at least 10 mins	2.4	0.03	1	3
Duration of walking on a day	1.5	0.04	0	3
Time spent sitting				
Time sitting/day	2.1	0.04	0	3
Hours spend watching TV	3.3	0.04	1	4
SE=Standard Error, * missing data				

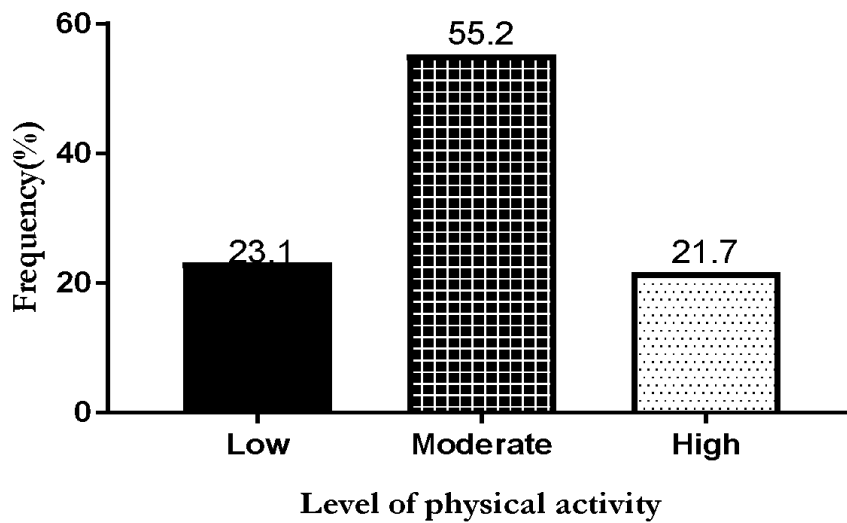


Figure 5: 1: Prevalence of physical activity level among study participants

5.6.2. Lifestyle factors

Most of the participants (68.7%) reported eating three times a day (breakfast, lunch and dinner) and 68.3% drink between 1-1.5 liters of water per day (Table 3). Among the total study participants, 59.7% said they typically eat more than they should for about 4-7 days.

Most of the participants 90.9% (n=339) reported never smoked or taken alcohol 69.0% (n=252) respectively. Most of them 64.1% (n=237) spend their time watching TV and slightly less than half 45.0% (n=163) agreed that they gain weight due to their lifestyle. The results are shown in Table 3.

Table 5: 4: Information on diet and lifestyle among participants

Do you usually eat breakfast, lunch and dinner every day n = 371(%)	
Yes	255(68.7)
No	102(27.5)

Not sure	14(3.8)
What is your diet pattern, n=368 (%)	
Different every day	126(33.9)
Different only sometimes during a week	130(34.9)
Different only during the weekend days	80(21.5)
Same everyday	36(9.7)
Over the past 7 days, how often do you eat, n =370(%)	
1 – 3 days	137(37.0)
4 -7 days	220(59.5)
Not sure	13(3.5)
Which beverages do you usually drink between meals, n =372(%)	
Mineral water	247(66.4)
Soft drinks	70(18.8)
Alcoholic drinks	28(7.5)
Fruit juice	27(7.3)
Do you take beverages in all your meals, n =371(%)	
All the time	197(53.0)
Sometimes	156(42)
Not sure	18(4.9)
Do you drink at least 1–1.5L of water every day, n =372 (%)	
Yes	254(68.3)
No	88(23.7)
Not sure	30(8)

Lifestyle characteristics	
Smoking status, n=373(%)	
Never	339(90.9)
Former	24(6.4)
Current	10(2.7)
Alcohol intake, n= (365)	
Yes	113(31.0)
No	252(69.0)
Describe your lifestyle, n=370(%)	
Very sedentary	28(7.6)
Sedentary	95(25.7)
Moderately active	167(45.1)
Very active	80(21.6)
Hours spent watching TV, n=370(%)	
1-2 hours a day	237(64.1)
3-4 hours a day	105(28.4)
5-6 hours a day	28(1.2)
I will never lose weight due to my lifestyle, n=362(%)	
Yes	199(55.0)
No	163(45.0)

TV=Television

Multivariate binary logistic regression analysis was used to determine the socio-cultural predictors of obesity (using BMI, WHR, and WHtR) among study participants. Participants who were employed, housewives, unemployed and other statuses of employment were all at lower risk of BMI-obesity (i.e. OR <1) compared to the retirees. The unemployed had the highest risks of WHR-obesity (1.6) and WHtR-obesity (2.4). Participants who considered themselves overweight were at higher risk for BMI obesity, WHR-obesity and WHtR-obesity compared to those who reported not being overweight. Participants who stated that their cultural background and beliefs could prevent them from losing weight were 1.4 times at risk of BMI obesity compared to those who thought otherwise. Participants with high physical activity generally had higher odds of obesity.

Table 5: 5: Multivariate binary logistic regression analysis, indicating the odds ratio of sociocultural risk factors for obesity (using BMI, WHR, and WHtR) among study participants

Sociocultural characteristics	BMI-Obesity aOR(95% CI)	WHR-Obesity aOR (95% CI)	WHtR-Obesity aOR (95% CI)
Employment status			
Employed	1.0(0.5- 2.1)	1.1(0.4 - 3.0)	0.8(0.3 - 2.4)
Retired	1	1	1
Housewives	0.6(0.2 - 1.8)	-	1.9(0.2 - 17.9)
Unemployed	0.7(0.3 - 1.7)	1.6(0.5 - 5.6)	2.4(0.6 – 10.0)
Others	0.6(0.1 - 3.6)	0.6(0.1 - 6.4)	0.6(0.1 - 6.4)
Are you overweight?			
Yes	1.9(1.0 - 3.6)	1.0(0.4 - 2.8)	1.3(0.4 - 3.6)
No	1	1	1

Not sure	0.7(0.3 - 1.4)	0.5(0.2 - 1.6)	0.7(0.2 - 2.2)
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Understanding of overweight

Absence of disease	1	1	1
Presence of Disease	0.6(0.3 - 1.2)	1.2(0.4 - 3.5)	0.9(0.3 - 2.6)
Not sure	0.9(0.4 - 1.9)	1.3(0.4 - 4.3)	0.9(0.3 - 3.3)

Are overweight women recognized?

Yes	1	1	1
No	1.5(0.8 - 2.9)	1.3(0.5 - 3.5)	0.9(0.3 - 2.6)
Not sure	1.6(0.8 - 3.4)	0.7(0.2 - 2.0)	0.5(0.2 - 1.4)

Cultural beliefs preventing losing weight

Yes	1.4(0.8 - 2.5)	0.6(0.3 - 1.6)	0.6(0.2 - 1.6)
No	1	1	1

Societal view on your current weight

Attractive	0.7(0.4 - 1.3)	0.9(0.3 - 2.1)	0.8(0.3 - 2.0)
Not attractive	1	1	1
Not sure	0.3(0.2 - 0.8) *	1.3(0.3 - 5.5)	0.8(0.2 - 3.2)

Physical activity

Low	1.0(0.5 - 2.1)	0.7(0.2 - 2.7)	0.9(0.2 - 3.3)
Moderate	1.0(0.5 - 2.0)	0.5(0.2 - 1.7)	0.8(0.3 - 2.4)
High	1	1	1

* aOR=Adjusted Odds Ratio. CI=Confidence Interval

5.7. Discussion

This study assessed physical activity, lifestyle, sociocultural factors and the prevalence of excess weight gain among postmenopausal women. Our results raise an important issue namely that a high number of the participants (50.8%, n=188) believe that cultural backgrounds encourage postmenopausal women to gain weight.

According to the findings, excess weight is viewed as attractive and symbolizes culturally appropriate body size despite its health implications. From the literature, all intervention focuses on exercise and diet and have not emphasized the inclusion of cultural perception which in fact influence behaviour [52]. As such the approach and measures used in managing this global epidemic which is a threat to public health need review [32, 33]. As a first step, a comprehensive program to manage excess weight and its health impact are essential. Programs, interventions, and studies focusing on the management of excess body weight must recognize the perception of society and cultural sentiment on body weight. Excluding these has the potential to underestimate the accurate effect of cultural beliefs, society's view, and perception of body weight. Similar results have been found [18, 21, 34-36], in a study by Rguibi and Belahsen, [16] stating that Moroccan Saharawi women practice fattening rituals to induce weight gain. In Africa, cultural belief in body image has been associated with obesity, particularly among black African women who were dissatisfied with their current body size. They perceived larger body sizes as ideal body sizes [35, 36]. Physical activity is known to be effective in reducing body weight and size [52]. Examining and use of local daily chores which themselves are physical activities may be a useful point of intervention.

Our study also indicates that unemployed postmenopausal women had the highest risk of WHR and WHtR obesity. The earlier studies of sedentary postmenopausal women with obesity and age-related disease by Kalyani et al. and Davenport et al. [37, 38] described the existence of declines in aerobic

fitness, muscle mass, muscle strength, and bone mineral density. The decline in these components is a prevalent and important risk factor for disability and potential mortality in individuals as they age [37]. Preventing this risk of weight gain during this period is critical [38]. Exercise has been demonstrated to be a simple, cost-effective means to improve these outcomes [37]. Therefore, exercise is particularly relevant to postmenopausal women with obesity to preserve their quality of life and improve active life expectancy into old age.

Accumulating 30 minutes of moderate-intensity physical activity on most days is enough to provide substantial health benefits [39], however, our study indicates that the majority (55.2%) of the participants had 1 to 2 days per week of moderate physical activities for 1 to 20 minutes per day during the last 7 days. The evidence suggests that participants may not be meeting the physical activity recommendation of 150-300 minutes of moderate-intensity per week for older adults [40, 41]. There is a need to increase the level of physical activity, particularly among postmenopausal women through promotion, education and interest in a culturally appropriate program [42]. Developing interventions that will increase awareness and result in behaviour change and increased activity is important. The World Health Organization guidelines on physical activity [40] may need to adopt culturally appropriate activities for instance “Ampe”, which is a Ghanaian indigenous game to gain an optimal effect and impact.

Our analyses also revealed that participants engage in regular moderate physical activity such as walking. In a similar manner to walking, our study found participants walked a maximum of 3 days per week for 20 minutes per day. The association between duration and frequency of walking suggests that participants in this sample may not be expending sufficient energy to meet the definition of moderate-intensity physical activity of 150 minutes per week. A study by Ogilvie et al., [43], described walking as near-perfect exercise. The reason could be its popularity, familiarity and a free

form of exercise that can be incorporated into everyday life and sustained into old age [43, 44]. In addition, a study suggests that walking may be influenced by physical-environmental factors and walking needs [45]. Such results suggest that several social conditions and walking needs act as moderators before people consider deciding to walk [45]. The findings are particularly important as our results indicate participants do not walk enough which could be due to the influences of environmental and societal conditions. However, considering that participants are more likely to be sedentary and inactive, they may find walking difficult and will find it easier to undertake their normal roles such as taking care of grandchildren and working in the market or doing general household chores [46]. They will not prioritize activities such as walking and exercise. To encourage greater activity, the use of a culturally appropriate activity to understand their physical activity may be useful. In addition to culturally appropriate interventions, it is important to counter the growing trend of sedentary lifestyles and poor eating habits.

Modification of a sedentary lifestyle and also eating habits have been proposed as a therapy to prevent weight gain during the postmenopausal stage [47]. Dietary habits reported in this current study showed that more than 50% of the participants eat three times a day and on most days of the week eat more than the recommended amount. These may be the reasons for the weight gain in this current study, agreeing with the finding of studies by Rguibi and Belahsen, Aloha [16, 34] which revealed that eating patterns affect weight gain. A study by Petrella et al. [48] projected that a caloric restriction associated with changes in eating behaviour and constant physical activity can reduce weight gain among obese women. Additionally, a summarized literature review regarding the impact of the menopause transition on body weight and body composition conducted by Douketis et al., [49] revealed that calorie restriction alone can elicit a reduction in body weight, total body and visceral fat, similar to exercise. However, the addition of exercise, with a weight loss of more than 5%, can

reduce risk factors for cardiovascular diseases, such as dyslipidemia, hypertension, and diabetes mellitus [49].

In Ghana, fried foods, fatty foods and sugary drinks are more popular compared to four or five decades ago [34]. Ghanaians also seem to be exercising less frequently due to changes in lifestyle and socioeconomic status that have a significant effect on physical activity. People used to walk considerable distances (sometimes miles) to work in the past. Nowadays, fewer Ghanaians walk, preferring instead to use “Pragyaya” (cheap city public transportation) or a car. Furthermore, because many more families now own a car, they are more likely to drive rather than walk. In the past, most families did not have television; those that did had only one channel (GTV), which was available from 18.00 to 22.00 hours each night [34]. However, most households now have more than five television channels and hours of viewing a day.

These changes resulting from modernization contribute to a sedentary lifestyle and increase the likelihood of increased obesity [46]. Hence, much more attention is required to promote lifestyle modification and encourage physical activity.

5.8. Limitation

The use of self-report methodologies to measure physical activity, lifestyle, and sociocultural outcomes was a constraint. Issues and limitations with self-reported outcomes have been raised in the literature [50], and these may have influenced the findings. Secondly, the study was not based on a representative national sample. Using recall of the number of days participants consumed food and perform physical activity on an average day may be influenced by recall bias.

5.9. Conclusions/Recommendation

Our study concluded that there is a high prevalence of obesity among Ghanaian postmenopausal women and certain socio-cultural risk factors increase the risk of being obese. However, most of the study participants engaged in moderate physical activities. Our findings suggest that motivating postmenopausal women to increase their physical activity and modify their lifestyle during their middle years can reduce abdominal fat during the menopause transition, which may impact positively the cardiovascular disease risk profile.

Population-based initiatives are needed to encourage physical activity and healthy eating and to conduct research to identify effective educational, behavioural and environmental approaches to control and prevent excess weight among this population.

Successful attempts to counter sedentary lifestyles have been documented [18, 51] however, negative social pressures such as ‘fat are beautiful, or prosperous’ should be addressed through educational programs. Individuals and communities must be made aware of the health risks associated with obesity and being overweight. Awareness creation should be complemented by population-based health programs that emphasize the benefits of Ghanaian traditional physical activity such as cultural dances (Adowa, Borborbor and Bamaya) and healthy eating in preventing and controlling excess weight.

5.10. Contributions to research

The results of the study provide insight into postmenopausal women’s self-reported physical activity and lifestyle status and sociocultural associated prevalence of weight gain. The results suggest both a need for physical activity program, lifestyle modification and interest in a community-based program.

5.11. Conclusion

In this chapter, the physical activity, lifestyle levels and sociocultural factors and associated prevalence were determined. In Chapter six, an exploration of current weight management practices among Ghanaian postmenopausal women will be discussed.

References

1. Nikpour, S., & Haghani, H. (2014). The effect of exercise on quality of life in postmenopausal women referred to the Bone densitometry centers of Iran University of Medical Sciences. *Journal of Mid-Life Health*, 5(4), 174. <https://doi.org/10.4103/0976-7800.145156>
2. Lee PH, Macfarlane DJ, Lam TH, Stewart SMJIJoBN, Activity P: Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. 2011, 8(1):1-11.
3. Nappi RE , Kokot-Kierepa M . Vaginal Health: Insights, Views & Attitudes (VIVA) –results from an international survey . *Climacteric* 2012 ; 15 : 36 – 44
4. Soldi, C. J. (2015) ‘What Determines Weight Loss Behaviour and Body Weight Satisfaction in Australia ? Evidence From The HILDA Survey’, (March).
5. 5. Soldi, C. J. (2015). *What Determines Weight Loss Behaviour and Body Weight Satisfaction in Australia ? Evidence From The HILDA Survey*. March.
6. Lovejoy JC, Champagne CM, de Jonge L, Xie H, Smith SR. Increased visceral fat and decreased energy expenditure during the menopausal transition. *Int J Obes (Lond)* 2008;32:949–958.
7. Dugan, S. A. et al. (2009) ‘Physical Activity and Reduced Intra-abdominal Fat in Midlife African-American and White Women’, *Obesity*, 18(6), pp. 1260–1265. doi: 10.1038/oby.2009.396.
8. Mirzaiinj Mabadi K, Anderson D, Barnes M: The relationship between exercise, body mass index and menopausal symptoms in midlife Australian women. *International journal of nursing practice* 2006, 12(1):28-34.

9. Society NAM: Treatment of menopause-associated vasomotor symptoms: a position statement of the North American Menopause Society. *Menopause* (New York, NY) 2004, 11(1):11.
10. Alizadeh M, Sayyah-Melli M, Ebrahimi H, Shishavan MK, Rahmani F: Social determinants and reproductive factors of the menopausal symptoms among women in Tabriz-Iran. *Social Determinants of Health* 2015, 1(1):2-8.
11. World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization; 2009.
12. World Health Organization Noncommunicable diseases country profiles (2018), p. 2018. Google Scholar
13. Iannotti RJ, et al. Interrelationships of adolescent physical activity, screen-based sedentary behaviour, and social and psychological health. *International Journal Of Public Health* 2009;54(Suppl. 2):191–8.
14. Prentice-Dunn H, Prentice-Dunn S. Physical activity, sedentary behavior, and childhood obesity: a review of cross-sectional studies. *Psychol Health Med* 2012;17(3): 255–73.
15. Leung MM, et al. Intervening to reduce sedentary behaviors and childhood obesity among school-age youth: a systematic review of randomized trials. *J Obes* 2012; 2012:685430.
16. Rguibi M, Belahsen R. Fattening practices among Moroccan Saharawi women. *EMHJ- Eastern Mediterranean Health Journal*, 12 (5), 619-624, 2006. 2006.
17. Walker ARP. Epidemiology and health implications of obesity, with special reference to African populations. *Ecology of food and nutrition*, 1998, 37:21–55.
18. Aryeetey RN. Perceptions and experiences of overweight among women in the Ga East District, Ghana. *Frontiers in nutrition*. 2016 Jun 2;3:13.

19. Pollock NJ. Cultural elaborations of obesity-fattening practices in Pacific societies. *Asia Pacific journal of clinical nutrition*, 1995, 4:357–60
20. Mciza Z, Goedecke JH, Steyn NP, Charlton K, Puoane T, Meltzer S, Levitt NS, Lambert EV: Development and validation of instruments measuring body image and body weight dissatisfaction in South African mothers and their daughters. *Public health nutrition* 2005, 8(5):509-519
21. Faber M, Kruger HS: Dietary intake, perceptions regarding body weight, and attitudes toward weight control of normal weight, overweight, and obese black females in a rural village in South Africa. *Ethn Dis* 2005, 15(2):238-245.
22. Suara SB, Siassi F, Saaka M, Foroshani AR, Asadi S, Sotoudeh G. Dietary fat quantity and quality in relation to general and abdominal obesity in women: a cross-sectional study from Ghana. *Lipids in health and disease*. 2020 Dec;19(1):1-3.
23. GSS G. Ghana statistical service (GSS), Ghana health service (GHS), and ICF macro. Accra: 350 Ghana Demogr Health Surv. 2009; 2008:79-96.
24. Charan J, Biswas T. How to calculate sample size for different study designs in medical research. *Indian journal of psychological medicine*. 2013 Apr;35(2):121-6.
25. Benkeser RM, Biritwum R, Hill AG. Prevalence of overweight and obesity and perception of healthy and desirable body size in urban, Ghanaian women. *Ghana medical journal*. 2012;46(2):66-75.
26. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF): a systematic review. *Int J Behav Nutr Phys Act*. 2011 Oct 21; 8:115. <https://doi.org/10.1186/1479-5868-8-115> PMID: 22018588
27. World Health Organization. Obesity: preventing and managing the global epidemic. In: Report of a WHO Consultation. World Health Organ Tech Rep Ser. Who; 2000. p. 1–253

28. Alberti KGMM, Zimmet P, Shaw J. Metabolic syndrome—a new world-wide definition. A Consensus Statement from the International Diabetes Federation. *Diabet Med.* 2006 May; 23(5):469–80. [https:// doi.org/10.1111/j.1464-5491.2006.01858.x](https://doi.org/10.1111/j.1464-5491.2006.01858.x) PMID: 16681555
29. World Health Organization. Waist circumference and waist-hip ratio: report of a WHO expert consultation, Geneva, 8–11 December 2008. Geneva: World health organization; 2011.
30. Ashwell M, Hsieh SD. Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. *Int J Food Sci Nutr.* 2005; 56:303–7
31. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. *World Health Organ Tech Rep Ser.* 1995; 854:1–452. PMID: 8594834
32. Mciza Z, Goedecke JH, Steyn NP, Charlton K, Puoane T, Meltzer S, Levitt NS, Lambert EV: Development and validation of instruments measuring body image and body weight dissatisfaction in South African mothers and their daughters. *Public health nutrition* 2005, 8(5):509-519.
33. Irwin ML, McTiernan A, Manson JE, Thomson CA, Sternfeld B, Stefanick ML, Wactawski-Wende J, Craft L, Lane D, Martin LW: Physical activity and survival in postmenopausal women with breast cancer: results from the women's health initiative. *Cancer prevention research* 2011, 4(4):522-529.
34. Amoah AG. Sociodemographic variations in obesity among Ghanaian adults. *Public health nutrition.* 2003 Dec;6(8):751-7.
35. Micklesfield LK, Lambert EV, Hume DJ, Chantler S, Pienaar PR, Dickie K, Goedecke JH, Puoane T: Socio-cultural, environmental and behavioural determinants of obesity in black South African women. *Cardiovascular journal of Africa* 2013, 24(9):369.

36. Puoane T, Tsolekile L, Steyn N: Perceptions about body image and sizes among black African girls living in Cape Town. 2010.
37. Kalyani RR, Corriere M, Ferrucci L. Age-related and disease-related muscle loss: the effect of diabetes, obesity, and other diseases. *The lancet Diabetes & endocrinology*. 2014 Oct 1;2(10):819-29.
38. H Davenport M, May Ruchat S, J Hazell T. Exercise Prescription for Post-Menopausal Women with Obesity. *Current Women's Health Reviews*. 2017 Apr 1;13(1):17-24.
39. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, Buchner D, Ettinger W, Heath GW, King AC, Kriska A. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Jama*. 1995 Feb 1;273(5):402-7
40. Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J. P., Chastin, S., Chou, R., Dempsey, P. C., Dipietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., ... Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, 54(24), 1451–1462. <https://doi.org/10.1136/bjsports-2020-102955>
41. Centers for Disease Control and Prevention: Physical activity and health: A report of the Surgeon General. Atlanta, US Dept of Health and Human Services. Centers for Disease Control and Prevention, National Ce
42. Balis, L. E., Sowatey, G., Ansong-gyimah, K., Ofori, E., & Harden, S. M. (2019). Older Ghanaian adults' perceptions of physical activity: an exploratory , mixed methods study. 1–16.

43. Ogilvie, D., Foster, C. E., Rothnie, H., Cavill, N., Hamilton, V., Fitzsimons, C. F., & Mutrie, N. (2007). Interventions to promote walking: Systematic review. *British Medical Journal*, 334(7605), 1204–1207. <https://doi.org/10.1136/bmj.39198.722720.BE>
44. Morris J, Hardman A. Walking to health. *Sports Med* 1997; 23:306-32
45. Alfonzo M. To walk or not to walk? The hierarchy of walking needs. *Environ Behav* 2005; 37:808-36
46. Metzgar CJ, Preston AG, Miller DL, Nickols-Richardson SM. Facilitators and barriers to weight loss and weight loss maintenance: a qualitative exploration. *J Hum Nutr Diet* 2015 Dec;28(6):593e603
47. Lartey ST, Magnussen CG, Si L, Boateng GO, De Graaff B, Biritwum RB, Minicuci N, Kowal P, Blizzard L, Palmer AJ: Rapidly increasing prevalence of overweight and obesity in older Ghanaian adults from 2007-2015: Evidence from WHO-SAGE Waves 1 & 2. *PloS one* 2019, 14(8):e0215045.
48. Petrella E, Malavolti M, Bertarini V, Pignatti L, Neri I, Battistini N, Facchinetti F: Gestational weight gain in overweight and obese women enrolled in a healthy lifestyle and eating habits program. *The Journal of Maternal-Fetal & Neonatal Medicine* 2014, 27(13):1348-1352.
49. Douketis JD , Macie C , Thabane L , Williamson DF . Systematic review of long-term weight loss studies in obese adults: clinical significance and applicability to clinical practice. *Int J Obes* 2005; 29 : 1153 – 67
50. T. Baranowski, L. M. Klesges, K. W. Cullen, and J. H. Himes, “Measurement of outcomes, mediators, and moderators in behavioral obesity prevention research,” *Preventive Medicine*, vol. 38, pp. S1–S13, 2004
51. Musaiger AO. Overweight and obesity in the Eastern Mediterranean Region: can we control it?. *EMHJ-Eastern Mediterranean Health Journal*, 10 (6), 789-793, 2004. 2004.

52. Nicklas, B. J., Wang, X., You, T., Lyles, M. F., Demons, J., Easter, L., Berry, M. J., Lenchik, L., & Carr, J. J. (2009). Effect of exercise intensity on abdominal fat loss during calorie restriction in overweight and obese postmenopausal women: A randomized, controlled trial. *American Journal of Clinical Nutrition*, 89(4), 1043–1052. <https://doi.org/10.3945/ajcn.2008.26938>

6. CHAPTER SIX: AN EXPLORATORY STUDY ON EXCESS WEIGHT GAIN: EXPERIENCES OF POSTMENOPAUSAL WOMEN IN GHANA

6.1. Manuscript details

Chapter six is presented as a published paper. The paper aimed to explore current weight management practices among postmenopausal women with excess weight gain in Ghana. . The paper was submitted to PLOS ONE Women's Health and the manuscript has been published. We explored the weight management approaches available for postmenopausal women in Ghana. The findings of the study would help to develop an appropriate weight loss intervention.

The manuscript's title is “An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana”.

Journal: *PLOS ONE Women's Health*

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6.2. Details of the author's contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix H.

Table 6: 1: Details of the author's contribution

	Mensah Bonsu	Myezwa	Brandt	Ajidahun	Asamoah	Monday
Conceptualization	√	√	√	√		
Method	√	√	√	√	√	√
Resources	√				√	√
Manuscript writing draft	√					
Manuscript writing review and editing	√	√	√	√	√	√
Supervision		√	√	√		√

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6.4. Published article: An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana

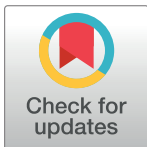
RESEARCH ARTICLE

An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana

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Abstract

Introduction

Excess weight gain is a problem with a significant impact on health and quality of life as well as the consequent economic burden on human populations. While society advocates preference for excess weight gain, limited evidence exists concerning postmenopausal women's experiences in Ghana.

Aim

The current study explored the experiences regarding excess weight (overweight and obesity) gain among Ghanaian postmenopausal women in Bono East (Techiman) region.

Methods

This is a qualitative exploratory descriptive study where anthropometric measurements [body mass index (BMI), waist-to-height ratio (WHtR) and waist-to-hip ratio (WHR)] were determined and participants who were identified with excess weight (obesity and overweight) were recruited to participate in a focus group discussion (FGD). Four focus group discussions were held and 24 postmenopausal women (>45 years) in Techiman took part. Discussions were audio-recorded and transcribed for thematic analysis.

Results

From the qualitative analysis of the FGD, three major themes emerged from the study namely, (i) perception of body weight, (ii) measures to reduce body weight, and (iii) support to adhere to the weight management program. Sub-themes revealed that weight gained was viewed as the presence of diseases and admired by society as a culturally accepted body image. Diet-related changes, a combination of diet modification and physical activity, and weight management supplements emerged as measures to reduce excess weight.

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Support to adhere to the weight program included health education, access, affordable exercise facilities, and social support.

Conclusions

Sociocultural norms influence the image perception and acceptance of weight gain among postmenopausal women in Ghana, but there is an acknowledgment of the perceived negative health implications of such excess weight. Measures for weight reduction and support to adhere to the weight reduction programme require attention in Ghana.

Introduction

Excess weight (overweight and obesity) refers to a build-up of adipose tissue (body fat) that causes deficiency in the well-being, physical health, and emotional health of an individual [1]. Globally, the prevalence and trend of excess weight gain are of major economic concern, as behaviour alterations have led to this unhealthy body weight [2]. The global prevalence of excess weight among post-menopausal women is about 10% [3]. In Ghana, the prevalence of excess weight gain is between 10.7% and 14.1% and women are particularly affected within the West African region [3].

Excess weight gain impacts the quality of life of an individual [4]. Studies revealed that individuals who are obese are adversely impacted and experience direct and indirect criticism and judgement from others [5–10]. Consequent negative feelings cause depression and anxiety among obese individuals [4]. Additionally, negative personal beliefs about inferiority are commonly associated with obese individuals [11–13]. Weight gain is a health concern for women especially those aged 55–65 years [14]. This is understandable as the occurrence of obesity is increasing globally and nearly 300 million women are obese [15]. The prevalence of weight gain is common during the menopausal transition [16]. Independent of women's early body size or race/ethnicity, women gain about 0.7 kg per year on average during the fifth and sixth decades of lifespan [16]. Additionally, the sharp increase in excess weight is due to numerous factors and is only in part attributable to the adoption of a western lifestyle (physical inactivity and excessive consumption of energy-dense food) observed in the last 20 years [17]. Other studies have demonstrated that the disruption of the circadian cycle, skipping breakfast, regular eating occurrence, unbalanced meals and consumption of large food size, could predict obesity [18,19].

Weight gain among postmenopausal women is associated with the appearance of excess central body fat, mostly visceral fat [18,19]. These associated changes are due to an estrogen deficiency level after menopause, ageing and factors that influence a healthy lifestyle [14]. Abdominal obesity has adverse metabolic concerns, such as hypertension and cardiovascular disease [20]. Given that weight gain is a major risk factor for coronary heart disease, infarction, and stroke and causes death in postmenopausal women [19,21], it is important to explore postmenopausal women's experiences of their weight gain.

Several studies have established that one's perception of body size differs with ethnicity, and culture [22–24] and can influence weight gain [25–28]. In the developed world, the thin body dimension is associated with attractiveness, and smartness and represents perfect body image [29]. However, studies conducted in African countries have shown that excess weight gain is associated with cultural standards and accepted appearance that signifies attractiveness, social success, beauty and wealth [30–33]. For instance, Holdsworth et al., [34] studied healthy and

desirable body size perception among urban Senegalese women. Out of 301 women sampled, the majority believed being overweight is appropriate and symbolizes socially desirable body size.

The public health interventions to address excess weight gain in Ghana have focused on diet-related changes and the adoption of physical activity [6]. Little is known about the experiences and factors influencing behaviour around weight gain of postmenopausal women and how these can be incorporated into management approaches in the Ghanaian population. An individual's body weight explains the long-term energy balance between the calories consumed from food and the energy expended [35]. The rise in urbanization and westernization in West Africa are two frequently mentioned factors for the change in the energy balance [36]. Theoretically, as societies get more urbanized and westernized, people engage in less physical exercise and have access to a wider variety of high-calorie fast foods and beverages [37]. Understanding the experiences of postmenopausal women can assist policymakers and public health services to develop evidence-based interventions to manage weight gain in the menopausal transition.

Aim

The current study explored the experiences regarding excess weight (overweight and obesity) gain among Ghanaian postmenopausal women in Bono East (Techiman) region.

Materials and methods

Study design

An exploratory, descriptive qualitative research design using focus group discussion (FGD) was used to explore the experiences of postmenopausal women with excess weight gain in the Bono East (Techiman) region of Ghana.

Study setting

The study was conducted in Techiman, the capital of the Bono-East region of Ghana. Techiman is one of the leading market towns in the country and one of the two main cities and settlements of the Bono-East region of Ghana [38]. There is diversity in cultural and social structure in the town due to the numerous economic activities engaged by the settlers [39]. These features made the town suitable for this study. A preliminary study was conducted to determine the lifestyle, sociocultural factors and prevalence of excess weight gain among postmenopausal women in Techiman. The study established a higher prevalence of excess weight gain among postmenopausal women using WHtR (91.8%), and WHR (91.0%) and is due to cultural beliefs, and a sedentary lifestyle [unpublished data]. Therefore, developing culturally appropriate interventions for postmenopausal women with weight gain will be helpful.

Study population and sample

A purposive sampling method was used to recruit participants who satisfied the inclusion criteria. The participants were recruited through public invitation (such as information centres, announcements at churches, Techiman main markets and mosques) where their anthropometric measurements [body mass index (BMI), waist-to-height ratio (WHtR) and waist-to-hip ratio (WHR)] were measured, and those who have excess weight (obesity or overweight) were purposively selected to be part of FGDs after endorsing the informed consent form. The sample frame comprised post-menopausal women in Techiman municipality in the Bono East Region of Ghana, aged 45 years and above and with a BMI > 25kg/m². The sample size

included twenty-four participants ($n = 24$) assembled into four focus groups with an average of six members per group.

Inclusion and exclusion criteria

Our study included postmenopausal Ghanaian women over 45 who were not on any weight-loss therapy and had no physical or mental disabilities. Women who are not Ghanaians and had not resided in Ghana for the previous three years before the study were not eligible.

Data collection tool and procedure

Moderator's guide ([S1 File](#)) for the focus group discussion was used as the data collection tool. The authors developed the guiding questions based on the study objective and available literature. During the interview information on their thoughts regarding their current weight, things they do to manage their weight and type of assistance to adhere to weight management programmes were gathered. The validity of the information to be gathered was determined by an expert in women's health (CB). Additional probes were used to gain a further understanding of the participants' experiences of weight gain.

A research assistant who spoke and wrote Twi (the local language) was consulted to translate the interview guide. Pre-interview demographic data (age, religion, marital status, ethnic origin and educational background) were collected using a self-administered questionnaire for each session of the focus group before the discussion. The FGDs were facilitated by a trained moderator who was aided by a research assistant. The average duration for each FGD was about 1 hour. The FGDs were all scheduled on a date other than the recruitment date at their convenient time and place. Dietitians and exercise scientists were consulted to offer nutritional and exercise counselling services for participants who needed support after sharing their experiences. Almost all the participants used these services. The discussion was audio-taped with the participants' consent. The first author obtained the recording and listened to the discussion immediately after each focus group session. Inconsistent comments were probed for understanding. The audio recordings from the discussion were transcribed by an independent translator fluent in both the Twi and English languages. Transcribed focus group discussions were provided to two randomly selected participants from each group to read through their responses for validation. The transcripts were independently read repeatedly by the first author (IMB) and the fifth author (BA) to make sense of the experiences of postmenopausal women with excess weight gain. Field notes were used for each session to capture the participants' non-verbal cues, apprehensions, and the author's reflections that gave context to the data. The field notes were reviewed, and reports were prepared for each focus group session.

Data analysis

A thematic analysis process was done in three phases namely pre-analysis, exploration, treatment and interpretation to analyse the data [40]. To generate data that directly relate to the experiences of postmenopausal women with excess weight gain, important frequent phrases or statements were extracted from transcripts as codes ([S2 File](#)). Related or similar codes were bundled into categories to help organize the data effectively. Formulated meanings were then generated from the significant phrases or statements. Subsequently, themes, sub-themes and categories that emerged were noted based on the multiple statements that conveyed similar meanings. We explored individual themes and attempted to determine possible interrelatedness between themes.

The first (IMB), third (MOM) and fifth (BA) authors coded all the focus group transcriptions while the second (CB) and sixth (HM) authors read the transcripts and reviewed the

fragments that resulted from the coding process. During the coding phase, we focused on three domains of interest: body weight, weight loss approaches and adherence to weight management. Each author (IMB, MOM, BA) independently coded one domain from the four transcripts. The codes were presented to the moderator for verification. Eventually, the authors deliberated about the coding and key themes that emerged. Field notes, made by IMB during the discussion, were used to supplement the results. Trustworthiness and credibility in this study were ensured by peer de-briefing and member checking [41]. At the end of each focus group session, member checks were carried out by summarising key responses for participants to validate if they accurately reflected participants' true experiences living with excess body weight. The first author also gathered the responses of each focus group interview to facilitate an exact representation of participants' views and experiences.

Ethical considerations

Ethical approval for this study was obtained from the Human Research Ethics Committee at the University of the Witwatersrand, South Africa (Ref no. M190467). In Ghana, approval was also obtained from the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology, Kumasi (Ref No. 596/19). The aim, risks and benefits of the study were explained to the participants during the recruitment stage. Participants were informed that their participation is voluntary and that they reserve the right to withdraw from the study without any prejudice. Those who consented signed the consent forms and were guaranteed their anonymity in future reports and publications. Participants were informed that their contribution will help identify measures to manage excess weight among postmenopausal women.

Results

Demographic characteristics of the participants

Twenty-four postmenopausal women consented to participate in the FGDs. Most of the participants were married and from the Akan tribe. The study included postmenopausal women, age range 45 to 74 years, a majority of whom were Christians (54.2%) and had at least a high school certificate (54.2%). The Participant's demographic characteristics and anthropometric data are summarised in [Table 1](#).

Main findings

From the qualitative analysis of the FGD, three major themes emerged from the study namely, perception of body weight, measures to reduce body weight, and support to adhere to the weight management programme, which is briefly described in [Table 2](#) below.

Perceptions of current body weight

The theme contextualises the postmenopausal woman's personal experiences of excess body weight (obesity and overweight). Two underlying sub-themes emerged from this main theme which includes (1) admirable/ presentable; and (2) the presence of diseases.

Sub-theme: Admirable/Presentable

Respondents expressed that their motivation for desiring some amount of body weight was the ability to fit well in their clothes during traditional functions like funerals, wedding ceremonies and others and these indicate a sign of "enjoying good living." The following quotes speak to this sub-theme.

Table 1. Demographic information of participants.

Demographics	
Age in years, Mean (SD)	58.00 (7.21)
Age group (years), n = 24(%)	
45–55	10 (41.7%)
56–66	11 (45.8%)
≥67	3 (12.5%)
Religion, n = 24(%)	
Christian	13 (54.2%)
Muslim	11 (45.8%)
Marital Status, n = 24(%)	
Married	14 (58.3%)
Widow	7 (29.3%)
Divorced	3 (12.5%)
Educational background, n = 24(%)	
Primary	7 (29.2%)
High School	13 (54.2%)
Tertiary	4 (16.7%)
Ethnic origin, n = 24(%)	
Northerner	8 (33.3%)
Akan	13 (54.2%)
Ga	1 (4.2%)
Voltarian	2 (8.3%)
Anthropometrics	
Focus group one (n = 24)	
Mean±SD	60.33±4.46
Mean/BMI	29.1
Mean/WHR	0.88
Mean/WHtR	0.59
Focus group two (n = 24)	
Mean±SD	63.66±7.66
Mean/BMI	32.4
Mean/WHR	0.92
Mean/WHtR	0.61
Focus group three (n = 24)	
Mean±SD	56.00±4.00
Mean/BMI	31.5
Mean/WHR	0.92
Mean/WHtR	0.60
Focus group four (n = 24)	
Mean±SD	58.66±6.28
Mean/BMI	30.9
Mean/WHR	0.90
Mean/WHtR	0.63

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I see myself as very active and admirable even though I have gained weight. I feel presentable when I attend functions like funerals, church and wedding ceremonies because I fit well in my cloth. I do almost all my activities myself. Most people admire me because of my weight and the activity I use to do work. I'm seen as being healthy and stronger than some of my age mates. (FGD 1, participant #3)

Table 2. Themes and sub-themes generated.

THEMES	SUB-THEMES
Perceptions of body weight	• Admirable/Presentable • Presence of diseases
Measures to reduce excess weight	• Diet-related changes • Combination of diet modification and physical activity • Weight management supplement
Support to adhere to the weight management programme	• Health Education • Access and affordable exercise facilities • Social support

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As for me, I take pride in myself and how I look. My weight is not a challenge to me in any way. When you feel good about yourself and who you are, you stand tall and naturally carry yourself with a sense of confidence and self-acceptance that makes you beautiful regardless of your body weight, size, or shape. (FGD 2, participant #4)

I am not concerned because I feel good about myself and am active. I am comfortable with my body weight and am full of confidence when I step out to anywhere. (FGD 3, participant #1)

Sub-theme: Presence of diseases

The participants in this study anticipate some negative health implications of excess weight among postmenopausal women. This understanding is expressed in the quotes by two respondents who indicated that their excess body weight status was responsible for them having health challenges.

I'm not as healthy as I used to be. I have health challenges and chronic diseases such as hypertension, waist pain and recently diagnosed diabetes. I have taken pain relief medications for several years but still, the pain comes when the medication gets finished. (FGD 2, participant #1)

A 56-year-old woman lamented that,

My weight makes me feel tired easily even if I do fewer demanding activities. I feel heaviness in my body which makes me uncomfortable. I have severe knee and waist pains and I am spending a lot of money on medications. (FGD 4, participant #4)

Measures to reduce body weight

This theme explored current weight management practices among postmenopausal women. Three measures emerged as subthemes that informed the postmenopausal weight management strategies. They include (1) diet-related changes; (2) diet modification and physical activity; (3) weight management supplements.

Sub-theme: Diet-related changes

They stated that they have reduced the intake of starchy food and meat and now enjoy seasonal fruits are grown locally, such as watermelon, orange, and mango, which were previously absent from their diet.

I have reduced my intake of starchy foods and meat. I am very selective about the kind of food I eat recently. I eat vegetables and fruits often to manage my body weight. I started these about a year ago and have seen some significant changes. (FGD 3, participant #5)

I take some fruits such as watermelon, mango, orange, etc. I don't eat after 5 pm. I have a backyard garden, so I have access to fruits. I also don't take salt and fresh meat. (FGD 4, participant #6)

Sub-theme: Diet modification and physical activity

Participants highlighted an amalgam of dietary and physical activity modification as a way of weight management. As part of the participants' weight management strategies, they indicated changes in diet and physical activity as an approach. Two participants commented as follows:

I control the quantity of food I eat now. I now eat heavy food in the morning and take fruits in the evening and engage in physical activities too. I have been going to the farm also and I believe all these are part of physical activities. (FGD 4, participant #4)

I eat dinner at 5:00 pm and walk for about 30 minutes every evening around my compound. I also walk to serve my customers, instead of using a car. I participate in outdoor games occasionally. (FGD 2, participant #2)

I like fufu (Ghanaian indigenous starchy food) very well and eat it every day, I have only reduced the size of the fufu. I eat some seasoned fruits like watermelon and mangoes. I have not seen any significant reduction in my body weight. I also walk most of the time to church and meetings. (FGD 4, participant #1)

One participant confessed that, even though the size of her meal has not reduced, she engaged in some form of physical activity such as walking and sweeping and occasionally participate in outdoor games during holidays to manage her excess weight as shown below:

I have not been able to reduce the quantity of food I take but I take in more of our local greens, fruit and dry fish almost every day, especially on weekends. I also walk up and down to serve my customers most often. (FGD 3, participant #5)

Sub-theme: Weight management supplement

Unlike other women who used diet modifications and physical activity as measures to manage body weight, some participants were motivated by weight management supplements, pills and teas which they believed are a fast and best option to achieve their weight management agenda. According to them, they use some of the supplements to prepare tea for breakfast without any sugar and milk as shown in the following narrations:

I am taking weight management supplements like herbal life as breakfast without sugar and milk. I take these products because I want to reduce my weight quickly. I take this twice a day with a required dosage for about four months now. (FGD 4, participant #6)

I drink slim tea in the morning and forever living products, clean 9. I started this about four months ago. I need a quicker way to reduce my weight because my blood pressure is not stable, and I'm told to do something about my weight. (FGD 1, participant #3)

I drink a mixture of warm water and honey every morning. A friend introduced this method to me, and I believe it will work for me. I am told I can also take warm water and lemon; I will try that one too. (FGD 3 participant #3)

I started with herbal life supplement a year ago, however, I recently bought slim tea to manage my weight because I wanted fast results. A friend introduced a forever-living supplement two weeks ago. These supplements are expensive, so I moved to natural means like a mixture of honey and lemon. I drink boiled lemon every morning before I step out (FGD 2, participant #4)

Support to adhere to the weight management programme

The theme describes the various supports to aid weight management programs. In this study, the sub-themes generated under this theme are (1) health education on lifestyle modification, (2) access to available and affordable exercise facilities, and (3) self-control and motivation.

Sub-theme: Health education

Participants raised a need for diet-related education including timing and type of food to eat. They also mentioned education that highlights the importance and type of exercise as measures of adherence to exercise programs. Some of the women cited they are oblivious to the risk of excess body weight and how to avoid its consequences and thus, health education through the local radio stations and hospital information centers can assist them to have all the necessary information to modify their lifestyle. This is illustrated in the narratives below:

We need health education in our homes through radio stations and public health systems. These will help us to reduce the causes of some diseases. (FGD 1, participant #1)

We will need education from qualified health professionals on how to modify our lifestyles such as eating habits and the dangers of not exercising. These will help our weight management program. (FGD 2, participant #4)

Doctors should constantly come to our end and educate us on the dangers attached to excess body weight and ways and means to prevent it. (FGD 4, participant #2)

In one of the groups, one respondent reported that the media and health workers should provide education on the efficacy of weight management supplements in the market. The FGD participant recounted bad experiences of consuming certain weight management supplements of which she had little knowledge and suggested that education on this topic is much needed.

We would be very grateful if the information is given on the effective weight management supplement that we should buy. I remember a friend introduced me to a weight management supplement called slim tea and I had a bad experience. I had diarrhea for a whole night and was admitted to the hospital for three days before discharge. (FGD 3, participant #1)

Sub-theme: Access and affordable exercise facilities

Participants cited that the availability of affordable exercise facilities encourages them to adhere to weight management programs.

We need gym facilities in the community that are accessible and not expensive. This will encourage us to exercise. (FGD 2, participant #5)

There must be exercise facilities in our community which are cheap with qualified people to assist us (FGD 3, participant #4)

Sub-theme: Social support

Other participants suggested encouragement from family members and society by offering positive words of support and approval can assist their adherence to the weight management program as described below:

Inspiration from family members and society can help us adhere to a weight management program. (FGD 4, participant #5)

Motivational words such as you are looking good, you have reduced in weight, and your health issues are getting better from family especially our partners and sometimes physicians will encourage us to adhere to a weight management program. (FGD 4, participant #1)

Discussion

This study aimed to explore the experiences of postmenopausal women with excess weight gain. Three themes were identified from our study and included perception of body weight, weight management practices and support to adhere to weight management programmes.

Excess body weight is usually deemed to be an indication of an unhealthy lifestyle, indicative of the onset of some non-communicable illness. In our study excess weight is viewed within the Ghanaian context as admirable and a culturally accepted norm of financial well-being. The cultural dynamics in Ghana tend to celebrate curvaceous and buxom women because it is seen as a sign of well-being [6,42]. In this regard, women in this cultural setting tend to flaunt their weight gain since the cultural ethos value such a large body size [42]. Participants surmised that traditional ceremonies such as funeral and marriage engagements present rare opportunities to showcase their beauty, thus, a plump and curved woman who fits beautifully in her dress is highly praised and admired. The perception motivates lots of postmenopausal women to accept and flaunt the weight gained during this phase of their lives since the culture celebrates them. This may fuel the epidemic of obesity and overweight in women which are risk factors for cardiovascular diseases, joint pain and other lifestyle diseases such as type 2 diabetes [43]. This affirms earlier findings that describe the perception of body weight as socially admirable and presentable [6]. The onset of postmenopausal symptoms is linked to a higher risk of chronic diseases which is a factor of concern when occurring with obesity or excess weight gain. The finding in our study namely, that being overweight or obese, indicates the presence of a disease, is consistent with a study that reviewed exercise guidelines and considerations in postmenopausal women with obesity. They found an association between the transition to menopause and increased heart disease and osteoporosis [43].

It is therefore important to consider the findings in the study which highlighted the current weight management practice such as diet-related changes. In the management of excess weight, participants narrated that they adopted dietary adjustments. This finding could be explained by the fact that participants saw dietary modification as a strategy for weight loss and its implication on health improvement and disease prevention [44], consequently modifying the quantity and type of diet. This finding, thus, has implications for health professionals especially in public health. Dieticians should educate postmenopausal women on how to manage their diet to prevent excess weight gain.

In addition to the measures to reduce body weight, participants also mentioned that they normally adopted a combination of physical activity and alteration of their diet to reduce their

excess weight gain. This finding indicates that regular physical activity such as walking, sweeping, stair climbing, and appropriate nutrition could be the main determinants of a healthy lifestyle in this population [44]. Previous authors established that reducing body mass index, losing weight and visceral adiposity through diet changes and physical activity, have been shown to reduce the risk and incidence of chronic diseases as well as type 2 diabetes more effectively [43,45]. Remarkably, some participants wanted to reduce their weight following the findings of Aryeetey [6] and in most cases, they wanted to reduce their body weight as fast as possible. Our results show that several management techniques such as supplements, diet-related changes and physical activities are being used by postmenopausal women, in their attempt to reduce their excess body weight. Most of the time, the efforts and efficacy of these therapies do not produce successful outcomes [6]. In Ghana, the Ministry of Health developed physical activity and diet guidelines, however, it has failed to recommend the prevention of excess weight gain in post-menopausal women. The evidence suggests the urgent need to develop policies and regulate the weight management industry in the country. The policies will guide the citizens and health care professionals towards evidence-based therapies for weight management [6].

Support to adhere to the weight management program identified included health education, access and affordable exercise facilities and social support. A 12-month study conducted by Acharya et al [46] to describe participants' adherence to multiple components of a standard behavioural treatment program revealed adherence rates as low as 10%. Thus, to increase adherence rates, the program should incorporate an aspect of social support. Social support (whether through family, friends or peers) is important for successful weight management and is a significant determinant in overall health [46] as it serves as a motivational tool for the women to remain involved in the weight reduction program. Our findings correspond with earlier studies which posits that social support is necessary for weight reduction programs and it encourages participants to adhere to weight management programmes [46,47].

Additionally, access to and availability of affordable exercise facilities are essential to supporting physical activity engagement as it decreases some emotional and physical barriers to exercise [48]. The finding of our study has implications for policymakers to create an environment that supports physical activity in the community (e.g., Recreational parks) and incorporates technology to track behaviour change. Again, when it comes to weight programs, the significance of health education cannot be overlooked [49]. Consequently, there is a need for public health departments and community health educators to address the community's specific needs regarding diet and physical activity through educational programs.

Conclusion

The present study has illuminated the experiences of postmenopausal women with excess weight gain in Ghana. Even though excess body weight is a threat to the health of an individual, it is admired and socially accepted by the society within the Ghanaian cultural context as we have established in the Bono-East (Techiman) region. Considering the measures to manage or reduce excess weight, there is a need for policies and regulations in the weight management industry to guide the public, particularly women. Additionally, incorporating aspects of social support will encourage adherence rates in weight management programs.

Supporting information

S1 File. Moderator's guide.
(DOCX)

S2 File. Coding tree.
(DOCX)

Author Contributions

Conceptualization: Isaac Mensah Bonsu, Hellen Myezwa, Corlia Brandt.

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References

1. James PT. Obesity: the worldwide epidemic. *Clinics in dermatology*. 2004 Jul 1; 22(4):276–80. <https://doi.org/10.1016/j.clindermatol.2004.01.010> PMID: 15475226
2. Turner E, Crowle J. Childhood obesity: an economic perspective.
3. Abubakari AR, Lauder W, Agyemang C, Jones M, Kirk A, Bhopal RS. Prevalence and time trends in obesity among adult West African populations: a meta-analysis. *Obesity Reviews*. 2008 Jul; 9(4):297–311. <https://doi.org/10.1111/j.1467-789X.2007.00462.x> PMID: 18179616
4. Pimenta FB, Bertrand E, Mograbi DC, Shinohara H, Landeira-Fernandez J. The relationship between obesity and quality of life in Brazilian adults. *Frontiers in psychology*. 2015 Jul 14; 6:966. <https://doi.org/10.3389/fpsyg.2015.00966> PMID: 26236255
5. RM P. Heuer CA. The stigma of obesity are view and update. *Obesity*. 2009; 17:941–64. <https://doi.org/10.1038/oby.2008.636> PMID: 19165161
6. Aryeetey RN. Perceptions and experiences of overweight among women in the Ga East District, Ghana. *Frontiers in nutrition*. 2016 Jun 2; 3:13. <https://doi.org/10.3389/fnut.2016.00013> PMID: 27313998
7. Wang YC, McPherson K, Marsh T, Gortmaker SL, Brown M. Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet* (2011) 378(9793):815–25. [https://doi.org/10.1016/S0140-6736\(11\)60814-3](https://doi.org/10.1016/S0140-6736(11)60814-3) PMID: 21872750
8. Bodiba PM, Madu SN, Ezeokana JO, Nnedum OA. The relationship between body mass index and self-concept among adolescent black female university students. *Curationis* (2008) 31(1):77–84. <https://doi.org/10.4102/curationis.v31i1.917> PMID: 18592952
9. MacLean L, Edwards N, Garrard M, Sims-Jones N, Clinton K, Ashley L. Obesity, stigma and public health planning. *Health Promot Int* (2009) 24(1):88–93. <https://doi.org/10.1093/heapro/dan041> PMID: 19131400
10. Puhl RM, Heuer CA. The stigma of obesity: a review and update. *Obesity (Silver Spring)* (2009) 17(5):941–64. <https://doi.org/10.1038/oby.2008.636> PMID: 19165161
11. Abilés V, Rodríguez-Ruiz S, Abilés J, Mellado C, García A, Pérez de la Cruz A, et al. Psychological characteristics of morbidly obese candidates for bariatric surgery. *Obesity surgery*. 2010 Feb; 20(2):161–7. <https://doi.org/10.1007/s11695-008-9726-1> PMID: 18958537

12. Yeh S, Hwang TS, Weleber RG, Watzke RC, Francis PJ. Acute macular outer retinopathy (AMOR): a reappraisal of acute macular neuroretinopathy using multimodality diagnostic testing. *Archives of ophthalmology*. 2011 Mar 14; 129(3):360–71.
13. Son Y. J., and Kim G. The relationship between obesity, self-esteem and depressive symptoms of adult women in Korea. *Korean J. Obes.* (2012) 21, 89. <https://doi.org/10.7570/kjo.2012.21.2.89>
14. Nappi RE, Kokot-Kierepa M. Vaginal Health: Insights, Views & Attitudes (VIVA)—results from an international survey. *Climacteric*. 2012 Feb 1; 15(1):36–44.
15. World Health Organization. Obesity and overweight. Fact sheet no. 311, May 2012. Retrieved from WHO website: <http://www.Who.Int/mediacentre/factsheets/fs311/en/> (<http://www.who.int/mediacentre/factsheets/fs311/en/>). 2012.
16. Abdunour J, Doucet E, Brochu M, Lavoie JM, Strychar I, Rabasa-Lhoret R, Prud'homme D. The effect of the menopausal transition on body composition and cardiometabolic risk factors: a Montreal-Ottawa New Emerging Team group study. *Menopause*. 2012 Jul 1; 19(7):760–7. <https://doi.org/10.1097/gme.0b013e318240f6f3> PMID: 22395454
17. Davis SR, Chedraui P, Lumsden MA, Nappi RE. Understanding weight gain at menopause Understanding weight gain at menopause.
18. Bezerra IN, Curioni C, Sichieri R. Association between eating out of home and body weight. *Nutrition reviews*. 2012 Feb 1; 70(2):65–79. <https://doi.org/10.1111/j.1753-4887.2011.00459.x> PMID: 22300594
19. Wing RR, Matthews KA, Kuller LH, Meilahn EN, Plantinga PL. Weight gain at the time of menopause: *Arch. Intern. Med.* 1991 151/1 (97–102). *Maturitas*. 1991 Oct 1; 13(4):339–40.
20. Gravena AA, Brischiliari SC, Lopes TC, Agnolo C, Carvalho MD, Pelloso SM. Excess weight and abdominal obesity in postmenopausal Brazilian women: a population-based study. *BMC women's health*. 2013 Dec; 13(1):1–7. <https://doi.org/10.1186/1472-6874-13-46> PMID: 24228934
21. Kapoor E, Collazo-Clavell ML, Faubion SS. Weight gain in women at midlife: a concise review of the pathophysiology and strategies for management. *In Mayo Clinic Proceedings* 2017 Oct 1 (Vol. 92, No. 10, pp. 1552–1558). Elsevier. <https://doi.org/10.1016/j.mayocp.2017.08.004> PMID: 28982486
22. Leon GR. Personality and behavioural correlates of obesity. In: Wolman BR (ed). *Psychological aspects of obesity. a handbook*. Van Nostrand Reinhold: New York; 1982. pp 15–29.
23. Furnham A, Alibhai N. Cross-cultural differences in the perception of female body shapes. *Psychol Med* 1983; 13: 829–837. <https://doi.org/10.1017/s0033291700051540> PMID: 6665099
24. Bush HM, Williams RG, Lean ME, Anderson AS. Body image and weight consciousness among South Asian, Italian and general population women in Britain. *Appetite* 2000; 37: 207–215.
25. Baker A, Sirois-Leclerc H, Tulloch H. The impact of long-term physical activity interventions for overweight/obese postmenopausal women on adiposity indicators, physical capacity, and mental health outcomes: a systematic review. *Journal of Obesity*. 2016 May 16; 2016. <https://doi.org/10.1155/2016/6169890> PMID: 27293882
26. Sotoudeh G, Khosravi S, Karbakhsh M, Khajehnasiri F, Khalkhali HR. What women think about their husbands' opinions might influence women's body image: An explorative study. *Indian journal of medical sciences*. 2008 Mar 1; 62(3):98–104. PMID: 18376082
27. Sobal J, Stunkard AJ. Socioeconomic status and obesity: a review of the literature. *Psychol Bull* 1989; 105: 260–275. <https://doi.org/10.1037/0033-2909.105.2.260> PMID: 2648443
28. Flynn K, Fitzgibbon BM. Body images and obesity risk among black females: a review of the literature. *Ann Behav Med* 1998; 20: 13–24. <https://doi.org/10.1007/BF02893804> PMID: 9755347
29. Metcalf PA, Scragg RK, Willoughby P, Finau S, Tipene-Leach D. Ethnic differences in perceptions of body size in middle-aged European, Maori and Pacific people living in New Zealand. *Int J Obes Relat Metab Disord* 2000; 24: 593–599. <https://doi.org/10.1038/sj.ijo.0801202> PMID: 10849581
30. Treloar C, Porteous J, Hassan F, Kasniyah N, Lakshmandu M, Sama M, et al. The cross-cultural context of obesity: an INCLIN multicentre collaborative study. *Health Place* 1999; 5: 279–286. [https://doi.org/10.1016/s1353-8292\(99\)00018-0](https://doi.org/10.1016/s1353-8292(99)00018-0) PMID: 10984582
31. Van der Sande MAB, Ceesay SM, Milligan PJM, Nyan OA, Banya W, Prentice A, et al. Obesity and undernutrition and cardiovascular risk factors in rural and urban Gambian communities. *Am J Public Health* 2001; 91: 1641–1644. <https://doi.org/10.2105/ajph.91.10.1641> PMID: 11574327
32. Walker A, Adam F, Walker B. World pandemic of obesity: the situation in Southern African populations. *Public Health* 2001; 11: 368–372. <https://doi.org/10.1038/sj/ph/1900790> PMID: 11781845
33. Mvo Z, Dick J, Steyn K. Perceptions of overweight African women about acceptable body size of women and children. *Curationis* 1999; 22: 27–31. <https://doi.org/10.4102/curationis.v22i2.719> PMID: 11040616

34. Holdsworth M., Gartner A., Landais E., Maire B., & Delpeuch F. (2004). Perceptions of healthy and desirable body size in urban Senegalese women. *International Journal of Obesity*, 28(12), 1561–1568. <https://doi.org/10.1038/sj.ijo.0802739> PMID: 15278107
35. Soldi CJ. What determines weight loss behaviour and body weight satisfaction in Australia? Evidence from the HILDA survey (Doctoral dissertation, Queensland University of Technology).
36. Benkeser R. M., Biritwum R., & Hill A. G. (2012). Prevalence of overweight and obesity and perception of healthy and desirable body size in urban, Ghanaian women. *Ghana medical journal*, 46(2), 66–75. PMID: 22942454
37. Duda R.B., Dark R., Seffah J., Adanu R.M.K., Anarfi J.K. and Hill A.G. Prevalence of Obesity in Women of Accra, Ghana. *African Journal of Health Sciences* 2007; 14: 154–15938.
38. Turrell G, Hewitt B, Patterson C, Oldenburg B, Gould T. Socioeconomic differences in food purchasing behaviour and suggested implications for diet-related health promotion. *Journal of Human Nutrition and Dietetics*. 2002 Oct; 15(5):355–64. <https://doi.org/10.1046/j.1365-277x.2002.00384.x> PMID: 12270016
39. Wikipedia contributors. Techiman. Wikipedia, The Free Encyclopedia. July 16, 2021, 21:21 UTC. Available at: <https://en.wikipedia.org/w/index.php?title=Techiman&oldid=1033955518>. Accessed August 27, 2021.
40. Bierhals CC, Santos NO, Fengler FL, Raubstt KD, Forbes DA, Paskulin LM. Needs of family caregivers in home care for older adults1. *Revista latino-americana de enfermagem*. 2017 Apr 6; 25.
41. Creswell JW, Miller DL. Determining validity in qualitative inquiry. *Theory into practice*. 2000 Aug 1; 39(3):124–30.
42. Tuakli-Wosornu YA, Rowan M, Gittelsohn J. Perceptions of physical activity, activity preferences and health among a group of adult women in urban Ghana: a pilot study. *Ghana medical journal*. 2014 Jul 8; 48(1):3–13. <https://doi.org/10.4314/gmj.v48i1.1> PMID: 25320395
43. H Davenport M, May Ruchat S, J Hazell T. Exercise Prescription for Post-Menopausal Women with Obesity. *Current Women's Health Reviews*. 2017 Apr 1; 13(1):17–24.
44. Amoah AG. Sociodemographic variations in obesity among Ghanaian adults. *Public health nutrition*. 2003 Dec; 6(8):751–7. <https://doi.org/10.1079/phn2003506> PMID: 14641945
45. Appiah CA, Steiner-Asiedu M, Otoo GE. Predictors of overweight/obesity in urban Ghanaian women. *Int J Clin Nutr*. 2014; 2(3):60–8.
46. Acharya SD, Elci OU, Sereika SM, Music E, Styn MA, Turk MW, et al. Adherence to a behavioral weight loss treatment program enhances weight loss and improvements in biomarkers. *Patient preference and adherence*. 2009; 3:151. <https://doi.org/10.2147/ppa.s5802> PMID: 19936157
47. Brantley PJ, Stewart DW, Myers VH, Matthews-Ewald MR, Ard JD, Coughlin JW, et al. Psychosocial predictors of weight regain in the weight loss maintenance trial. *Journal of behavioral medicine*. 2014 Dec; 37(6):1155–68. <https://doi.org/10.1007/s10865-014-9565-6> PMID: 24722826
48. Cereijo L, Gullón P, Cebrecos A, Bilal U, Santacruz JA, Badland H, et al. Access to and availability of exercise facilities in Madrid: an equity perspective. *International journal of health geographics*. 2019 Dec; 18(1):1–0.
49. Danielle Gagnon. The Importance of Health Education. (2021) [Access internet on 23rd September 2021].

6.4. Conclusion

In conclusion, sociocultural beliefs influence body image perception and acceptance of weight gain among Ghanaian postmenopausal women. Measures to reduce excess body weight and support to adhere to the weight reduction programme require attention in Ghana

In the next chapter, the validation of the developed culturally adapted exercise-based program using the Delphi technique will be presented.

7. CHAPTER SEVEN: A CULTURALLY ADAPTED EXERCISE PROGRAM FOR POSTMENOPAUSAL WOMEN WITH EXCESS WEIGHT GAIN: A MODIFIED INTERNATIONAL/LOCAL DELPHI STUDY

7.1. Manuscript details

Chapter seven is presented as a manuscript structured according to the journal guidelines. The paper aimed to validate a culturally adapted exercise-based program for weight loss in postmenopausal women with excess weight using Delphi Technique. The manuscript's title is 'A culturally adapted exercise program for postmenopausal women with excess weight gain: A modified international/local Delphi study'. This manuscript is under review in BMC Women Health. We are working on post-review feedback.

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7.2. Details of author's contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix H.

Table 7: 1: Details of the author's contribution

	Mensah Bonsu	Myezwa	Brandt	Ajidahun
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

7.3. Abstract

Background

Previous reports suggest that exercise intervention can reduce body weight and body composition parameters in obese postmenopausal women. Although some exercise recommendations have been constructed, international and local consensus on the recommendations for weight loss among postmenopausal women with excess weight (overweight and obesity) gain are lacking. We aimed to establish consensus regarding a culturally adapted exercise-based intervention programmes for weight loss among postmenopausal women in Ghana.

Methods

The study process consisted of three Delphi rounds among international and local experts. Participants were recruited via purposive sampling based on their expertise and experience. Preliminary program and components were developed from literature reviews and the outcomes from the first two phases of the project. In round one, answers to open-ended questions were analysed thematically and translated into statements. In round two, experts rated their level of agreement on application questions using a 5-point Likert scale and provided comments. The consensus was considered reached if at least 60% of the panel strongly agree/disagree that an item should be included or excluded. In round three, participants evaluated the programme in round two and confirm the answer to the same question. The consensus was set at 80%.

Results

Thirty-two participants completed all three rounds and reached a consensus on most items representing four domains. Participants included twelve international and twenty-one local experts. Thirty-two participants completed all three rounds and reached a consensus all items representing

four domains (Health assessment, pre-exercise parameters, exercise dosage, and physician referral form).

Of the 41 participants who received the first questionnaire, 37 (90.2%) responded. Of the 37 participants who received the second questionnaire, 34 (91.9%) responded. Of the 34 participants who received the third questionnaire, 32(94.1%) responded. As a result, a high participation rate was attained, with 33 (80.5%) of the 41 participants completing all three rounds.

Conclusions

A high degree of consensus among both international and local experts was reached for a developed exercise-based programme for Ghanaian postmenopausal women to loss excess body weight.

Keywords: Culturally, exercise program, postmenopausal women, excess weight, Delphi survey,

7.4. Background

There are many factors contributing to women's excess weight, it is generally known that menopause is associated with weight gain and an undesirable change in body composition (Tchernof and Poehlman, 1998, Kapoor et al., 2017). Studies have shown that postmenopausal women have higher visceral adipose fat deposition levels (Faria et al., 2002, Kapoor et al., 2017). Increased metabolic risk factors and hence a rise in cardiovascular diseases have been related to visceral fat accumulation (Hernández-Ono et al., 2000, You et al., 2004). Women at the postmenopausal stage are at an increased risk for atherothrombotic disorders (Deibert et al., 2007). Therefore, it is important to develop effective methods for reducing excess weight gain which subsequently could reduce metabolic risk factors in women, especially after menopause.

There is consensus that dietary adjustments and regular physical activities are the foundations of the management of excess weight and metabolic syndrome (Deedwania and Volkova, 2005, Ernst and Cleeman, 2002, Mosca et al., 2011). Additionally, a study by Irwin et al., (2003) on exercise recommendations for sedentary overweight postmenopausal women aged 50 to 75 years concluded that regular exercise results in reduced body weight among overweight and obese postmenopausal women. However, a study by Velthuis et al., (2009) revealed that a 12-month exercise regimen involving aerobic and muscle-strengthening exercises did not affect body weight but rather significantly impacted postmenopausal women's body composition (body mass index, and hip circumference). These studies potentially create inconsistency as to the effect of structured exercise programs on the body weight of postmenopausal women. Krukowski et al., (2022) created a consensus guideline for weight loss programs that focuses on self-monitoring strategies for long-term weight control. Furthermore, several of their recommendations were limited to diet modifications and behavioural strategies. An executive summary for the management of obesity and overweight in midlife women, by Ranjan et al., (2022) also addressed guidelines via lifestyle

modification techniques. The American College of Sports Medicine (ACSM) published a position stand that recommended a minimum of 200-300 min per week of physical activity for overweight and obese adults to lose weight (Donnelly et al., 2009). However, from these recommendations, no reference was made to the indigenous physical activity in different settings which can contribute to weight loss, because of the absence of experts from different settings. However, on this specific point, an international and local consensus on the guidelines for such exercise programs is lacking. This Delphi study builds on the evidence gathered in the literature findings and three previous studies that were undertaken to develop consensus. Evidence has shown that the use of consensus guidelines improves the quality of healthcare provided by recommending evidence-based best-practice care (Sullivan et al., 2006). Therefore, the goal was to achieve consensus on an exercise programme in a local context with cultural adaptation for postmenopausal women with excess weight gain to lose body weight.

7.5. Methods

7.5.1. Delphi Technique

Defining consensus.

The purpose of a Delphi technique is to arrive at a consensus of an appropriate culturally exercise-based programme for weight loss in Ghanaian postmenopausal women with excess body weight. Other Delphi experiments employed and reported consensus levels ranging from 60% to 80% (Deane et al., 2003). For this study, 80% agreement was chosen as the threshold for consensus.

7.5.2. Selection of participants

In our study, the area of expertise was defined as the “development of exercise programs,” and exercise physiology. Consequently, the experts in exercise development and exercise prescription with an interest in women’s health possessed the expertise to determine the composition of the programme and were purposively sampled. For this reason, physiotherapists, exercise physiologists,

exercise scientists, human kinetics and health educationalists were considered eligible to participate in the Delphi process. Snowballing techniques also were used to identify potential panel members. The recruitment process began with the principal investigator (I.M.B) e-mailing an invitation to participate to experts who were most likely to meet the eligibility requirements. The study's informed consent form and background information were included in this email. Panellists who were interested in the study were encouraged to email the primary researcher (I.M.B). Participants were also encouraged to share information about the study with anyone they believed might be interested and meet the requirements. The primary researcher was then emailed by interested participants with their signed consent forms. Participants were formally recruited for the study after feedback was collected and reviewed. The questionnaire was sent via email when the invitation to participate was received with a positive response.

7.5.3. Development and validation of the questionnaire

The outcomes of three prior investigations and the findings of the literature review were used to generate a list of questions for the first round of the Delphi survey. The preliminary result from the overall project established a high prevalence of excess weight gain among postmenopausal women using BMI, WHtR and WHR. The second study revealed that postmenopausal women do not engage in adequate physical activity, have poor lifestyles due to their eating patterns and believe that cultural backgrounds encourage them to gain weight. This study contributed to understanding their levels of physical activity, lifestyle and cultural influences on weight gain. These results confirmed the need to incorporate culturally appropriate physical activity in the development of the exercise program. “Ampe” which is Ghanaian household indigenous recreational activity was identified in the literature (Omoniyi et al., 2020). This physical activity (Ampe) involves clapping while singing and jumping vertically with two contestants at a time, meanwhile it can perform individually. “Ampe” involves a

combination of good physical workouts and social bonding with critical thinking. It combines moderate high aerobic movements with intermittent active rest.

A third study explored the experiences of postmenopausal women with excess weight gain.

The results revealed that excess weight is viewed as attractive and symbolizes culturally appropriate body size. Lack of adequate physical activity and poor dietary habits increase the risk of weight gain.

The results of these three studies were then collated with the literature findings on the development of culturally sensitive exercise-based programs, postmenopausal women and weight gain, and formed the basis of the questionnaire. The program was subsequently categorized under four main sections (health assessment, pre-exercise parameters, exercise dosage and, barriers and facilitators). Integrating the results from the previous three studies confirmed the questionnaire had both face and content validity because postmenopausal women responded. In a standard Delphi survey, expert advice is sought during the questionnaire development; however, in this case, the questionnaire was developed using information from the three different studies mentioned above and literature findings. Therefore, a modified Delphi methodology was applied in this survey.

7.5.4. Procedure

The respondents completed three surveys in succession, and each round was modified in response to comments from the preceding version. A special, secured “REDCap” link was used to deliver each survey to the experts. REDCap is a secured web-based applications and workflow methodology designed to collect and manage data for research studies (Harris, 2012). A summary of the first round's findings was emailed to panellists who completed the first round's survey to serve as an introduction to the second round's survey, and a summary of the second round's findings was sent with the third round's survey. The summaries did not contain any personally identifiable information. Participants were requested to complete each questionnaire within three weeks. Those participants who had not answered in two weeks were sent e-mail reminders. Participants were given extra

reminders and more time to respond if they were unable to finish the questionnaires within the given three weeks. For our study, 80% agreement was chosen as the threshold for consensus according to the recommendations of Deane et al. (2003).

7.5.4.1. Round 1

The questionnaire was sent via email to the panellists / participants. Demographic data for the expert panel was gathered using multiple-choice questions (MCQs). The first questionnaire mostly included open-ended questions to let participants express their ideas without being given any leading information. (Supplementary file, appendix 1). This method reduces response bias (Choi and Pak, 2005). Respondents were asked three main questions in this round. Firstly, they were asked to list and provide dosage variables they consider important when prescribing low-impact cardiovascular and strength/resistance exercises for the management of excess weight among postmenopausal women. Secondly, participants were asked to provide exercise prescription variables other than dosage they consider important when prescribing exercises (low-impact cardiovascular and strength/resistance exercises). Finally, participants were also asked to indicate personal (postmenopausal women) and other factors they consider important that may change the exercise variables identified. Participants were also allowed to provide comments. Responses to open-ended questions in the first questionnaire were analysed thematically to provide a qualitative summary. Three researchers (HM, CB, AT) were involved in this process to ensure the validity and consistency of the approach. Themes identified from participant responses then were translated into application statements. The development of the second questionnaire utilized these statements.

7.5.4.2. Round 2

All respondents who participated in the first round of the survey were invited to participate in the second iteration. Based on themes found in responses to the first questionnaire, the second survey was developed. A 5-point Likert response scale was used to determine the level of agreement

(“strongly agree,” “agree,” “undecided” “disagree,” and “strongly disagree). The consensus was determined when panel members strongly agreed or agreed with an item. If the percentage of agreement was less than 60% to a question (Deane et al., 2003)., however, it was concluded that a consensus had not been reached. Open-ended questions also were provided to ensure participants were able to express any further thoughts or opinions.

7.5.4.3. Round 3

In this round, any questions that did not reach consensus during the second round were removed in the final round. Participants were asked to evaluate the results in round two and confirm the answer to the same question. Each item that achieved 80% or greater of expert votes was included in the exercise program. Additional themes identified in open-ended questions in the second round were included to ensure a thorough exploration of participant opinions.

7.5.5. Ethical considerations

Ethical approval for this study was obtained from the Human Research Ethics Committee at the University of the Witwatersrand, South Africa (Ref no. M190467). In Ghana, approval was also obtained from the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology, Kumasi (Ref No. 596/19).

7.5.6. Data Analysis

Descriptive statistics were used to determine the frequency of each response. To determine the status of the agreement, the frequencies of “strongly agree” and “agree” were combined (Myezwa et al., Responses to open-ended questions were summarized qualitatively using thematic analysis. The number of identified themes was noted, and these themes were used to generate questions for subsequent rounds.

7.6. Results

Panel selection

The Delphi rounds were conducted between April and August 2022. One hundred and two (102) invitations were sent via email to identified experts by the principal researcher (IMB). Three potential participants e-mailed to decline to participate in the study, as they are on sabbatical leave, and two showed interest, however, declined due to their busy schedules. Forty-one experts who met the selection criteria provided informed consent to participate.

7.6.1. Results: Round 1

7.6.1.1. Participant Demographics

Of the 41 participants who received the first round, 37 (90.2%) responded. Of the 41 individuals who consented to participate in the study, 32 completed all the rounds. As such, detailed demographics were not collected from the eight participants who did not complete the rounds. Of the 32 participants who completed all the rounds, 24.2% (n=8) had bachelor's degrees, 30.3% (n=10) had master's degrees (MSc) or equivalent, and 42.4% (n=14) had doctoral degrees. Twelve of the participants were international panellists while twenty were local panel member. International experts are individuals who have gained expertise, and prominence in their respective fields on a global scale. Local experts, on the other hand, are individuals who possess specialized knowledge, experience, and expertise within Ghanaian context. Most of the participants 72.7% (n=24) had expertise in both academic and clinical fields in the management of weight gain.

7.6.1.2. Thematic Analysis of the first round

From nine different open-ended questions in round one, a total of 25 themes were identified. These themes were used to generate questions regarding weight management programs for postmenopausal women with weight gain for subsequent rounds.

7.6.2. Results: Round 2

7.6.2.1. Development of an exercise program

The consensus was reached on 94.2% (n=49) of questions related to health assessment, pre-exercise parameters, exercise dosage (supplementary file, appendix II) and physician referral form (Table. 1).

Table 7: 2: Consensus: Second Round of the Delphi Questionnaire (n = 37)

Item	Consensus Agreement n (%)
General questions to consider when prescribing low-impact cardio (Ampe) and resistance exercises for postmenopausal women in Ghana.	
Has a doctor ever said that you have a heart condition and recommended only medically supervised exercise?	35(94.6)
Do you have chest pain brought on by physical activity?	34(91.9)
Have you developed chest pain in the past month when you were doing physical activity?	35(94.6)
Have you on one or more occasions lost consciousness or fallen over as a result of dizziness?	36(97.3)
Do you have a bone or joint problem (for example, back, knee or hip) that could be aggravated by the proposed physical activity?	35(94.6)

Has a doctor ever recommended medication for your blood pressure or a heart condition?	34(91.9)
Are you aware, through your own experience or a doctor's advice, of any other physical reason that would prohibit you from exercising without medical supervision?	36(97.3)
Indicate how you prefer the exercise program to be delivered	30(81.1)
Do you have enough time to exercise?	31(83.8)
Are you motivated to exercise?	32(86.5)
What mode of exercise counselling do you prefer?	31(83.8)
What additional support do you need to achieve your exercise program goal?	29(78.4)
Motivational strategies that will aid your exercise program	28(75.7)
What will remind you to do exercises?	29(78.4)
When heat and humidity are high, do you wear loose-fitting, porous and lightweight clothing to exercise?	27(73.0)
What time do you prefer to exercise?	30(81.1)
Do you prefer a less expensive exercise program?	31(83.8)
Which dietary self-monitory approach will enhance the efficacy of your weight management program?	30(81.1)
Pre-exercise parameters for Low impact-cardio exercise	
Step test will be used to measure aerobic fitness	32(86.5)
Pre-exercise parameters for resistance exercise	
The Senior Fitness Test (SFT) will be used to assess key physiological parameters (e.g., strength, endurance, agility, balance)	33(89.2)

Exercise dosage variable (cardio exercise) (Ampe) supplementary figure 1	
Number of sets	
3 – 4 sets	34(91.9)
Frequency	
3 – 4 times/week	33(89.2)
Repetition	
10-15 reps	35(94.6)
Duration	
10-15 minutes	34(91.9)
Resistance exercise dosage	
Number of sets (theraband exercise). supplementary figure 2	
4 sets	28(75.7)
Frequency	
3-5 times/ week	28(75.7)
Repetition	
10 reps	30(81.1)
Duration	
15-30 minutes	29(78.4)
Number of sets (squat to chair exercise) supplementary figure 3	
4 sets	34(91.9)
Frequency	
3-5 times/ week	34(91.9)
Repetition	

10 reps	30(81.1)
Duration	
15-30 minutes	31(83.8)
Number of sets (wall push-ups) supplementary figure 4	
4 sets	35(94.6)
Frequency	
3-5 times/ week	35(94.6)
Repetition	
10 reps	34(91.9)
Duration	
15-30 minutes	35(94.6)
Number of sets (water bottle floor chest press) supplementary figure 5	
4 sets	31(83.8)
Frequency	
3-5 times/week	35(94.6)
Repetition	
10 reps	34(91.9)
Duration	
15-30 minutes	35(94.6)
Number of sets (water bottle overhead press) supplementary figure 6	
4 sets	30(81.1)
Frequency	
3-5 times	34(91.9)

Repetition	
10 reps	33(89.2)
Duration	
15-30 minutes	36(97.3)
Number of sets (standing water bottle biceps curl) supplementary figure 7	
4 sets	35(94.6)
Frequency	
3-5 times/week	33(89.2)
Repetition	
10 reps	35(94.6)
Duration	
15-30 minutes	36(97.3)
Physician referral form	36(97.3)
Without consensus	
Is the exercise program suitable or will need to change for you?	20(54.1)
Which one will minimize the impact and duration of a relapse?	22(59.5)
Do you have enough energy to exercise?	18(48.6)

7.6.3. Results: Round 3

In round three, items, where consensus was obtained in the second questionnaire, were repeated in this round). Table 2 outlines detailed results of consensus obtained under specific items. After round 3, all items listed in the questionnaire obtained consensus as shown in Table 2

Table 7: 3: Consensus: Third Round of the Delphi Questionnaire (n = 32)

<i>Item</i>	<i>Consensus Agreement n (%)</i>
Health assessment	
Has a doctor ever recommended that you can only participate in medically supervised exercise due to a heart or other condition?	30(93.8)
Do you experience chest discomfort with physical exertion?	31(96.9)
Do you have pain in joints (back, knee, hip or other joints) that could be aggravated by physical activity?	30(93.8)
Do you have pain when performing the following physical activity?	31(96.9)
Have you on one or more occasions lost consciousness or fallen over as a result of dizziness?	30(93.8)
Do you have blood pressure or a heart condition?	32(100)
Has a doctor ever recommended medication for your blood pressure or a heart condition?	29(90.6)
Are you aware, through your own experience or a doctor's advice, of any other risk factors that would prohibit you from exercising without medical supervision?	28(87.5)

Pre-exercise parameters	
Step test will be used to measure aerobic fitness	30(93.8)
The Senior Fitness Test (SFT) will be used to assess key physiological parameters (e.g., strength, endurance, agility, balance)	31(96.9)
What is your nutritional status?	27(84.4)
What time of the day do you prefer to exercise?	28(87.5)
Knowing your maximum heart rate can help determine exercise intensity.	27(84.4)
Ensure you wear loose-fitting clothes to perform the following activities.	26(81.3)
Remain hydrated during the period of the exercise programme (It is suggested that drinking 2.7 litres of water per day is good for the body).	31(96.9)
What is your physical activity status?	30(93.8)
Which of the following means will serve as a preferred reminder for you to engage in exercises?	29(90.6)
Do you prefer a locally designed exercise programme that involves a combination of good physical workout and, social bonding and combines moderate to high-intensity aerobic movements with intermittent active rest patterns that can aid in weight reduction?	30(93.8)
What will motivate you to adhere to an exercise program?	28(87.5)
Indicate the mode of exercise programme delivery	26(81.3)
What support do you need to achieve your exercise program goal?	30(93.8)
How would you prefer to receive support and advice when you are exercising?	29(90.6)
Exercise dosage	
Moderate-intensity Ampe exercise of 3-4 sets, 3-4 times/week and	31(96.9)

10-15 repetitions for 10-15 minutes (Ampe exercise dosage). Supplementary figure 1	
4 sets, 3-5 times/ week and 10 repetitions for 15-30 minutes (theraband dosage). Supplementary figure 2	28(87.5)
3 sets, 3-5 times/ week and 10 repetitions for 5-10 minutes (squat to chair). Supplementary figure 3	30(93.8)
3 sets, 3- 5 times/week of 10 repetitions for 5-10 minutes (Wall Push-ups) Supplementary figure 4	31(96.9)
4 sets, 3-5times / week of 10 repetitions for 5-10 minutes (Water-Bottle-floor Chest Press). Supplementary figure 5	30(93.8)
4 sets, 3-5times / week of 10 repetitions for 5-10 minutes (Water-bottle-overhead press). Supplementary figure 6	31(96.9)
4 sets, 3-5times / week of 10 repetitions for 5-10 minutes (Standing water bottle biceps curls). Supplementary figure 7	29(90.6)
Physician Referral Form	30(93.8)

7.7. Discussion

Weight gain is prevalent in women at the time of menopause and is associated with the risk of coronary heart disease observed during this period (Kapoor et al., 2017). Generally, menopausal women with weight gain are given generic lifestyle counselling like “exercise regularly” (Khandelwal, 2020) without consensus on the content of the exercise. Therefore, there is a need for evidence-based consensus where there is an agreement on the culturally acceptable exercise program for Ghanaian women. (Supplementary file, Appendix II)

In this Delphi survey, 32 (94.1%) participants reached a consensus on most items relating to the content of exercise programs for weight loss among postmenopausal women with weight gain. After three rounds of questionnaires, all the items presented in the Delphi questionnaire achieved over 80% consensus. Our Delphi study helps to develop a consensus about what should be included in an exercise program for weight loss in postmenopausal women. This proposed exercise program is appropriate for Ghanaian women and could be adapted to other sub-Saharan African countries with similar acculturation. Exercise had been developed to improve the health of postmenopausal women (Asikainen et al., 2004, Velthuis et al., 2009). To our knowledge, this is the first use and reporting of a modified Delphi method incorporating indigenous physical activity (Ampe) (supplementary figure 1) in the development of an exercise program for weight loss in postmenopausal women. A study by Ranjan et al., (2022) emphasizes the requirement for evidence-based clinical practice to standardize the management of excess weight in women across various settings to ensure consistent and effective weight management.

Participants agreed on effective exercise dosages (supplementary figures 1-7) for adults that are similar to other exercise recommendations for weight loss. In our study, participants agreed to include moderate-intensity aerobic “Ampe” and resistance exercises. For example, the American College of Sports Medicine recommended a minimum of 150 min/per week of moderate-intensity

exercise interventions for adult weight loss (Donnelly et al., 2009). They also recommend resistance exercises to increase strength and function (Donnelly et al., 2009).

Conducting an appropriate health assessment and pre-exercise parameters before an exercise program can play a crucial role in identifying specific barriers (Chopra et al., 2021, Chiu et al., 2020). Barriers including body image issues, joint pain, heart-related conditions, lack of time, lack of social support, and household and work-related responsibilities need to be addressed for appropriate weight loss (Chopra et al., 2021 & Chiu et al., 2020). For example, the health assessment can reveal an unexpected condition or add to the information already collected (Dudley-Brown, 2012).

The Delphi technique provides for the organizing of group communication to identify a collective consensus of professional opinion on an issue (Slade et al., 2014). The Delphi participants in our study were informed of the findings, which may have influenced their decision-making regarding the exercise program's content. A study by Williams et al., (2004) affirmed this conclusion that the first time a rating is presented, an independent opinion can be accurate; however, afterwards, the respondent may be potentially influenced by the group findings. Therefore, researchers must exercise caution in the understanding of consensus. This possible influence raises questions about the study's validity.

The obtained response rate is essential to the Delphi method's validity. The response rate in our study was higher compared to previous studies (Shaw et al., 2013, Sowell et al., 2000). Shaw et al., (2013) reported a 66% response rate while Sowell et al., (2000) reported a 79% response rate in the second round. None of the two investigations had response rates that were stronger than our study.

The lack of discussion of the themes is one disadvantage of employing the Delphi technique that is noted in the literature (Philips et al., 2003). However, the development of the questionnaire in our study explored weight management practices of postmenopausal women with excess weight. This

provided an in-depth understanding of the physical activity and lifestyle levels of postmenopausal women.

7.8. Limitations

Our Delphi study strayed from the standard methodology by using data from three earlier surveys instead of an iterative approach to decide the content of the program. The list of items obtained from the previous three studies was used as background in the first round of this study and this can introduce bias.

Another area of concern may be the inclusion of indigenous Ghanaian physical activity (Ampe). Despite the detailed background, procedure and clinical exercise implications of Ampe being explained to experts, international participants were unfamiliar with the activity, suggesting the need to regularize some of the indigenous physical activity at a higher level such as the Olympics games. It is important to note that because our study incorporated Ghanaian household physical activity, its findings may not be applicable in other settings, although the method and reasoning underpinning it may be useful to plan similar studies in different contexts.

7.9. Conclusion

A high level of agreement in the findings provides a framework for exercise professionals and members of the health care team to involve exercise programs in the health needs of postmenopausal women with excess weight gain.

7.10. Availability of data and materials

The datasets analysed during the current study are available from the corresponding author at a reasonable request.

7.11. Conflict of interest

The authors declared no conflict of interest

7.12. Funding

Authors did not receive funding

7.13. Conclusion

In this chapter, the study findings revealed a high degree of consensus among both international and local experts on the components of the appropriate Ghanaian traditionally induced exercise program for postmenopausal women to reduce body weight. The next chapter reports the randomized controlled trial to determine the effects of the developed exercise program on anthropometrics and body composition of postmenopausal women with excess weight gain in Ghana.

References

- Asikainen, T. M., Kukkonen-Harjula, K., & Miilunpalo, S. (2004). Exercise for health for early postmenopausal women: A systematic review of randomised controlled trials. *Sports Medicine*, 34(11), 753–778. <https://doi.org/10.2165/00007256-200434110-00004>
- Chiu, H. H., Wu, S. F., & Wang, P. H. (2020). The experience of menopausal women participating in weight management program: A pilot study. *Taiwanese Journal of Obstetrics and Gynecology*, 59(5), 686–690. <https://doi.org/10.1016/j.tjog.2020.07.011>
- Choi, B. C. K., & Pak, A. W. P. (2005). A catalogue of biases in questionnaires. *Preventing Chronic Disease*, 2(1), 1–13.
- Chopra, S., Malhotra, A., Ranjan, P., Vikram, N. K., Sarkar, S., Siddhu, A., Kumari, A., Kaloiya, G. S., & Kumar, A. (2021). Predictors of successful weight loss outcomes amongst individuals with obesity undergoing lifestyle interventions: A systematic review. *Obesity Reviews*, 22(3), 1–15. <https://doi.org/10.1111/obr.13148>
- Deane, K. H. O., Ellis-Hill, C., Dekker, K., Davies, P., & Clarke, C. E. (2003). A Delphi survey of best practice occupational therapy for Parkinson's disease in the United Kingdom. *British Journal of Occupational Therapy*, 66(6), 247–254. <https://doi.org/10.1177/030802260306600603>
- Deedwania, P. C., & Volkova, N. (2005). Current treatment options for the metabolic syndrome. *Current Treatment Options in Cardiovascular Medicine*, 7(1), 61–74. <https://doi.org/10.1007/s11936-005-0007-1>
- Deibert, P., König, D., Vitolins, M. Z., Landmann, U., Frey, I., Zahradnik, H. P., & Berg, A. (2007). Effect of a weight loss intervention on anthropometric measures and metabolic risk factors in pre- versus postmenopausal women. *Nutrition Journal*, 6, 1–7. <https://doi.org/10.1186/1475-2891-6-31>

- Donnelly, J. E., Blair, S. N., Jakicic, J. M., Manore, M. M., Rankin, J. W., & Smith, B. K. (2009). Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine and Science in Sports and Exercise*, 41(2), 459–471. <https://doi.org/10.1249/MSS.0b013e3181949333>
- Dudley-Brown, S. (2012). The importance of the physical examination. *Gastroenterology Nursing*, 35(5), 350–352. <https://doi.org/10.1097/SGA.0b013e31826b16b8>
- Ernst, N. D., & Cleeman, J. I. (2002). National Cholesterol Education Program keeps a priority on lifestyle modification to decrease cardiovascular disease risk. *Current Opinion in Lipidology*, 13(1), 69–73. <https://doi.org/10.1097/00041433-200202000-00010>
- Faria, A. N., Ribeiro Filho, F. F., Ferreira, S. R. G., & Zanella, M. T. (2002). Impact of visceral fat on blood pressure and insulin sensitivity in hypertensive obese women. *Obesity Research*, 10(12), 1203–1206. <https://doi.org/10.1038/oby.2002.164>
- Hernández-Ono, A., Monter-Carreola, G., Zamora-González, J., Cardoso-Saldaña, G., Posadas-Sánchez, R., Torres-Tamayo, M., & Posadas-Romero, C. (2000). Association of visceral fat with coronary risk factors in population-based postmenopausal women. *Atherosclerosis*, 151(1), 101. [https://doi.org/10.1016/s0021-9150\(00\)80458](https://doi.org/10.1016/s0021-9150(00)80458)
- Irwin, M. L., Yasui, Y., Ulrich, C. M., Bowen, D., Rudolph, R. E., Schwartz, R. S., Yukawa, M., Aiello, E., Potter, J. D., & McTiernan, A. (2003). Effect of exercise on total and intra-abdominal body fat in postmenopausal women: A randomized controlled trial. *Journal of the American Medical Association*, 289(3), 323–330. <https://doi.org/10.1001/jama.289.3.323>

Kapoor, E., Collazo-Clavell, M. L., & Faubion, S. S. (2017, October). Weight gain in women at midlife: a concise review of the pathophysiology and strategies for management. In *Mayo Clinic Proceedings* (Vol. 92, No. 10, pp. 1552-1558). Elsevier.

Khandelwal, S. (2020). Obesity in midlife: lifestyle and dietary strategies. *Climacteric*, 23(2), 140–147. <https://doi.org/10.1080/13697137.2019.1660638>

Krukowski, R. A., Harvey, J., Borden, J., Stansbury, M. L., & West, D. S. (2022). Expert opinions on reducing dietary self-monitoring burden and maintaining efficacy in weight loss programs: A Delphi study. *Obesity Science and Practice*, 8(4), 401–410. <https://doi.org/10.1002/osp4.586>

Mosca, L., Benjamin, E. J., Berra, K., Bezanson, J. L., Dolor, R. J., Lloyd-Jones, D. M., Newby, L. K., Piña, I. L., Roger, V. L., Shaw, L. J., Zhao, D., Beckie, T. M., Bushnell, C., D’Armiento, J., Kris-Etherton, P. M., Fang, J., Ganiats, T. G., Gomes, A. S., Gracia, C. R., ... Wenger, N. K. (2011). Effectiveness-based guidelines for the prevention of cardiovascular disease in women-2011 update: A Guideline from the American Heart Association. *Circulation*, 123(11), 1243–1262. <https://doi.org/10.1161/CIR.0b013e31820faaf8>.

Philips, B. U., Anderson, G. D., & Ridl, K. A. (2003). Establishing a women’s health curriculum using the Delphi method. *Education for Health*, 16(2), 155–162. <https://doi.org/10.1080/1357628031000116934>

Raine, S. (2006). Defining the Bobath concept using the Delphi technique. *Physiotherapy Research International*, 11(1), 4-13.

Ranjan, P., Vikram, N. K., Choranur, A., Pradeep, Y., Ahuja, M., Meeta, Puri, M., Malhotra, A., Kumari, A., Chopra, S., Batra, A., Balsalkar, G., Goswami, D., Guleria, K., Sarkar, S., Kachhawa, G., Verma, A., Kumari, M. K., Madan, J., ... Guleria, R. (2022). Executive summary of evidence

and consensus-based Clinical Practice Guidelines for management of obesity and overweight in midlife women: An AIIMS-DST initiative. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 16(3), 102426. <https://doi.org/10.1016/j.dsx.2022.102426>

Slade, S. C., Dionne, C. E., Underwood, M., & Buchbinder, R. (2014). A standardised method for reporting exercise programmes: Protocol for a modified Delphi study. *BMJ Open*, 4(12), 1–5. <https://doi.org/10.1136/bmjopen-2014-006682>

Shaw, L. R., Leahy, M. J., Chan, F., & Catalano, D. (2013). Contemporary Issues Facing Rehabilitation Counseling: A Delphi Study of the Perspectives of Leaders of the Discipline. *Rehabilitation Education*, 20(3), 163–178. <https://doi.org/10.1891/088970106805074430>

Sowell, R. L. (2000). Identifying HIV/AIDS research priorities for the next millennium: a Delphi study with nurses in AIDS care. *Journal of the Association of Nurses in AIDS Care*, 11(3), 42-52.

Sullivan, W. F., Heng, J., Cameron, D., Lunsy, Y., Cheetham, T., Hennen, B., Bradley, E. A., Berg, J. M., Korossy, M., Forster-Gibson, C., Gitta, M., Stavrakaki, C., McCreary, B., & Swift, I. (2006). Consensus guidelines for primary health care of adults with developmental disabilities. *Canadian Family Physician*, 52(11), 1410–1418

Tchernof, A., & Poehlman, E. T. (1998). Effects of the menopause transition on body fatness and body fat distribution. *Obesity Research*, 6(3), 246–254. <https://doi.org/10.1002/j.1550-8528.1998.tb00344>.

You, T., Ryan, A. S., & Nicklas, B. J. (2004). The metabolic syndrome in obese postmenopausal women: Relationship to body composition, visceral fat, and inflammation. *Journal of Clinical Endocrinology and Metabolism*, 89(11), 5517–5522. <https://doi.org/10.1210/jc.2004-0480>

Velthuis, M. J., Schuit, A. J., Peeters, P. H. M., & Monninkhof, E. M. (2009). Exercise program affects body composition but not weight in postmenopausal women. *Menopause*, 16(4), 777–784. <https://doi.org/10.1097/GME.0b013e318197122a>

Williams, J. K., Tripp-Reimer, T., Schutte, D., & Barnette, J. J. (2004). Advancing genetic nursing knowledge. *Nursing Outlook*, 52(2), 73–79. <https://doi.org/10.1016/j.outlook.2003.10.013>

Wing, R. R., Matthews, K. A., Kuller, L. H., Meilahn, E. N., & Plantinga, P. L. (1991). Weight gain at the time of menopause. *Archives of internal medicine*, 151(1), 97-102.

8. CHAPTER EIGHT: EFFECT OF A CULTURALLY ADAPTED EXERCISE PROGRAMME ON THE ANTHROPOMETRICS AND BODY COMPOSITION OF POSTMENOPAUSAL WOMEN WITH EXCESS WEIGHT GAIN: A RANDOMIZED CONTROLLED TRIAL

8.1. Manuscript details

Chapter eight is presented as a published paper. This paper addresses the final objective “to test the effectiveness of the developed culturally appropriate exercise-based program for weight loss among postmenopausal women with excess weight.

Title of the Publication: “Effect of a culturally adapted exercise program on the anthropometrics and body composition of postmenopausal women with excess weight gain: A randomized controlled trial”

This manuscript is under review in the International Journal of Public Health (IJPH). We are working on post-review feedback.

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8.2. Details of the author's contribution

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms is in Appendix H.

Table 8: 1: Details of the author's contribution

	Mensah Bonsu	Myezwa	Brandt	Ajidahun
Conceptualization	√	√	√	√
Method	√	√	√	√
Resources	√			
Manuscript writing draft	√			
Manuscript writing review and editing	√	√	√	√
Supervision		√	√	√

8.3. Abstract

Introduction

Physical activity (PA) is recommended as a component of weight management for the prevention of weight gain and weight regains after weight loss, yet no literature has adapted culturally appropriate PA on postmenopausal women's health. Therefore, we aimed to investigate the effect of a developed culturally appropriate exercise programme for Ghanaian postmenopausal women with excess weight gain on the anthropometrics and body composition.

Methods

A single-blind randomized controlled trial in which participants randomly received 12 weeks of culturally-induced exercise program. A total of 226 postmenopausal Ghanaian postmenopausal women were randomized into exercise and control groups (113 in the control and 113 in the exercise group). Anthropometrics (BMI, WHR, WHtR WC, HC and body weight) and body composition (body fat, visceral fat, muscle mass) were determined pre and post-the 12-week intervention.

Results

Post-menopausal women were on average 58.70 ± 6.38 years old with more than half (52.1%) above 58 years. Except for waist-to-hip ratio (WHR), there were statistically significant differences in body weight, BMI, WHtR, visceral fat, and total body fat in the exercise and control groups. Muscle mass increased significantly (+0.21 kg), whereas hip circumference (-2.46 cm) and waist circumference (-1.39 cm) decreased significantly compared with the control group. Within the exercise group when stratified by BMI, there were higher reductions in BMI (1.01kg/m^2 vs. 0.46kg/m^2), WC (2.18cm vs. 0.22cm), body weight (2.12kg vs. 1.17kg) and body fat (1.84% vs 1.6%) in obese women compared to overweight women.

Conclusion

A 12-week culturally adapted exercise program combining indigenous recreational aerobic activity (Ampe) and resistance exercises positively influenced body composition and anthropometrics of postmenopausal women. Impacting in anthropometrics, body composition and fat distribution have important clinical implications. Therefore, our study gives more credence to the efforts of general professionals and public health officers to encourage indigenous physical activity in postmenopausal women.

Keywords: postmenopausal women, exercise program, cultural, anthropometrics, body composition

Trial Registration: PACTR202301779437544.

8.4. Introduction

Menopause is generally associated with several changes that can worsen women's health-related fitness, particularly when combined with a sedentary lifestyle as well as weight gain (Asikainen et al., 2004). Research to date has demonstrated that postmenopausal women frequently present with an increased prevalence of risk factors for cardiovascular disease (CVD) (Blair et al., 1996, Castelo-Branco et al., 2003). Most often associated with weight gain (Sowers and La Pietra, 1995) postmenopausal women gradually lose lean body mass and cardiovascular health (Lynch et al., 2002), and there is an increase in visceral fat and total body fat (Van Pelt et al., 2002) which contribute considerably to the rise in morbidity and death rates (Pérez-López et al., 2009). Additionally, the physical activity level in women decreases with ageing which also results in adverse alterations to their body composition (Monninkhof et al., 2007).

Evidence-based recommendations on the management of weight gain encourage the use of waist circumference as a measurement of abdominal obesity for determining the relative risk of disease in a person with excess weight gain (Hedley et al., 2004). Therefore, interventions that specifically aim to reduce abdominal fat may be more successful in lowering the CVD risk associated with excess weight in postmenopausal women (Nicklas et al., 2009).

A systematic review of randomized controlled trials examining the impacts of exercise programs in postmenopausal women demonstrated that exercise improves body composition in almost half of the studies (Asikainen et al., 2004). The studies investigating overweight women who combined physical activity with diet modification had the best results (Asikainen et al., 2004). The effect of exercise on body composition has been validated in subsequent studies that investigated the benefits of aerobic and muscle strength training separately and in some cases in combination with a weight loss intervention in postmenopausal women (Jakicic et al., 2008, Bouchard et al., 2009, Slentz et al.,

2005, Maddalozzo et al., 2007, Kuller et al., 2006). These studies generally demonstrated that aerobic exercise decreases body weight and total fat, whereas muscle strength training increases lean body mass. Based on these findings and the American College of Sports Medicine's recommendations, we estimate that aerobic exercise combined with resistance exercises will have the most beneficial effects on body composition (Haskell et al., 2007).

The positive effects of an exercise program on total body fat, body weight and lean mass are undisputed (Jakicic et al., 2008, Bouchard et al., 2009, Slentz et al., 2005, Maddalozzo et al., 2007, Kuller et al., 2006), however, no study has investigated the effect of culturally appropriate exercise programs on postmenopausal women's body composition and anthropometrics. This study was part of a bigger project to understand the cultural perspective of physical activity on women's health. As a result, we aimed to examine the effect of culturally adapted exercise programs in the Ghanaian context on the anthropometrics and body composition of postmenopausal women with excess weight gain.

8.5. Method

8.5.1. Study design

This study was a single-blind randomized controlled trial conducted at the Bono-East regional capital, Techiman over three months (from June to August 2022). Our study investigated the effect of an exercise program developed in a Ghanaian context on anthropometrics and body composition of postmenopausal women with excess weight gain. The study and protocol were approved by the Human Research Ethics Committee at the University of the Witwatersrand, South Africa (Ref no. M190467) and the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology, Kumasi (Ref No. 596/19). Participation was voluntary and written informed consent was obtained from each participant according to the Helsinki declaration.

8.5.2. Selection/recruitment process

Participants within the Bono-East regional capital, Techiman were recruited through local advertisements in the markets, churches, mosques and community. An announcement was made in the women's association, churches and mosque meetings one week before the recruitment while the queen mothers (tubers, fish, second-hand cloth) in the markets announced the study to the women through information centres three days before recruitment. Postmenopausal women were enrolled based on the following criteria: 1) BMI ≥ 25 kg/m² 2) age 48– 70 years, 3) postmenopausal status (no menses for .1 year), 4) not engaged in weight management programs and sedentary lifestyle (15 min exercise 2 times/week and not adherent to the WHO physical activity recommendation). Participants were excluded if they had a medical condition that might be adversely affected by increasing their physical activity, as determined by the physical activity readiness questionnaire (PAR-Q) (Lawton et al., 2008). Three researchers who were trained by the principal investigator (IMB) carried out the recruitment process.

A total of 1002 women were initially screened from ten (10) different study sites (churches, women's organizations, markets, mosques and the communities). Of those women, 301 were medically screened and underwent an exercise test (step tests) to determine their aerobic fitness on each study site. Out of the population of 301, 226 were enrolled on the study and randomized into the control and intervention. (Figure 1).

8.5.3. Sample size calculation

All Ghanaian postmenopausal women with excess weight gain constituted a sample frame.

$$N = 2 \times \left(\frac{z_{1-\alpha} + z_{1-\beta}}{\delta - \delta_0} \right)^2 \times S^2$$

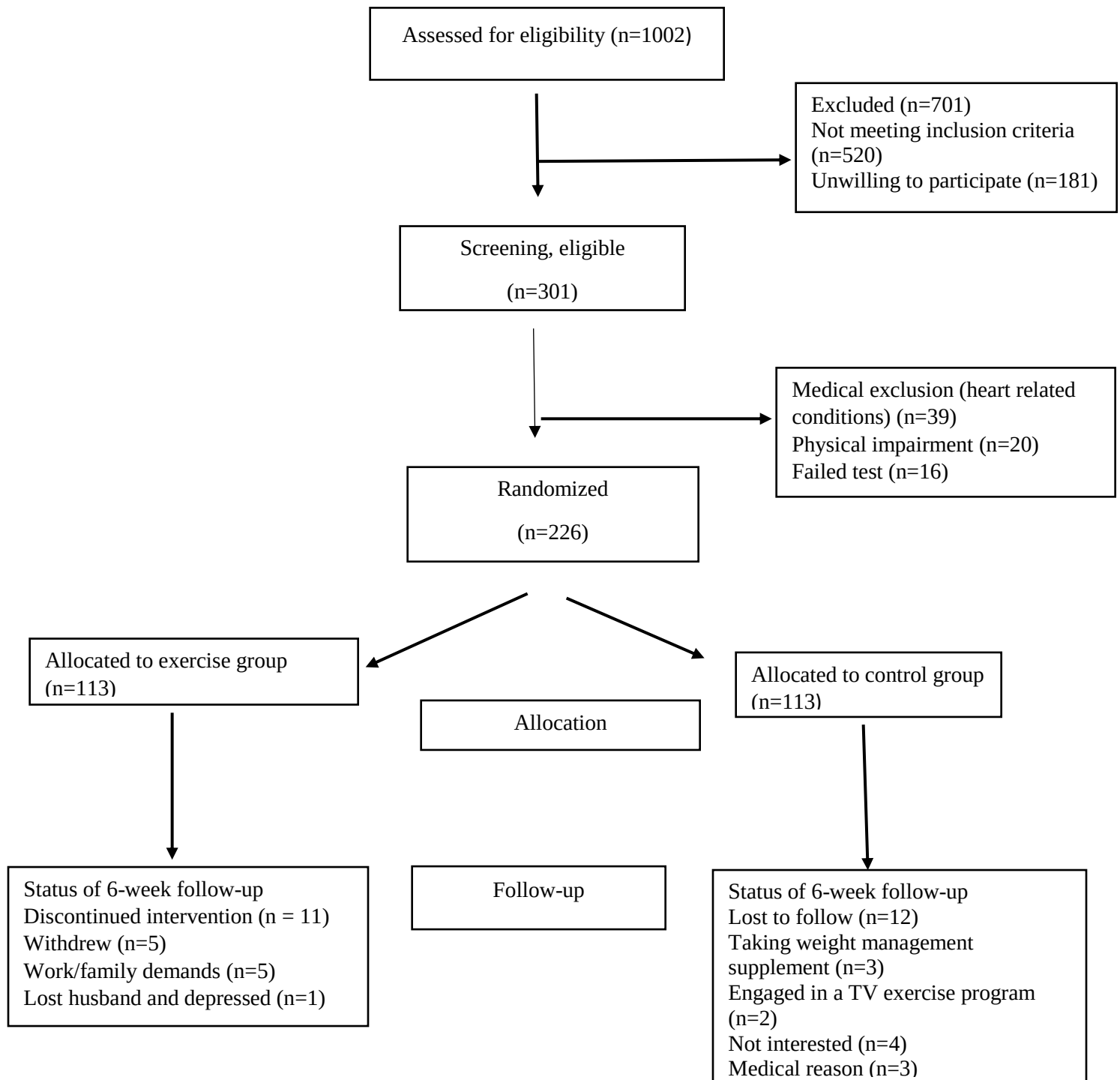
Using this formula, with a 20% dropout rate, a sample size of 270 was determined.

$$N_{\text{Clinical superiority}} = 2 \times \left(\frac{1.645 + 0.845}{4 - 3} \right)^2 \times 6^2 = 112 \times 20 \% (\text{dropout rate}) = 270$$

8.5.4. Randomization and blinding

Two researchers trained by the principal investigator (IMB) and not involved in the recruitment process, performed computer-generated block randomization. In each of the sites, participants were randomized into intervention (exercise) and control groups using blocks of 4, 8 and 12 chosen with equal probability. A total of 226 were randomly assigned to either the control group (n=113) or the exercise group (n=113). We maintained allocation concealment in our study until after we obtained written informed consent, demographics and completed baseline measures. Following baseline measurement, a researcher opened a sequentially numbered opaque envelope containing the allocated group (exercise or control) and showed the allocation to the participant. The researcher assessing participants at 6 and 12-week follow-up visits were blind to group allocation, and participants were requested not to discuss group allocation. The principal investigator (IMB) was blinded to group allocation while assessing the outcome measures and plotting and analyzing the data. Participants agreed to maintain their baseline level of physical activity if not assigned to the intervention for the period of our study. All participants accepted the randomization results after a detailed information session. The control group did not receive any specified program; however, measuring their vital signs (blood pressure) and other anthropometrics were enough incentives and motivation for them.

Women in both groups were asked to maintain their lifestyle (usual diet) and after 12 weeks, post-intervention data were collected. Consort guidelines for reporting are shown in Figure 8.1 (Schulz et al.,2010).



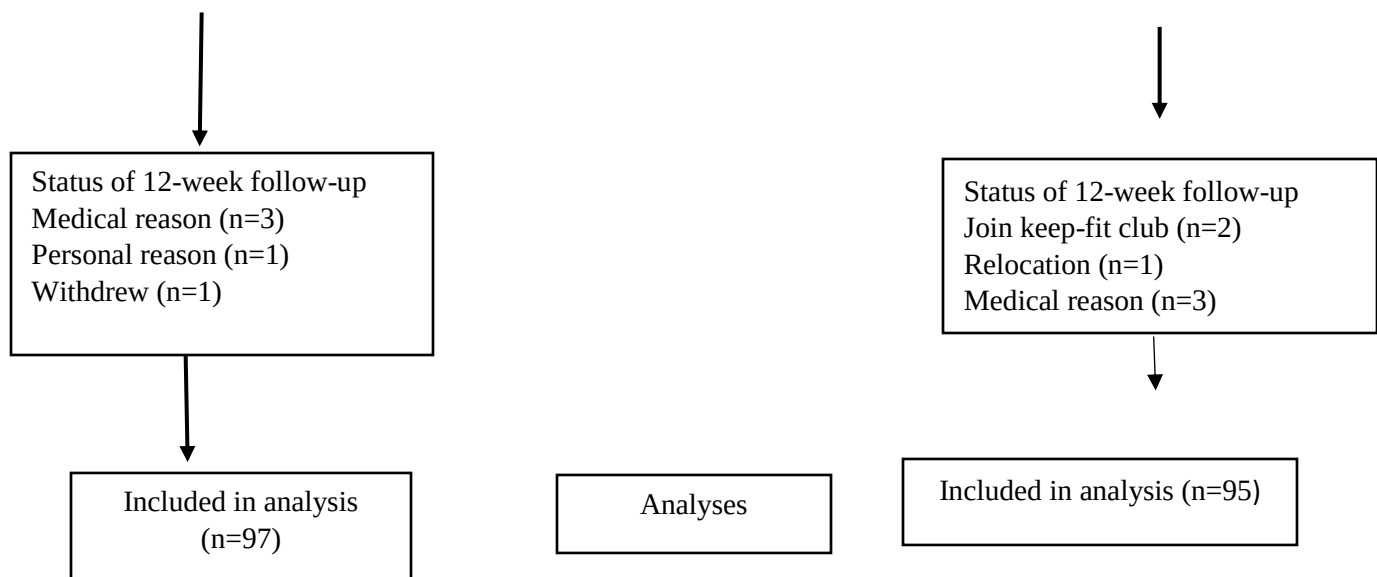


Figure 8: 1: Sample selection, allocation and follow-up.

8.5.5. Exercise program

The intervention was developed by a consensus study in a local context with cultural adaptation. The home-based exercise program included Ghanaian indigenous physical activity (Ampe) that involves clapping while singing and jumping vertically. ‘Ampe’ is an aerobic recreational activity that incorporates good physical workouts and social bonding with intermittent active rest. Additionally, the exercise program had six (6) different resistance exercises such as squat to chair, wall push-ups and exercises with water bottles. The details of the exercise dosage were explained, printed and given to the participants in the exercise group. The Consensus on Exercise Reporting Template (CERT) was used to report the exercise program. A trained female exercise instructor based in the community provided telephonic support (an average of three calls, each lasting 8 minutes) over the 12 weeks, encouraging and motivating them to overcome personal barriers to exercise. The women played the Ampe exercise in 3-4 sets, 3-4 times/week with 10-15 repetitions for a maximum of 10-15 minutes. The resistance exercises involved 4 sets, 3-5 times/week of 10 repetitions for 10-15 minutes. A high degree of consensus among both international and local experts was reached on the component of the exercise program (unpublished data). A culturally appropriate exercise program recognizes the importance of cultural diversity and the influence of cultural factors on weight loss. By adapting the

program to the cultural context of the participants, it enhances engagement, adherence, and effectiveness, leading to improved health outcomes and overall well-being.

8.5.6. Outcome measurements

At baseline and after 12 weeks of intervention, participants' anthropometrics and body composition were obtained. Height was determined by a stadiometer (Ghaziabad, Scorpia India Medicare Pvt. Ltd. | ID: 4076377262) and an Omron Body Composition Monitor with Scale (Omron BF-511 T – rozbaleno) was used to measure weight, skeletal muscle mass, visceral fat area body fat percentage as well as BMI while the participants wore light clothes and no shoes. With the participant in a standing position (with feet together), an inelastic tape was used to measure waist and hip circumference (to the nearest 0.1 cm) as the smallest girth around the waist and the region of maximum girth around the buttocks– (the trochanteric region) for hip circumference (McARDLE and Jackson, 2000). The waist-hip ratio (WHR) and waist-to-height ratio (WHtR) were determined. All these parameters were measured pre-and post-intervention.

8.5.7. Statistical analyses

Baseline characteristics were reported as means $\pm$ SD or as percentages and frequencies of the study groups. An independent t-test was used to compare the baseline anthropometric and body composition measures between the intervention and control groups. Additionally, we performed stratified analyses to investigate variations in body composition and anthropometric changes within the exercise group (overweight vs. obese women) classified by baseline age (48-58 and 58+) using a repeated-measures linear mixed model. Statistical analyses were performed using SPSS software, version 26.

8.6. Results

8.6.1. Socio-demographic characteristics of the trial participants

The socio-demographic characteristics of the 192 participants randomized to the exercise trial are shown in Table 1. Post-menopausal women were on average 58.70 ± 6.38 years old with more than half ($n=100$, 52.1%) above 58 years. Most of the participants ($n=104$, 54.2%) had completed junior or senior high school. More than two-thirds of them were Akans ($n=138$, 71.9%), employed ($n=153$, 79.7%), Christians ($n=154$, 80.6%), and traders ($n=132$, 68.8%) by profession. Almost three-fifths (57.3%, $n=110$) were divorced or married respectively whereas 24.0% ($n=46$) were widowed (Table 1). Except for educational level ($p=0.037$), there were no statistically significant differences in any demographic characteristic between the study groups at baseline (all $p > 0.05$).

Table 8: 2: Socio-demographic characteristics of the trial participants

Characteristics	Total (N=192)	Control (N=95)	Exercise (N=97)	P-value
Age (years)	58.70 ± 6.38	58.83 ± 6.63	58.58 ± 6.15	0.783
Age group (years)				0.669
48-58	92 (47.9)	47 (49.5)	45 (46.4)	
58+	100 (52.1)	48 (50.5)	52 (53.6)	
Religion				0.307
Christians	154 (80.6)	73 (77.7)	81 (83.5)	
Muslims	37 (19.4)	21 (22.3)	16 (16.5)	
Marital status				0.306
Single	17 (8.9)	8 (8.4)	9 (9.3)	
Married	110 (57.3)	50 (52.6)	60 (61.9)	
Divorced	110 (57.3)	13 (13.7)	6 (6.2)	

<i>Widowed</i>	46 (24.0)	24 (25.3)	22 (22.7)	
Ethnicity				0.529
<i>Akan</i>	138 (71.9)	65 (68.4)	73 (75.3)	
<i>Ga or Ewe</i>	15 (7.8)	9 (9.5)	6 (6.2)	
<i>Northerner</i>	39 (20.3)	21 (22.1)	18 (18.6)	
Educational level				0.037
<i>None</i>	35 (18.2)	21 (22.1)	14 (14.4)	
<i>Primary</i>	31 (16.1)	21 (22.1)	10 (10.3)	
<i>Junior or High</i>	104 (54.2)	44 (46.3)	60 (61.9)	
<i>Tertiary</i>	22 (11.5)	9 (9.5)	13 (13.4)	
Occupation type				0.683
<i>Trader</i>	132 (68.8)	64 (67.4)	68 (70.1)	
<i>Others</i>	60 (31.3)	31 (32.6)	29 (29.9)	
Employment status				0.184
<i>Unemployed</i>	39 (20.3)	23 (24.2)	16 (16.5)	
<i>Employed</i>	153 (79.7)	72 (75.8)	81 (83.5)	

8.6.2. Baseline anthropometric and body composition measures of the trial participants

The baseline anthropometric and body composition measures of the trial participants are presented in Table 2. Except for muscle mass with a higher mean in the control than in the exercise group [25.45 ± 3.62 vs 24.68 ± 2.47], all other anthropometrics and body composition measures at pre-test (baseline) were higher in the exercise group compared to the control group (all $p > 0.05$).

Table 8: 3: Baseline anthropometric and body composition measures of the trial participants

Variables	Total (N=192)	Control (N=95)	Exercise (N=97)	P-value[†]
Weight (kg)	77.81 ± 12.01	76.67 ± 10.80	78.91 ± 13.07	0.197
Height (cm)	157.48 ± 7.17	157.24 ± 6.52	157.71 ± 7.77	0.651
BMI (Kg/m ²)	31.43 ± 4.43	31.19 ± 4.56	31.67 ± 4.31	0.449
Muscle mass (kg)	25.06 ± 3.11	25.45 ± 3.62	24.68 ± 2.47	0.090
Body fat (%)	42.65 ± 5.47	42.09 ± 5.39	43.19 ± 5.52	0.164
Visceral fat	11.02 ± 1.93	10.95 ± 2.04	11.08 ± 1.82	0.628
WC (cm)	101.21 ± 9.44	100.03 ± 9.22	102.36 ± 9.57	0.086
HC (cm)	112.22 ± 9.66	111.57 ± 8.76	112.87 ± 10.47	0.353
WHR	0.90 ± 0.06	0.90 ± 0.07	0.91 ± 0.06	0.246
WHtR	0.64 ± 0.06	0.64 ± 0.06	0.65 ± 0.06	0.143
p <0.05				

8.6.3. Changes from baseline for anthropometric and body composition measures with the intervention of the exercise trial

Anthropometric and body composition changes were evaluated at baseline and twelve weeks and are presented in Table 3.

Anthropometrics

After twelve weeks, the intervention group lost a mean of 1.72 kg (a loss of 2.2%) vs. a 1.64 kg gain (a gain of 2.1%) in the control group ($p < 0.0001$). Body mass index decreased on average in the exercise group but increased in the control group (+0.78 vs. -0.64 kg/m², $p < 0.0001$). Waist circumference (WC) decreased by a mean of 1.39 cm in the exercise group vs. a 2.02 cm increase in

controls ($p < 0.0001$). In the exercise group, the mean hip circumference (HC) decreased by 2.46 cm, but the mean increased by 0.21 cm in controls ($p < 0.001$). A similar trend was observed for WHtR between the exercise group vs the control group (+0.01 vs. -0.01, $p < 0.0001$). However, WHR did not differ between the exercise group and the control groups [-0.01 for both, $p = 0.130$].

8.6.4. Body Composition and Fat Distribution Changes

The exercise group experienced a mean 1.72% decrease in total body fat which represented a decline from 43.3% to 41.5% vs. an insignificant 0.23% mean gain of fat in controls ($p < 0.0001$) (Table 3). A similar trend was observed for visceral fat between the exercise group and the controls (+0.36 vs. -0.56%, $p = 0.033$). Muscle mass however increased by an average of 0.21 kg in the exercise group but decreased by 0.25kg in the control group with a much less statistical significance compared to body fat and visceral fat ($p = 0.033$ vs. $p < 0.0001$ for both visceral and body fat).

Table 8: 4: Changes from the pre-test for body composition with the intervention of the exercise trial.

Variables	Control (N=95)	Exercise (N=97)	P-value [†]
Weight (kg)			<0.0001
<i>Pre-test</i>	76.67 ± 10.80	78.91 ± 13.07	
<i>Post-test</i>	78.31 ± 10.66	77.19 ± 77.19	
Δ (% Δ)	-1.64 (-2.12)	1.72 (2.20)	
BMI (Kg/m²)^a			<0.0001
<i>Pre-test</i>	31.19 ± 4.56	31.67 ± 4.31	
<i>Post-test</i>	31.83 ± 4.45	30.89 ± 4.40	
Δ (% Δ)	-0.64 (-2.03)	0.78 (2.49)	
Muscle mass (kg)			0.033

<i>Pre-test</i>	25.45 ± 3.62	24.68 ± 2.47	
<i>Post-test</i>	25.20 ± 3.82	24.89 ± 2.61	
Δ (% Δ)	0.25 (0.99)	-0.21 (-0.84)	
Body fat (%)			<0.0001
<i>Pre-test</i>	42.09 ± 5.39	43.19 ± 5.52	
<i>Post-test</i>	42.32 ± 5.77	41.47 ± 5.91	
Δ (% Δ)	-0.23 (-0.54)	1.72 (4.06)	
Visceral fat (%)			<0.0001
<i>Pre-test</i>	10.95 ± 2.04	11.08 ± 1.82	
<i>Post-test</i>	11.51 ± 2.20	10.72 ± 2.60	
Δ (% Δ)	-0.56 (-4.99)	0.36 (3.30)	
WC (cm)			<0.0001
<i>Pre-test</i>	100.03 ± 9.22	102.36 ± 9.57	
<i>Post-test</i>	102.05 ± 9.33	100.97 ± 10.07	
Δ (% Δ)	-2.02 (-2.00)	1.39 (1.37)	
HC (cm)			<0.0001
<i>Pre-test</i>	111.57 ± 8.76	112.87 ± 10.47	
<i>Post-test</i>	111.78 ± 8.74	110.41 ± 10.86	
Δ (% Δ)	-0.21 (-0.19)	2.46 (2.20)	
WHR ^b			0.130
<i>Pre-test</i>	0.90 ± 0.07	0.91 ± 0.06	
<i>Post-test</i>	0.91 ± 0.07	0.92 ± 0.06	
Δ (% Δ)	-0.01 (-1.10)	-0.01 (-1.10)	

WHtR^c			<0.0001
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<i>Pre-test</i>	0.64 ± 0.06	0.65 ± 0.06	
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<i>Post-test</i>	0.65 ± 0.06	0.64 ± 0.06	
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Δ (% Δ)	-0.01 (-1.55)	0.01 (1.55)	
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8.6.5. Pre-test and post-test anthropometric and body composition measures stratified by baseline BMI (overweight vs. obese participants)

Table 4 presents anthropometric and body composition measures stratified by baseline BMI (overweight vs. obese participants)

Anthropometry

After twelve (12) weeks, the overweight exercise group lost a mean of 1.17 kg (a loss of 1.7%) vs. 2.26 kg gain i.e., a gain of 3.2%) in controls ($p < 0.0001$); the obese exercise group lost 2.12 kg (a loss 2.5%) vs. 1.05-kg loss (a loss of 1.3%) in the control group ($p < 0.0001$) (Table 4). Body mass index decreased, on average, in the overweight exercise group (+0.46 vs. -1.12 kg/m² in controls, $p < 0.0001$) and the obese exercise group (+1.01 vs. 0-0.2 kg/m² in controls, $p = 0.001$). Waist circumference decreased by a non-substantial mean of 0.22 cm (representing 0.2%) in the overweight exercise group vs. 1.76-cm increase in controls ($p = 0.025$) and decreased by 2.2 cm in the obese exercise group vs. 2.26-cm increase in the control group ($p < 0.0001$).

Fat Distribution Changes

The overweight exercise group had a mean decline of 1.6% in body fat mass changing from 39.4% to 37.8% vs. a mean gain of 0.6% fat in controls ($p = 0.001$). On the other hand, the obese exercise group experienced an average 1.8% loss of total fat mass, which represented a decline in the percentage of body fat from 45.9% to 44.0% vs. a slight (0.1%) increase in controls ($p = 0.001$) (Table 4).

Table 8: 5: Pre-test and post-test body anthropometric and body composition measures stratified by baseline BMI

	<i>Baseline BMI < 30 Kg/m² (Overweight women)</i>			<i>Baseline BMI ≥ 30 Kg/m² (Obese women)</i>		
	Control	Exercise	P-	Control	Exercise	P-
Variables	(N=46)	(N=40)	value[†]	(N=49)	(N=57)	value[†]
Weight (Kg)	<0.0001			<0.0001		
	69.53 ±			83.38 ±	85.52 ±	
<i>Pre-test</i>	7.49	69.50 ± 8.25		8.92	11.75	
	71.79 ±			84.43 ±	83.40 ±	
<i>Post-test</i>	7.39	68.33 ± 8.83		9.61	12.19	
	-2.26 (-			-1.05 (-		
<i>Δ (% Δ)</i>	3.20)	1.17 (1.70)		1.25)	2.12 (2.51)	
BMI (Kg/m²)^a	<0.0001			0.001		
	27.55 ±			34.60 ±	34.33 ±	
<i>Pre-test</i>	1.63	27.89 ± 1.22		3.69	3.67	
	28.67 ±			34.80 ±	33.32 ±	
<i>Post-test</i>	1.95	27.43 ± 1.50		4.09	3.98	
	-1.12 (-					
<i>Δ (% Δ)</i>	3.98)	0.46 (1.66)		-0.2 (-0.58)	1.01 (2.99)	
Body fat (%)	0.001			0.001		
	38.46 ±			45.50 ±	45.85 ±	
<i>Pre-test</i>	4.22	39.40 ± 3.60		3.97	5.07	

	39.03	±		45.40	±	44.01	±
<i>Post-test</i>	4.39		37.84 ± 4.32	5.19		5.56	
	-0.57	(-					
Δ (% Δ)	1.47)		1.56 (4.04)	0.1 (0.22)		1.84 (4.10)	
WC (cm)			0.025				<0.0001
	96.08	±		103.74	±	106.92	±
<i>Pre-test</i>	6.16		95.85 ± 7.03	10.08		8.44	
	97.84	±		106.00	±	104.72	±
<i>Post-test</i>	6.60		95.63 ± 7.10	9.83		10.20	
	-1.76	(-		-2.26	(-		
Δ (% Δ)	1.82)		0.22 (0.23)	2.16)		2.18 (2.06)	

8.7. Discussion

Given that postmenopausal women are at an increased risk for several health conditions, we aimed to test the effectiveness of culturally developed exercise programs on anthropometrics and body composition in postmenopausal women with excess weight gain (overweight and obesity). Our results show statistically significant differences between groups in anthropometrics and body composition changes over time and indicate that an exercise program that is culturally designed results in increased benefits.

Our 12-week exercise program in postmenopausal women with excess weight gain led to significant decreases in body weight, BMI, WHtR, total body fat, visceral fat, and an increase in muscle mass. Our intervention did not influence WHR, however, there were statistical differences between waist circumference ($p < 0.0001$) and hip circumference ($p < 0.001$) in the intervention group compared with the control group. Therefore, changes in these variables after the intervention might not reflect a change in WHR.

Although, the body weight lost at 12 weeks in our exercise group was modest (1.72kg), a meta-analysis conducted by Dattilo and Kris-Etherton (1992) and MacMahon et al, (1987) revealed that a weight loss of 1 kg decreases triglycerides by 1.9% or 1.5 mg/dL (0.02 mmol/L), serum cholesterol by 1% or 2.3 mg/dL (0.06 mmol/L) and fasting plasma glucose by 3.6 mg/dL (0.2 mmol/L). Thus, a 5-kg weight loss would result in an 18 mg/dL (1.0 mmol/L) reduction in the average fasting plasma glucose values. Additionally, a study by the Diabetes Prevention Program Research Group (Knowler et al., 2002) found that overweight adults with a weight loss aim of 7% and at least 150 min/week of physical activity had a 58% lower risk of type 2 diabetes. Therefore, consistent with the guidelines of the American College of Sports Medicine and the National Heart, Lung, and Blood Institute, a

primary weight-reduction goal should be to lose weight by 5% to 10% and maintain this loss over the long term (Blair et al., 1996).

The major interventional effects between groups were found in total body fat, BMI, WHtR and muscle mass. The reduction in the intervention group is encouraging as it demonstrates that a decrease in total body fat may lower the chance of developing chronic diseases (Lindström et al., 2003, Knowler et al., 2002, Lindström et al., 2006) and metabolic syndrome (Karelis et al., 2008) in postmenopausal women. In the context of weight reduction in adults, the conservation of muscle mass is essential for the maintenance of metabolic capacity, the motor capability of skeletal muscles (Deibert et al., 2007) and the prevention of osteoporosis (Capozza et al., 2008). Our findings have demonstrated that the preservation of muscle mass is essential. We found that by using the exercise program, considerable weight reduction may be reached with an increase in muscle mass.

The women had higher waist circumferences before the intervention in our study. The increase in waist circumference is consistent with other literature findings showing that weight gain in ageing mostly occurs around the abdominal region (Ley et al., 1992, Haarbo et al., 1991). Also, it is known that after menopause, visceral adipose tissue accumulation and waist circumference increase above and over the consequences of ageing (Kuk et al., 2005). When compared to the control group in our study, postmenopausal women in the exercise group showed a reduction in waist circumference (1.39cm vs -2.02cm) and hip circumferences (2.46cm vs -0.21cm). An earlier study that investigated the effect of a weight-management program on the body composition of obese postmenopausal women reported weight loss in different areas namely the thigh and abdominal region (CORDERO-MacINTYRE et al., 2000). However, our culturally induced exercise program used in the study does not allow differentiation between different fat regions because the “Ampe” in the program involves a total body physical workout.

Our analysis within the exercise group stratified by baseline BMI (overweight and obese), demonstrated that the effects of the exercise program were more evident in the body composition (body fat) and anthropometrics (BMI, WC and body weight) in obese postmenopausal women compared with overweight participants. For instance, obese women experienced a mean 1.84% decline in body fat mass compared to 1.6% in overweight women. Again, there were a higher reduction in BMI (1.01kg/m^2 vs. 0.46kg/m^2), WC (2.18cm vs. 0.22cm), and body weight (2.12kg vs. 1.17kg) in obese postmenopausal women compared to overweight women. This variation in effect between obese and overweight postmenopausal women should be interpreted carefully because this finding was based on within-group analyses and could be due to chance. Our finding is consistent with a study by Velthuis et al., (Velthuis et al., 2009) that investigated 189 sedentary postmenopausal women. Their results revealed that in the exercise group, the effect of the exercise program on the body composition of normal-weight women was higher compared to overweight women. Improving the body composition and anthropometrics in obese postmenopausal women is relevant, however, there are too few studies to conclude the effects of exercise programs on glucose levels and lipids in postmenopausal women. More studies are needed because elevated blood pressure and lipid profiles are very common conditions in the postmenopausal stage.

The finding shows a significant difference in educational level between the treatment and control group. Women in the exercise group have significantly higher education which may influence their nutrition preferences as well as health behaviours and, most importantly, their adherence to the program. However, a study by McDonald and colleagues [38] revealed that aside educational level, adherence to intervention program improved following higher severity of condition investigated. Again, determinants of adherence of lifestyle intervention in adults was investigated by Burgess and

colleagues [39]. They found that lack of enjoyment of the intervention can be barrier to behaviour change [39]. In our study, the adherence was increased and may due to enjoyment of the program.

Weight reduction interventions are associated with substantially higher drop-out rates (King et al., 1995). In our study, the intervention was well accepted by the participants which may be due to cultural adaption within the Ghanaian context.

Finally, our study was conducted in excess weight, postmenopausal women a population at high metabolic risk of cardiovascular disease. However, there are limitation to keep in mind when interpreting and translating our findings. Importantly, because the exercise programme of the intervention was culturally designed, our results are only applicable in this context. The step test results and the measuring of anthropometrics alone may have served to encourage the women in the control group to increase their physical activity level, affecting the outcomes of this group. Again, due to logistical issues, only telephonic support was carried out in this study to improve compliance. In future studies, we intend to monitor postmenopausal women's daily dietary intake before, during, and after the exercise program.

8.8. Conclusion

This is the first study that investigated the effect of culturally adapted exercise-based programme on postmenopausal women with excess weight. We have demonstrated that our intervention program can increase muscle mass, and reduce anthropometric variables (BMI, WHtR, WC and HC) and body composition (visceral fat, total body fat) in postmenopausal women with an increase in body weight. Weight loss programs may be challenging for postmenopausal women with excess weight gain (Chiu et al., 2020), however, the outcome of this study has demonstrated that women need to overcome the obstacles since there are important health implications (Pischon et al., 2008).

8.9. Conflict of interest

The authors declared no conflict of interest

8.10. Availability of data and materials

The datasets analysed in the current study are accessible from the corresponding author on fair request.

8.11. Conclusion

In this chapter, we discussed the effects of culturally adapted exercise programs on anthropometrics and the body composition of postmenopausal women with excess weight. The next chapter includes an integrative synthesis of the PhD study outcomes.

References

1. Asikainen, T. M., Kukkonen-Harjula, K., & Miilunpalo, S. (2004). Exercise for health for early postmenopausal women: A systematic review of randomized controlled trials. *Sports Medicine*, 34(11), 753–778. <https://doi.org/10.2165/00007256-200434110-00004>
2. Blair SN , Kampert JB , Kohl HW3rd, et al. Influences of cardiorespiratory fitness and other precursors on cardiovascular disease and all-cause mortality in men and women. *JAMA* 1996; 276 : 205 – 10
3. Castelo-Branco, C., Blümel, J. E., Roncagliolo, M. E., Haya, J., Bolf, D., Binfa, L., ... & Colodron, M. (2003). Age, menopause and hormone replacement therapy influences on cardiovascular risk factors in a cohort of middle-aged Chilean women. *Maturitas*, 45(3), 205-212.
4. Sowers, M. R., & La Pietra, M. T. (1995). Menopause: its epidemiology and potential association with chronic diseases. *Epidemiologic reviews*, 17(2), 287-302.
5. Lynch, N. A., Ryan, A. S., Berman, D. M., Sorkin, J. D., & Nicklas, B. J. (2002). Comparison of VO2max and disease risk factors between perimenopausal and postmenopausal women. *Menopause*, 9(6), 456–462. <https://doi.org/10.1097/00042192-200211000-00012>
6. Van Pelt, R. E., Evans, E. M., Schechtman, K. B., Ehsani, A. A., & Kohrt, W. M. (2002). Contributions of total and regional fat mass to risk for cardiovascular disease in older women. *American Journal of Physiology - Endocrinology and Metabolism*, 282(5 45-5), 1023–1028. <https://doi.org/10.1152/ajpendo.00467.2001>
7. Pérez-López, F. R., Chedraui, P., Gilbert, J. J., & Pérez-Roncero, G. (2009). Cardiovascular risk in menopausal women and prevalent related co-morbid conditions: facing the post-Women's Health Initiative era. *Fertility and sterility*, 92(4), 1171-1186.

8. Monninkhof, E. M., Elias, S. G., Vlems, F. A., van der Tweel, I., Schuit, A. J., Voskuil, D. W., & van Leeuwen, F. E. (2007). Physical activity and breast cancer: a systematic review. *epidemiology*, 137-157.
9. National Institutes of Health. (1998). Clinical guidelines for the identification, evaluation, and treatment of overweight and obesity in adults-the evidence report. *Obes res*, 6(2), 51S-209S.
10. Nicklas, B. J., Wang, X., You, T., Lyles, M. F., Demons, J., Easter, L., Berry, M. J., Lenchik, L., & Carr, J. J. (2009). Effect of exercise intensity on abdominal fat loss during calorie restriction in overweight and obese postmenopausal women: A randomized, controlled trial. *American Journal of Clinical Nutrition*, 89(4), 1043–1052. <https://doi.org/10.3945/ajcn.2008.26938>
11. Jakicic JM, Marcus BH, Lang W, Janney C. Effect of exercise on 24month weight loss maintenance in overweight women. *Arch Intern Med* 2008;168:1550-1559.
12. Bouchard DR, Soucy L, Senechal M, Dionne IJ, Brochu M. Impact of resistance training with or without caloric restriction on physical capacity in obese older women. *Menopause* 2009;16:66-72.
13. Slentz CA, Aiken LB, Houmard JA, et al. Inactivity, exercise, and visceral fat. STRRIDE: a randomized, controlled study of exercise intensity and amount. *J Appl Physiol* 2005;99:1613-1618.
14. Maddalozzo GF, Widrick JJ, Cardinal BJ, Winters-Stone KM, Hoffman MA, Snow CM. The effects of hormone replacement therapy and resistance training on spine bone mineral density in early postmenopausal women. *Bone* 2007;40:1244-1251.
15. Kuller LH, Kinzel LS, Pettee KK, et al. Lifestyle intervention and coronary heart disease risk factor changes over 18 months in postmenopausal women: the Women On the Move through

- Activity and Nutrition (WOMAN study) clinical trial. *J Womens Health (Larchmt)* 2006;15:962-974.
16. Haskell WL, Lee IM, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc* 2007;39:1423-1434
 17. Canadian Society for Exercise Physiology. Physical activity readiness questionnaire (PAR-Q). 2002. www.csep.ca/main.cfm?cid=574&nid=5110
 18. McARDLE AN, Jackson MJ. Exercise, oxidative stress and ageing. *The Journal of Anatomy*. 2000 Nov;197(4):539-41.
 19. Dattilo A, Kris-Etherton P. Effects of weight reduction on blood lipids and lipoproteins: a meta-analysis. *Am J Clin Nutr*. 1992;56:320-328.[PubMedGoogle ScholarCrossref](#)
 20. MacMahon S, Cutler J, Brittain E, Higgins M. Obesity and hypertension: epidemiological and clinical issues. *Eur Heart J*. 1987;8:57-70.[PubMedGoogle ScholarCrossref](#)
 21. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002; 346:393-403.
 22. Blair S, Kampert J, Kohl H, et al. Influence of cardiorespiratory fitness and other precursors on cardiovascular disease and all-cause mortality in men and women. *JAMA*. 1996; 276:205-210.
 23. Lindstrom J, Eriksson JG, Valle TT, et al. Prevention of diabetes mellitus in subjects with impaired glucose tolerance in the Finnish Diabetes Prevention Study: results from a randomized clinical trial. *J Am Soc Nephrol* 2003;14: S108-S113.
 24. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002; 346:393-403.

25. Lindstrom J, Louheranta A, Mannelin M, et al. The Finnish Diabetes Prevention Study (DPS): lifestyle intervention and 3-year results on diet and physical activity. *Diabetes Care* 2003;26:3230-3236
26. Karelis AD, Lavoie ME, Messier V, et al. Relationship between the metabolic syndrome and physical activity energy expenditure: a MONET study. *Appl Physiol Nutr Metab* 2008; 33:309-314.
27. Deibert, P., König, D., Vitolins, M. Z., Landmann, U., Frey, I., Zahradnik, H. P., & Berg, A. (2007). Effect of a weight loss intervention on anthropometric measures and metabolic risk factors in pre-versus postmenopausal women. *Nutrition journal*, 6(1), 1-7.
28. Capozza RF, Cure-Cure C, Cointy GR, et al. Association between low lean body mass and osteoporotic fractures after menopause. *Menopause* 2008;15:905-913.
29. Ley CJ, Lees B, Stevenson JC: Sex- and menopause-associated changes in body-fat distribution. *Am J Clin Nutr*. 1992, 55: 950-954.CAS PubMed Google Scholar
30. Haarbo J, Marslew U, Gotfredsen A, Christiansen C: Postmenopausal hormone replacement therapy prevents central distribution of body fat after menopause. *Metabolism*. 1991, 40: 1323-1326. 10.1016/0026-0495(91)90037-W.
31. Kuk JL, Lee S, Heymsfield SB, Ross R: Waist circumference and abdominal adipose tissue distribution: influence of age and sex. *Am J Clin Nutr*. 2005, 81: 1330-1334
32. Cordero-Macintyre ZR, Peters W, Libanati CR, Espana RC, Howell WH, Lohman TG: Effect of a weight-reduction program on total and regional body composition in obese postmenopausal women. *Ann N Y Acad Sci*. 2000, 904: 526-535
33. Velthuis, M. J., Schuit, A. J., Peeters, P. H. M., & Monninkhof, E. M. (2009). Exercise program affects body composition but not weight in postmenopausal women. *Menopause*, 16(4), 777–784. <https://doi.org/10.1097/GME.0b013e318197122a>

34. King AC, Haskell WL, Young DR, et al. Long-term effects of varying intensities and formats of physical activity on participation rates, fitness, and lipoproteins in men and women aged 50 to 65 years. *Circulation* 1995; 91: 2596–604
35. Chiu, H. H., Wu, S. F., & Wang, P. H. (2020). The experience of menopausal women participating in weight management program: A pilot study. *Taiwanese Journal of Obstetrics and Gynecology*, 59(5), 686–690. <https://doi.org/10.1016/j.tjog.2020.07.011>
36. Pischon T, Boeing H, Hoffmann K, et al. General and abdominal adiposity and risk of death in Europe. *N Engl J Med* 2008;359: 2105-2120
37. Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *Journal of Pharmacology and pharmacotherapeutics*, 1(2), 100-107.
38. McDonald, M. T., Siebert, S., Coulter, E. H., McDonald, D. A., & Paul, L. (2019). Level of adherence to prescribed exercise in spondyloarthritis and factors affecting this adherence: a systematic review. *Rheumatology International*, 39(2), 187–201. <https://doi.org/10.1007/s00296-018-4225-8>
39. Burgess, E., Hassmén, P. and Pumpa, K.L., 2017. Determinants of adherence to lifestyle intervention in adults with obesity: a systematic review. *Clinical obesity*, 7(3), pp.123-135.

9. CHAPTER NINE: INTEGRATIVE DISCUSSION

In chapter nine an integrative discussion of the implications and significance of study in the light of the literature (Chapter 2) is presented. The study aimed to develop and test the effect of a culturally adapted exercise-based programme for weight loss in Ghanaian postmenopausal women with excess weight. The study results emanated from five studies of which the results are outlined and depicted as chapters in Figure 9.1.

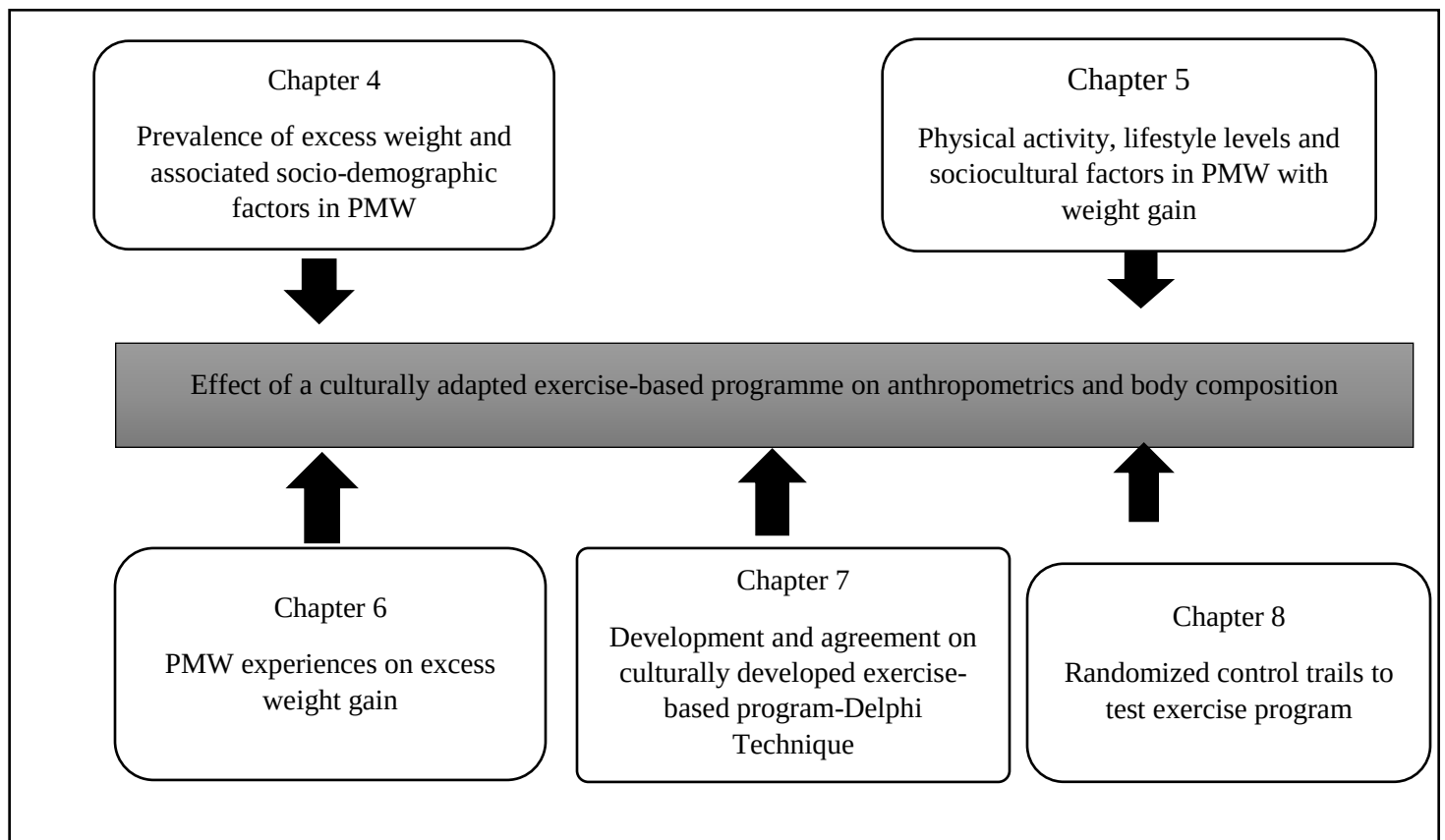


Figure 9. 1: Schematic diagram of the studies conducted

To achieve the study aim, the prevalence of postmenopausal women (PMW) and associated demographic factors with excess weight were identified (Chapter Four). In Chapter Five, the physical activity, lifestyle and sociocultural factors led to exploring the experiences of PMW with weight gain in Chapter Six. In Chapter Seven, a culturally adapted exercise programme was developed based on the findings from the three previous Chapters and literature review findings. The exercise programme was compiled using a modified international and local Delphi technique. In Chapter Eight, the methodology and results of a randomized controlled trial was reported that tested the effectiveness of the culturally developed exercise programme.

Section A

The discussion in this section will reflect on the study findings, summarising the main findings followed by discussion of the results using the Health Belief Model (HBM). The Health Belief Model (HBM) was used as the theoretical framework for this thesis. The HBM framework is often used to explain why individuals change or maintain specific health behaviours (Seiler et al., 2022). This model assumes that individual involvement in health-related behaviours is determined by understanding the six constructs: perceived susceptibility (an individual's assessment of their risk of getting a disease or condition), perceived severity (an individual's perception of the seriousness and potential consequences of the condition), perceived benefit (an individual's beliefs about whether the recommended behaviour will reduce the risk or severity of impact), Perceived barrier (an individual's assessment of the difficulties and cost of adopting behaviours), cue to action (the internal or external motivations promoting the desired behaviour), and self-efficacy (an individual's belief about their capabilities to successfully perform a new health behaviour) (Rosenstock et al., 1988, Bandura, 1982,).

9.1. A synthesised narrative of the thesis

The study aimed to develop and test the effect of a culturally adapted exercise-based programme for weight loss in Ghanaian postmenopausal women with excess weight. To develop an appropriate programme, the study initially established the extent of the epidemic proportion of postmenopausal women with excess weight in Ghana. Literatures to date have reported overweight/obesity prevalence among women in Ghana (Asosega et al., 2021, GSS, 2015, Duda et al., 2007). For instance, Duda and colleagues (2007) documented 62.2% overweight/obesity prevalence among adult women, aged 18 years and older in Ghana. Additionally, The Ghana Statistical Service (2015) reported that the prevalence rate of overweight/obesity increased from 25% in 2003 to 40% in 2014 among women of reproductive age in Ghana. Asosega and authors (2021) documented similar findings among the same population (reproductive women). Their study reported a 35.4% overall prevalence of overweight/obesity among reproductive Ghanaian women (Asosega et al., 2021). While there is a rich body of literature on overweight/obesity prevalence among women, the prevalence in postmenopausal women is not known in Ghana. Therefore, it was necessary to increase the knowledge of overweight/obesity prevalence in Ghana to inform appropriate weight loss programme. To fill the research gap, the study determined the prevalence of overweight/obesity in Ghanaian postmenopausal women (Chapter Four). Although overweight/obesity affects other populations (Centers for Disease Control and Prevention [CDC], 2012), the current study reported an overweight/obesity prevalence rate of 73.2%, 91.8% and 91.0% using BMI, WHtR and WHR respectively. Education and ethnicity were predictors of excess weight gain using WHR among the women. Postmenopausal women from the Ga tribe with high school education had 4.7- and 8.6-times increased odds of having excess weight gain characterized by the WHR criterion. These results put postmenopausal women at risk for modifiable diseases such as cardiac disease, renal disease and diabetes (Avery et al., 2012). The reason for the development of these chronic diseases is due to

alterations in lipid metabolism and estrogen deficiency (Mijatovic et al., 1999). In menopausal stage, there is decrease in estradiol (E2) that contributes to lipid metabolic disorders (Ko and Jung, 2021). The peculiar function of E2, which is produced in the ovary using low-density lipoprotein cholesterol (LDL-C), is the reason (Ko and Jung, 2021). Thus, a reduction in E2 production means that LDL-C is not used for synthesizing estradiol (E2), hence it remains in the systemic circulation and these increase the risk of metabolic syndrome symptoms (Mumusoglu and Yildiz, 2019).

After establishing the extent of the epidemic in postmenopausal women, we determined the behaviours, beliefs and attitudes toward the development of excess weight. The findings revealed that over 55 (55.2%) of PMW engaged in moderate physical activities, 23.1% attained a low level and 21.7% had a high level of physical activities. Housewives and unemployed postmenopausal women have a higher risk of gaining excess weight using WHR and WHtR criteria. The study further found that the majority of PMWs believe that cultural background will prevent them from losing weight as society sees PMWs' current body weight as attractive. The majority of PMWs have poor lifestyles due to their attitude towards food (59.7%) and sedentary behaviour (64.1%).

The higher prevalence rate of excess weight identified from this study (Chapter Four) necessitated the exploration of women's weight management practices. The findings revealed three major themes namely, (i) perception of body weight, (ii) measures to reduce body weight, and (iii) support to adhere to the weight management program. Sub-themes revealed that weight gain was viewed as the presence of diseases and admired by society as a culturally accepted body image. Diet-related changes, a combination of diet modification and physical activity, and weight management supplements emerged as measures to reduce excess weight. Support to adhere to the weight program included health education, access, affordable exercise facilities, and social support.

To address the issue of excess weight, we further developed a culturally sensitive exercise-based programme since excess weight is associated with life-threatening risk factors that affect morbidity and mortality rates (Akers et al., 2010). Many factors identified in this study (Chapters Four-Six) hinder postmenopausal women from losing weight. For example, demographic information revealed that the majority were traders and are more likely to work full-time, have family responsibilities (chores, taking care of grandchildren) and have children (Barnes and Kimbro, 2012). These challenges could interfere with finding time to exercise (Campo et al., 2011). Additionally, unhealthy eating patterns, low physical activity and socially accepted excess body size were also mentioned. However, the programme included Ghanaian house-hold indigenous recreational activity (Ampe) which can be performed without the need for special conditions. After three rounds of questions, all the items presented in the Delphi questionnaire achieved over 80% consensus with a 90.2% (n=37) response rate.

The programme was tested among postmenopausal women. After 12 weeks, there were statistically significant differences in body weight, BMI, WHtR, visceral fat, and total body fat in the exercise group compared with the control group even though WHR was not affected. Again, muscle mass increased significantly (+0.21 kg), whereas hip circumference (-2.46 cm) and waist circumference (-1.39 cm) decreased significantly compared with the control group. Within the intervention group when stratified by BMI, there were higher reductions in BMI (1.01kg/m² vs. 0.46kg/m²), WC (2.18cm vs. 0.22cm), body weight (2.12kg vs. 1.17kg) and body fat (1.84% vs 1.6%) in obese postmenopausal women compared to overweight women.

9.2. Perceived threat (susceptibility and severity)

The level of perceived threat or risk of a certain situation (also known as "readiness to act"), which is a combination of perceived seriousness and susceptibility, is the main driver of change under health belief model (Baranowski et al., 2003).

9.2.1. Perceived susceptibility to excess weight

As postmenopausal women continue to be challenged by weight management (Jung et al., 2015, James et al., 2012), it is important to understand the perceived susceptibility to weight gain. In this study, 55.2% of the participants had 1 to 2 days per week of moderate physical activities for 1 to 20 minutes per day during the last 7 days, however, they did not meet the minimum amount recommended by the World Health Organization. Thus, the finding of this study indicates that participants in this study do not engage in adequate physical activity to be beneficial for their health. Participants' engagement in insufficient physical activity may have influenced the women's susceptibility to excess weight. The result makes an important contribution to our understanding of the prevalence and predisposing factors of weight gain in postmenopausal women in Ghana. A life of inactivity increases the risk of developing several chronic diseases (WHO, 2018), which leads to 2 million deaths worldwide each year (WHO, 2020). Regular physical activity is necessary for long-term weight management and studies consistently show that older adults do not meet the national recommendations of 150-300 minutes of moderate-intensity of physical activity per week (Bull et al., 2020). The menopausal stage is often considered a sign of reduced health and this stage compared to the premenopausal stage is more susceptible to disease (Tiansawad et al., 2009). People go through a variety of physiological, physical, cognitive, and social changes during the onset of menopause, which makes them more susceptible to changes that have an impact on their health (Antonio et al., 2009, Utian, 2005). These changes include the first signs of chronic diseases like hypertension,

arthritis, cardiovascular disease, and diabetes (Antonio et al., 2009). A decrease in physical activity may be expected as women may find it challenging to engage in regular physical activity throughout the menopausal years due to increased daily life demands (such as job-related obligations, caregiving for grandchildren and/or parents) (Carson et al., 2018). Again, most of their available time for physical activity has been replaced by sedentary activities like watching television and using other screen-based media; there is also reason to believe that domestic mechanization (with the advent of labour-saving devices like blender, "fufu" pounding machine, and washing machines) has also contributed to increased sedentariness (Archer et al., 2013). Various studies have shown the benefits of regular physical activity in preventing chronic diseases and early death (Barbagelata, 2016, Antonio et al., 2009, Babatunde, 2022). Given the importance of physical activity in women's health, emphasis should be focused on setting attainable goals such as engaging in traditionally appropriate aerobic activities and participating in family-centred activities (James et al., 2012). Mostly, short intervals of physical activity are recommended for women with excess weight gain and those starting an exercise program (Jeffery et al., 2003).

Over the past three decades, there has been an increase in emerging NCDs related to diet and lifestyle; this has often been attributed to the demographic transition, epidemiologic transition, and contemporary nutrition transition (Defo, 2014, Remais et al., 2013). The nutrition transition is characterized by a change in the disease burden from undernutrition to over nutrition-related chronic diseases (Ofori-Asenso et al., 2016). Among other factors related to excess weight, eating habits has received more attention due to their preventable aspect (Goel, 2006, Barbagelata, 2016). In essence, consistent healthy eating has long been linked to either a healthier weight or more successful weight loss. (Wyatt et al., 2002). From the study, participants had poor eating habits as more than 50% of the participants on most days of the week eat more than the recommended amount which explains

the perceived susceptibility to weight gain. Unsurprisingly this eating behaviour is believed to result in increased caloric intake and, eventually, has a substantially detrimental effect on weight outcomes (Hout et al., 2005). Moreover, undue eating behaviour leading to excess weight gain in individuals can be considered a disorder (Barbagelata, 2016). The presence of disordered eating behaviours may compromise attempts to maintain healthy eating and weight loss (Barbagelata, 2016). An eating disorder is therefore not only linked with a psychological problem but is also associated with weight regain and poorer long-term outcomes in those with weight loss intervention (Barbagelata, 2016). Since such problems occur rather often among individuals with excess weight gain, targeting eating disorders may result in better psychological functioning and weight loss treatment outcomes which will decrease the perceived threat to weight gain (Elfhag & Rössner, 2005). Some of these behaviours are challenging to assess and may require specific knowledge and training or referral for accurate assessment and the design of effective interventions. Various approaches for the treatment of eating disorders have been tested (Barbagelata, 2016), however, cognitive behavioural therapy, behavioural weight loss intervention and interpersonal therapy are the best-studied and the most well-established psychological treatment for eating disorders and have shown comparable outcomes with some work suggesting its superiority in the long-term maintenance of results (Grilo et al., 2011, Wilson & Shafran, 2005, Hilbert et al., 2012, Wilson et al., 2010). More flexible control of overeating behaviour is recommended in the treatment of individuals with excess weight gain, as it is associated with weight maintenance compared with rigid control (Westenhoefer, 2001). The habits associated with overeating highlighted in the study informed the decision to include nutritional education in the programme.

Linked to the psycho-social factors, are the women's understanding and definition of the concept of body weight as important because it affects their perception of body image and the likelihood of

developing excess weight (James et al., 2012). The evidence from the current study indicated that in addition to insufficient physical activity and poor eating patterns, participants are susceptible to weight gain due to cultural influences or values and perceptions of excess weight. The participants assume that their body weight is normal, partly because they believe that being overweight or obese is not a disease like diabetes or a stroke (Okop et al., 2016). This misconception about weight gain could explain why women in this study, for instance, did not perceive the personal risk of weight gain. Previous studies have emphasized the importance of an appropriate perception of risk in enhancing intention and willingness to engage in healthy behaviours (Okop et al., 2016). Interestingly, the participants viewed their excess body weight to be presentable or attractive within the Ghanaian cultural context and research suggests that many Ghanaian communities have a strong admiration for larger body sizes (Benkeser et al., 2012, Aryeetey, 2016). Earlier studies in Africa have been conducted in Gambia (Van der Sande et al., 2001), South Africa (Walker et al., 2001) and Nigeria (Belek, 2019). These studies report that excess weight is seen as either positively associated with prosperity, (Belek, 2019, Walker et al., 2001, Van der Sande et al., 2001) or viewed with ambivalence (Walker et al., 2001). Due to the social desirability of excess weight as such, the women in the present study may not consider themselves being overweight or obese to take further action. People change their behaviour if they perceive that their health is in danger and that their present behaviour could have negative effects. Researchers also recommended highlighting the risk and severity of the medical issues and health complications that might result from being overweight or obese (Daddario, 2007). The perception of body weight as attractive and admired by society could present a challenge to weight reduction interventions in this setting (Okop et al., 2016). Lack of knowledge about potential risks that have been highlighted in earlier research is mainly responsible for the poor perceptions of the risk and severity of excess weight (Draper et al., 2016, Faber et al., 2005, Puoane et al., 2005). Lack of access to accurate health information on the risks associated with

excess body weight in this population may also contribute to poor views of the risk of mortality and morbidity associated with excess weight (Micklesfield et al., 2013). It might be helpful to emphasize health complications or the threat of excess weight which is linked to the increased prevalence of heart disease, metabolic disorders and osteoporosis, especially among postmenopausal women (Marinou et al., 2010, Hosseini et al., 2017). Access to reliable health education can motivate some women to change their behaviour to mitigate the risk of chronic diseases, early mortality and morbidity. Health information can be used as a starting place for behavioural change. With the increased use of technology after the COVID-19 pandemic (Koeze and Popper, 2020), virtual platforms could be used to deliver menopause health education, exercise and dietary guidance as long as the women are free to question each other and share their experiences (Kracht et al., 2022).

9.2.2. Perceived severity/seriousness

Despite the public's access to a variety of weight-loss methods, this study documented a higher prevalence of excess weight using BMI (73.2%), WHtR (91.8%) and WHR (91.0%). A higher prevalence of excess weight by inference highlights the seriousness of the growing burden of weight gain among postmenopausal women in the country. The increasing burden of excess weight found in this study is consistent with findings made by previous studies in the nation (Agyei-Mensah & De-Graft Aikins, 2010, Ofori-Asenso et al., 2016), and it is further confirmed by the Ghana statistical services (GSS, 2014, GSS, 2004). Ghana DHS's reported steadily rising obesity/overweight prevalence over the period 1988 to 2014 in the general population (GSS, 2014, GSS, 2004). The increasing prevalence of weight gain is closely linked to insulin resistance and increased incidence of metabolic syndrome (Marinou et al., 2010, Brochu et al., 2000, Farlane et al., 2001). This high prevalence shows the continued need for cognitive and behavioural strategies intended to reverse this population's (postmenopausal women) increased trend in excess weight gain. The continued rise

in weight gain urged other researchers to use the HBM to investigate weight-related attitudes or behaviours and develop weight management programs (Downs & Ashton, 2011, Kwan et al., 2012). The expectancy of HBM was defined in terms of the person's assessment of their susceptibility to and severity of a disease, as well as their chance of being able to lower that threat by personal action (Rosenstock et al., 1988). However, the outcomes of other studies have demonstrated that perceived susceptibility and severity are not predictors for engaging in preventive behaviour (Hosseini et al., 2017, Baghianimoghadam et al., 2013, Keating et al., 2005, Solimanian et al., 2014, Edmonds 2009). For instance, a study by Baghianimoghadam et al. (2013), Edmonds (2009), Keating et al. (2005) and Solimanian et al. (2014) revealed that there was no statistically significant correlation between perceived severity and behaviour prevention, however, there was a direct correlation between behaviour and perceived susceptibility. It appears that knowing the threat and feeling vulnerable to the negative effects of weight gain is insufficient to alter or encourage the behaviour. However, since perceived susceptibility and severity are influenced by medical knowledge and information, it shows that the reason for the disparity in findings across studies is the difference in the level of awareness of the disabilities and risks associated with unhealthy behaviour (Hosseini et al., 2017). There is a greater need for more research in this area to understand the relationship between these two constructs and behaviour given that different results from studies about the relationship between perceived susceptibility and severity with behaviour have been reported.

Excess weight was viewed by the participants as a life-threatening, debilitating condition as they lamented that they experience severe joint pains, especially around their knees, waist, and ankles. Perceived threat exerted the greatest influence on behavioural intention of weight management and studies have shown that it is a strong predictor of some health behaviours (Bishop et al., 2015, O'connell et al., 1985). Several women said the risk of increased body weight limited their mobility

and prevented them from enjoying life to the fullest. Increased weight can increase the likelihood of developing improper movement and alignment of the bones and muscles (Walsh et al., 2008), increasing the risk for osteoarthritis (Franklin et al., 2009) as well as increasing susceptibility to joint injury (Andersson, 2008) and effort to accomplish everyday tasks (Roffey et al., 2011). The development of musculoskeletal pain is likely to increase healthcare utilization (Faghri and Momeni, 2014) which can adversely affect the individual financially. Weight-management programmes including exercises are encouraged, but their positive effects will be significantly improved if they are specifically designed to address the high prevalence of musculoskeletal discomfort in this population. It has been demonstrated that a program that is tailored to the needs of the individual has a favorable impact on the participant's involvement in the program (Faghri and Momeni, 2014). A positive effects of the walking programme on body weight and other risk factors has been reported (Faghri et al., 2008) and can be initiated for such individuals, encouraging them to increase the number of steps they take while performing chores. Health promotion programmes involving health educators, such as dietitians, can improve weight reduction and other related conditions in individuals with excess-weight and musculoskeletal discomfort.

Additionally, the participants mentioned that their increased BMI contributed to their health complications and made them spend a lot of money on pain relief medications. Besides direct excess healthcare expenditure for diagnosis and treatment, indirect costs such as productivity loss due to morbidity and early mortality also impede economic growth (Tremmel et al., 2017, Gold et al., 1996). Recent studies and analyses have discussed the economic burden connected to a gradient between rising BMI and costs related to increased BMI (Ofori-Asenso et al., 2016, Specchia et al., 2015, Dee et al., 2014). Research on the cost of illness has several advantages and importance. Firstly, it will help policymakers understand the economic burden associated with increased BMI. Secondly, the

studies will identify different components of costs of excess weight-related complications in different sectors of society, which may have been saved if the condition had not existed. The study can be conducted from different perspectives that can determine the types of costs included in the analysis. Measurement could include costs to society, participants and their families, healthcare systems, and health insurance companies (Hodgson, 1994, Rice, 2000). Furthermore, studies on the cost of excess weight can have a significant role in public health in formulating and prioritizing healthcare policies and allocating healthcare resources by estimating the amount attributable to morbidity and mortality associated with excess weight (Jo, 2014). There have been several literature reviews on the cost of overweight/obesity (Bierl et al., 2013, Lehnert et al., 2013, Tran et al., 2013, von Lengerke and Krauth, 2011, Hammond and Levine, 2010), however, none of the analyses have thoroughly examined the co-morbidities associated with obesity factored into the cost estimate (Tremmel et al., 2017). To improve the standard of living during the postmenopausal period, systematic reviews should be conducted in the context of the cost of excess weight-related co-morbidities to provide a high level of evidence on the cost burden due to increased BMI. The information may be used to develop policies to address the problem of overweight/obesity within the Ghanaian context (McCormick, et al., 2007).

9.3. Predictors of weight gain in postmenopausal women

It is documented in this study that postmenopausal women of the Ga tribe and high school graduates have increased odds of excess weight indicated by the WHR criterion. According to Amoah (2003), the Ga and Akan tribes had the greatest prevalence rates of overweight and obesity, while Ewes had comparatively low rates. Agbeko et al.'s secondary analysis of data from the 2008 DHS produced similar findings (Agbeko et al., 2013). Women in the Ga tribe often undertake sedentary occupations (such as tabletop trading), and studies have shown that they engage in less physical activity (Ofori-

Asenso et al., 2016). The disparities in the frequency of excess weight among the ethnic groups are regarded to largely reflect differences in social behaviours, such as work habits, meal preparation, and perception of body image. Understanding the perceptions and beliefs of body size can serve as the foundation for including service providers and policy makers in the development of contextualized, evidence-based measures to address overweight/obesity among postmenopausal women in Ghana and other countries with similar backgrounds.

Weight loss is generally not successful, despite numerous weight-reduction programmes accessible to the public (Stubbs et al., 2011). Additionally, the maintenance of successful weight loss as well as long-term weight-loss program compliance rates are typically low (Stubbs et al., 2011). Consequently, identifying risk factors for weight gain may help to increase the effectiveness of treatment (Lazzeretti et al., 2015, Faghri et al., 2016). The analysis also indicated the impacts of ethnicity and educational level as predictors of weight gain among Ghanaian postmenopausal women. Only about 21% of urban Ghanaian women in a study on the determinants of overweight and obesity maintained adequate levels of physical activity (Appiah et al., 2014). Lifestyle changes are especially relevant when an individual's BMI increased (Baranowski et al., 2003). The primary motivation for lifestyle change is the level of perceived threat or risk of a specific condition (Baranowski et al., 2003). Baranowski and colleagues (2003) noted that fear-based communications (using statements or explanations that promote fear to encourage positive changes) have been investigated as a mean to promote behaviour change by affecting the perceived susceptibility and seriousness of an illness. This form of communication effectively influenced the person's perception of a threat and the selection of behaviour to reduce the threat based on the efficacy of a response (whether the behaviour reduces the threat) and self-efficacy (whether the person is confident that the

behaviour can be performed). To understand the efficacy of this fear-based communication within the Ghanaian context, a well-constructed body of research is needed.

Although people with lower socioeconomic status tend to develop excess weight more frequently in many high-income countries, the opposite is true in low-income countries (Pampel et al., 2012). Studies have shown that high-income Ghanaians are more likely to be overweight or obese than lower socioeconomic residents (Amoah 2003, Appiah et al., 2014). A study by Ofori-Asenso et al documented that Ghanaians with tertiary education were shown to have the highest frequency of excess weight gain compared to those with lower educational level (Ofori-Asenso et al., 2016). This may relate to how many Ghanaian societies view wealth and large body sizes as a socially accepted image (Benkeser et al., 2012). It may also be related to how increasing wealth come with more food options and accessibility, which may encourage the consumption of larger portion sizes (Appiah et al., 2014, Darmon & Drewnowski, 2008). According to Agyei-Mensah and de-Graft Aikins findings, there is a rising tendency of people to work late or visit bars after work to avoid the congested evening traffic, which is linked to late dining among Ghana's working (middle to high class) population (Agyei-Mensah and de-Graft Aikins, 2010). Literature indicates that the main drive to change within the Health Belief Model is a combination of perceived seriousness and susceptibility (Baranowski et al., 2003), however, the present study shows that higher socioeconomic status did not influence the participants to react positively to their weight gain. Multiple interactions between measures of these two concepts (perceived seriousness and susceptibility) concerning socioeconomic status should be investigated in a future study.

9.4. Perceived benefits and barriers related to weight loss

External factors and negative beliefs frequently prevent women from making an effort to lose weight (James et al., 2012). Although they may be aware of the advantages of losing weight, the sacrifices may be overwhelming or unrealistic for them. (James et al., 2012). According to the Health Belief Model, people will change their behaviour if they initially think that their health is in danger and that their current actions might have negative effects (Bandura, 1982, Rosenstock et al., 1988, James et al., 2012). The individuals must believe that the advantages of changing their behaviour outweigh any barriers they may meet while attempting to make the changes. According to earlier findings in this study, the perceived barriers to weight loss were due to problems such as lack of health education, access and affordable exercise facilities and social support (interpersonal). The findings from Saghafi-Asl et al. demonstrated that the perception of barriers to engage in regular physical activity and eating healthily could not substantially change behaviour with weight management (Saghafi-Asl et al., 2020). This evidence is following some (Park, 2011, Garcia & Mann, 2003), though not all (Huang et al., 2016, Deshpande et al., 2009), studies that found that a higher perception of the cost and difficulties of engaging in healthy behaviour which is adversely correlated with a lower likelihood of performing the positive health behaviours. A study conducted by Greaney et al (2009) indicated that barriers fall into three categories: interpersonal, intrapersonal, and environmental. According to Ofori-Asenso and Garcia (2016), the built environment in many areas of Ghana has not changed to accommodate the growing population. The roads are frequently crowded, and there are few sidewalks or parks to promote physical activity like jogging and walking. If these issues with urban planning are not properly addressed, they may be the trigger for the rise in excess weight rates in the nation even as other variables create an environment that is conducive to weight gain. Furthermore, access to credible health information was a major barrier to weight loss. The use of the internet was mentioned by some participants in an earlier study as a means to get adequate

information on weight management practices (James et al., 2012). With less than 3% internet usage among Ghanaians above 40 years (Nkrumah et al., 2015), the women in this study said that they will be comfortable when health care professionals through the local radio stations educate them on reliable weight loss programs. Some participants recalled bad experiences of consuming certain weight management supplements with little knowledge and health complications. Lack of education highlights the urgent need for public health professionals to intensify evidence-based therapies for weight management.

9.5. Motivational Predictors of Weight Loss

Lack of social support was a barrier to weight loss as participants mentioned that motivation from relatives and friends could encourage them to lose weight. The HBM was cited by Williams and authors (1996) as the motivating strategy most often used in healthcare settings. The authors suggested that people will be motivated to reduce weight if they think that doing so will lessen their risk of getting a life-threatening condition. Concerning losing weight, they proposed that maintaining long-lasting behaviour change requires embracing personal responsibility for the regulation for change rather than simply adhering to calls for change (Williams et al., 1996). Internalizing values and controlling pertinent behaviours is a necessary step in this process so that they can form the foundation for independent regulation. In weight loss and weight loss maintenance programmes, a balance should be created between self-motivation or internalizing values and social support. A balance of these factors plays a prominent role in participants' successful weight loss efforts. The nature and potential benefit of social support and self-motivation for weight loss in postmenopausal women merits further evaluation as a weight loss resource for healthcare providers to recommend to patients.

9.6. Perceived benefits of weight loss

The potential health benefits of reducing weight can serve as a powerful encouragement to change dietary habits, exercise routines, and response to environmental and cultural influences (James et al., 2012). The current study documented that improved health is the main benefit of reducing body weight. The findings from a single-blind randomized controlled trial (chapter eight) revealed statistically significant differences in body composition and anthropometrics in the exercise and control groups. In Saghafi-Asl et al.'s study, all respondents' behavioural intentions to reduce their weight were mostly influenced by a perceived threat and before perceived benefit (Saghafi-Asl et al., 2020). According to the same report, participants may be more motivated to control their weight if they anticipate the benefits of adopting a healthy lifestyle (Saghafi-Asl et al., 2020). These findings are consistent with research suggesting that various health behaviours are strongly predicted by perceptions of benefits, threats, and self-efficacy. (O'connell et al., 1985, Kang et al., 1998, Bishop et al., 2015). According to O'Connell et al. the benefits of dieting were the best indicator of dieting behaviour (O'connell et al., 1985). In a study by Kang et al. perceived benefits emerged as the most powerful predictors of females' intention to control their weight (Kang et al., 1998). This finding implies that individuals may participate in weight management programs if they are aware of the advantages or benefits of weight loss. It appears that in Ghanaian postmenopausal women, the perceived benefits and barriers (Chapters Five and Six) constructed of the HBM are effective components for improving their body weight. Therefore, different dimensions of perceived benefits and barriers should be examined well.

9.7. Cues to weight loss

Different factors influence women to reduce their weight (James et al., 2012). For some, one cue might be enough to motivate or encourage them to lose weight, however, multiple cues may be necessary for other people (James et al., 2012). In this present study, health issues and the cost of medications were often mentioned as a motivating force towards change in their body weight. For instance, a participant said that her recent diagnosis of high blood pressure and the price of hypertensive drugs motivated her to manage her body weight (Chapter Six). The current results suggested that these groups of women may consider themselves susceptible enough to being overweight or obese to take further action due to cues from their health implications. Cues to action are a potential method for encouraging change, but little research has been done on them because they may be unpredictable or fleeting (Glanz et al., 2002). Internal cues were regarded as being the most likely to motivate behaviour, such as feeling better physically or psychologically after acting (Jones et al., 2000). According to the same report, the next influence most likely to encourage action was information from physicians based on the individual medical test that the person underwent (Jones et al., 2000). However, this finding is inconsistent with a study by Strychar et al that suggests that individuals who received their medical test results after screening were less likely to change their behaviours to reduce their risk than those who did not receive feedback (Strychar et al., 1998). The outcomes in the literature show that people may not appropriately assess the importance of a cue to change (Baranowski et al., 2003). Contrary to what the HBM had predicted, young individuals were not more likely to start exercising or lose weight after learning that a family member had a heart attack or stroke (Kip et al., 2002). The mental and physical benefits of losing weight provide satisfaction for those who are intrinsically motivated, due to that, research on factors associated with internal drive to weight loss is crucial. Therefore, the first step in any research aiming to establish

internal benefits associated with intrinsic motivation is the adoption of a self-efficacy toward weight loss.

9.8. Self-efficacy in weight management

Self-efficacy or level of confidence is the main tool for change (Daddario, 2007). Self-efficacy is essential for successful weight management. (James et al., 2012). According to the authors, a person who has higher confidence will be more inclined to adopt a particular health-improving behaviour (Baranowski et al., 2003). There are various steps in this process. Certain indicators or cues could increase the threat of the disease by influencing perceived susceptibility, seriousness or both. The person is motivated to act by stronger cues, cues that are more relevant to her personally or the accumulation of cue. This might happen if the individual watches a television program on a co-morbid condition that is associated with excess weight, or if they have a close friend or relative who is overweight or obese and has a co-morbid disease. The individual's conduct is the result of perceived benefits and barriers that could be surmounted, expenses that could be reduced, and the individual's confidence in her capacity to carry out the new behaviour (Baranowski et al., 2003). Self-efficacy can also be increased through a tailored culturally appropriate program (James et al., 2012). Personalised programs are generally effective because individuals are likely to examine and personalize the information, thereby increasing the possibility of change. This finding is consistent with the current study that developed a culturally appropriate exercise-based programme for weight loss. The culturally developed program involved house-hold indigenous recreational activity in Ghana (Asare & Danquah, 2015). The results in a single randomized controlled trial showed statistically significant differences between groups regarding change in anthropometrics and body composition over time and indicate that an exercise program that is culturally designed results in

increased benefits. Therefore, our study gives more credence to the efforts of general professionals and public health officers to encourage indigenous physical activity in postmenopausal women.

Dietetic professionals can promote self-efficacy by encouraging positive behaviour changes to manage obesity effectively. They can also acknowledge individuals to join a support group, practice positive thinking, and repeat daily affirmations (Foreyt, 2005).

9.9. Conclusion

In this chapter, we discussed the study findings based on the HBM and compared it to the available evidence. Excess weight is prevalent among postmenopausal women in Ghana. The participants are susceptible to excess weight gain due to insufficient physical activity and poor eating patterns and cultural influences. The study also highlights the impacts of ethnicity and educational level as predictors of weight gain. The perceived barriers to weight loss were due to challenges such as a lack of health education, access and affordable exercise facilities and social support. Improvement of health conditions was the main perceived benefit of reducing body weight. Health issues and the cost of medications could be the cues to activate the action. The development of a culturally appropriate exercise-based weight loss program enhanced self-efficacy in weight management. Weight reduction interventions are best carried out using a team-based approach comprising medical professionals, behavioral psychologists, dietitians, physiotherapists, exercise specialists, and lifestyle coaches (Alamuddin et al., 2016). Health professionals play a crucial role in providing the right information, encouragement, support, and goalsetting. In addition, physicians should assess for medical challenges to the implementation of lifestyle changes, such as weight-affecting drugs and joint discomfort.

10. CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

10.1. Overall summary of the research

The study aimed to develop and test the effect of a culturally adapted exercise-based programme for weight loss in Ghanaian postmenopausal women. The research was conducted by means of four studies. A cross-sectional study to establish the prevalence of excess weight among postmenopausal women in Ghana was conducted. This was followed by an investigation of the physical activity, lifestyle and sociocultural factors in Ghanaian postmenopausal women with excess weight. Postmenopausal women's current weight management practices were also explored. Based on the evidence from the three studies and literature review findings, the exercise programme was developed. A Delphi survey was used to develop and validate the culturally adapted exercise-based intervention for weight loss among postmenopausal women with excess weight in Ghana. To test the effectiveness of the culturally adapted exercise-based programme for weight loss, a single randomized controlled trial was conducted.

10.2. Prevalence and associated risk factors

A cross sectional study was conducted among postmenopausal women in Ghana to determine the prevalence of excess weight gain as well as investigate lifestyle, sociocultural and physical activity levels of postmenopausal women with excess weight gain. The mean age of the 378 postmenopausal women that participated in the study was 60.09 ± 6.24 years. The prevalence of excess weight among Ghanaian postmenopausal women was high using BMI (73.2%), WHtR (91.8%) and WHR (91.0%) (Chapter Four). This high prevalence is emphasized since excess weight is associated with higher rates of mortalities and morbidities in this population and promotes the progression and development of several obesity-related health complications. The central excess weight (WHR), in particular, identified in this study has several detrimental metabolic effects including dyslipidemia,

dysglycemia, cardiovascular diseases and hypertension. Further studies can be conducted to determine the incidence of Ghanaian postmenopausal women with excess body and metabolic and cardiovascular complications. The high prevalence of excess weight reported is relevant as evidence from a systematic review and meta-analysis only documented a high prevalence of excess weight (42.5%) among Ghanaian adults (≥ 18 years) (Ofori-Asenso et al., 2016). Therefore, by inference, the reports (Chapter Four) highlight the growing burden of excess weight among postmenopausal women in Ghana.

Socio-demographic factors such as ethnicity and education are predictors that influence the development of excess weight among the women in this study. These predictors are inherent to the development of excess weight and underscore their relevance in the planning and implementation of interventions to address excess weight among postmenopausal women in Ghana. The disparity in the overweight/obesity prevalence among the ethnic groups largely reflects differences in social behaviors, such as work habits, meal preparation, and body image (Ofori-Asenso et al., 2016). An association was found between education and the high prevalence of excess weight. The sociocultural perception of admiration for larger bodies could be a possible explanation for this relationship in many Ghanaian communities (Benkeser et al., 2012). In addition, it may also be related to the fact that increased wealth may come with more food options and accessibility, which may encourage consumption (Appiah et al., 2014). Moreover, the majority of fast food places and restaurants in Ghana are located in affluent areas and frequently target high-income customers and which contributes to the development of excess weight (Omari et al., 2013). Reduced energy expenditure due to domestic mechanization of daily tasks may have played a substantial role in the higher prevalence of excess weight in postmenopausal women. Most wealthy people regularly use these labour-saving tools (such as blenders and "fufu" pounding machines), and their contribution to

population energy balance in high-income groups has been considered substantive (Wiklund, 2016). These socio-demographic associated factors could be further explored in future studies to determine what could be specifically responsible for these differences in overweight/obesity prevalence.

In the postmenopausal period, some factors interfere with the adoption of a healthy lifestyle that contributes to weight gain (Kapoor et al., 2017). To address these elements, lifestyle, physical activity, levels and sociocultural factors contributing to excess weight gain were investigated in a cross-sectional study. These risk factors have been studied and recommendations have been made by other authors based on these factors' association with excess weight. In this thesis, inadequate physical activity, poor attitude towards eating habits and cultural influences on body size were found to be associated with the incidence of excess weight among postmenopausal women in Ghana (Chapter Five). It is therefore important to address support to promote the adoption of healthy lifestyles in postmenopausal women, social aspects of dieting and exercising should be promoted. These social aspects included engaging in an activity with a partner or engaging in a friendly competition. Examples included participating in activities with a friend or co-religious members, dancing or attending an all-women's fitness program. Being a part of a lifestyle program with other women will keep them motivated and help them stay focused while also encouraging friendship. Regarding nutritional consumption, flexibility in diet plans should be encouraged. Even though substantial weight loss may take several months to achieve, opportunities to focus on short-term benefits, such as improvements in general health and sleep, may help postmenopausal women stay motivated.

The influence of socio-cultural factors on body weight remains extremely important when developing an intervention. In this thesis, cultural backgrounds are associated with weight gain. In the literature, these same cultural standards have been linked to excess weight as an accepted appearance that indicates success, beauty, social attractiveness and wealth (Micklesfield et al., 2013, Puoane et al., 2010). It should thus be established whether culturally-sensitive guidelines will help promote weight loss. If this is the case, then these culturally sensitive guidelines should be used by healthcare professionals in the primary care setting to improve the quality of care and decrease the incidence of morbidity and mortality in postmenopausal women.

10.3. Exploration of current weight management

An exploratory, descriptive qualitative research design using focus group discussion (FGD) was used to explore the experiences of Ghanaian postmenopausal women with excess weight gain. Three major themes and sub-themes respectively emerged from the study. The key outcome from the study revealed that excess body weight is seen as a sign of wellbeing, admired and represents financial prosperity, then this would have been the ideal factor to emphasize as part of weight reduction guidelines in a cultural environment that recognizes curvaceous and buxom women. Therefore, future studies should explore the extent of culture in the development of overweight/obesity prevalence among postmenopausal women in Ghana.

Diet-related adjustments alone, a combination of diet modification and physical activity, and weight management supplements emerged as measures to manage excess body weight. Various authors have established the benefits of some of these methods in the management of overweight/obesity among the general population (Amoah, 2003, Davenport et al., 2017, Appiah et al., 2014). For instance, walking was documented in this thesis as some form of physical activity engaged by the participants,

future research can explore the effects of group walking on anthropometrics and body composition among postmenopausal women.

Even though weight-loss supplements are promoted with claims of effectiveness, the reported complications (such as hepatic injury, risk of psychiatric, autonomic or gastrointestinal adverse events, heart palpitations and death) are adequate to shift the risk–benefit balance from using most weight-loss supplements (Pittler et al., 2005). Support to adhere to the weight program included health education, access, affordable exercise facilities, and social support. Social support is important for weight loss programs because it motivates participants to adhere to the programme (Acharya et al., 2009, Brantley et al., 2014). This social support could be further explored in future studies to determine the impact on weight management in the Ghanaian context.

10.4. Validation of culturally developed exercise-based programme

A three round Delphi study was conducted to develop and validate culturally appropriate exercise-based programmes for weight loss in postmenopausal women with excess weight gain. Participants were recruited via purposive sampling based on their expertise and experience. Thirty-two participants completed all three rounds and reached a consensus on all items representing four domains (Health assessment, pre-exercise parameters, exercise dosage, and physician referral form) (Chapter Seven). The pre-participation health assessment component of the program involves screening participants for history and symptoms of cardiovascular risk and musculoskeletal disorders. The health assessment section was included to avoid exposing physically unfit participants to the documented risks of exercise including sudden cardiac-related death (ACSM, 2013).

The pre-exercise parameters included cardio and resistance exercise test to assess key physiological parameters (e.g. strength, endurance, agility, balance). The objective of the exercise testing was to determine exercise intensity and prescription of the exercise program (ACSM, 1997, Durstine, 2009).

In addition, personal, psychological and environmental factors to promote participation were evaluated. Social support (whether through family, friends or peers) was included in the programme as it is a significant determinant of overall health (Acharya et al., 2009).

To develop an intervention that is culturally sensitive, Ghanaian house-hold indigenous recreational physical activity, “Ampe” was adopted into the programme. “Ampe” is played with low-moderate-high intensity competition amongst multiple groups or can be played individually (Porter et al., 2017). Within Ghanaian communities in the past, people would go to witness “Ampe's” tournaments which could last for up to two or three days (Balis et al., 2019). Ampe requires critical thinking, balance, speed, physical endurance, coordination, and efficient oxygen consumption (Omoniyi et al., 2020). Ampe combines an excellent physical workout, social interaction, and tactical play patterns where the opponent(s) is/are being analyzed in anticipation of the next move to make snappy counter decisions with quick reflexes (Omoniyi et al., 2020). The FITT principle (frequency, intensity, time, and type) guides the prescription of “Ampe” aerobic exercise (Davenport et al., 2016). Our recommendation for “Ampe” exercise prescription for postmenopausal women with excess weight is presented in Appendix K. The recommendations are based on older adults and adults with obesity by the American College of Sports Medicine (ACSM, 2013). The need for muscular conditioning is especially relevant for women because the majority of muscle loss and strength in this population happens after menopause (Davenport et al., 2016). As such, resistance exercises such as bottle exercises were recommended to have a balanced exercise programme (ACSM, 2013).

Before beginning a physical activity program, it's important to ensure a person has no medical conditions that might prevent them from exercising (ACSM, 2013). Other comorbidities, such as dyslipidaemia, hypertension, hyperinsulinaemia and hyperglycemia may raise the risk stratification for overweight and obese people, necessitating further medical examination before exercise testing

(ACSM, 2013). Therefore, a referral form was added to the exercise to help identify individuals who may be at risk for exertion-related sudden cardiac challenges. The rationale for the inclusion of referral form was due to findings in Chapter Six that highlights association of excess weight gain and diseases. This exercise programme should be used on women in the reproductive stage to determine its outcomes. The developed exercise programme is comparable to the exercise programme developed for postmenopausal women with excess weight by Velthuis et al. (2009), although their programme was focused more on body composition (total body fat, lean mass and waist circumference) than weight loss. Their components of the exercise programme are similar in some aspects especially combining aerobic and muscle strengthening exercises. They referred to adherence to the exercise programme and further suggested adherence might be increased by adding a cognitive behavioral intervention (Velthuis et al., 2009). In this study, the developed programme focused more on weight loss and adherence to the programme was increased because of the blend in strengthening exercise and Ghanaian traditional aerobic activity, “Ampe”. The inclusion of indigenous recreational aerobic activity increased adherence and decreased in drop-out rate because the programme represented Ghanaian cultural identity (Chapter Eight). I recommend to other settings, programmes for weight loss should be adapted culturally to promote adherence and reduce drop-out rate.

10.5. Testing of the programme-Randomized controlled trial

In Chapter Eight, culturally adapted exercise-based intervention was tested experimentally using a single-blind randomized controlled trial for 12 weeks. A total of 226 postmenopausal Ghanaian women were randomized into exercise and control groups (113 in the control and 113 in the exercise group). Anthropometrics (BMI, WHR, WHtR WC, HC and body weight) and body composition (body fat, visceral fat, muscle mass) were determined pre and post-the 12-week intervention. Except for waist-to-hip ratio (WHR), there were statistically significant differences in body weight, BMI,

WHtR, visceral fat, and total body fat in the exercise and control groups. Muscle mass increased significantly (+0.21 kg), whereas hip circumference (-2.46 cm) and waist circumference (-1.39 cm) decreased significantly compared with the control group. Within the exercise group when stratified by BMI, there were higher reductions in BMI (1.01kg/m^2 vs. 0.46kg/m^2), WC (2.18cm vs. 0.22cm), body weight (2.12kg vs. 1.17kg) and body fat (1.84% vs 1.6%) in obese women compared to overweight women. The findings in Chapter Eight may lead us to the recommendation that 12 weeks of culturally adapted exercise programme will positively impact anthropometrics, body composition and fat distribution. Body composition, fat distribution, and their effects on anthropometrics all have significant clinical implications. Our research thus supports the efforts of general practitioners and public health officials to promote native physical activity among postmenopausal women. However, before making inferences on results, it should be noted that the adoption of “Ampe” is a Ghanaian traditional physical activity and for this reason, cannot be used in other settings.

In conclusion, the prevalence of excess weight among Ghanaian postmenopausal women is high and for this reason, management is crucial. The culturally adapted exercise-based programme developed for Ghanaian postmenopausal women with excess weight gain focused on reducing body weight. Health assessment and physical referral forms integrated into the exercise programme improved the outcome of the programme. The developed exercise programme can be adaptable for premenopausal women, although, changes such as decreased estrogen levels, ageing and other unique factors that influence weight gain after the menopause adaptation process should be considered.

10.6. Strengths and limitations of the thesis

Several study designs were used to address the overall study aim. A descriptive study design was used to identify the prevalence of excess weight gain and associated socio-demographic factors (Chapter Four). The results of the first study (Chapter Four) were based on the measurement of anthropometric parameters (height, weight, waist and hip circumferences). Measurement errors may have occurred which influences the interpretation of excess weight gain. Although anthropometric measurement error cannot be completely avoided as reported by Ulijaszek et al. (1999), it can be minimised by carefully monitoring every step of the data-gathering procedure. Future research should ensure there is adequate lighting for measurements, routine equipment calibration, and prevention of research personnel fatigue to lower the likelihood of errors. Despite the stated limitation, this is the first study to identify the prevalence of excess weight among postmenopausal women in Ghana. It is recommended that prospective studies be conducted in the future to evaluate the development of excess weight and risk factors.

A cross-sectional study design was used to investigate the physical activity, lifestyle, sociocultural factors and prevalence of excess weight gain (Chapter Five). A limitation was the use of self-report approaches to assess sociocultural, lifestyle, and physical activity outcomes. The findings might have been influenced by challenges with self-reported outcomes (Baranowski et al., 2004). Recall bias may have affected the method used to recall the participants' average daily food consumption and physical activity levels. Future longitudinal research should be conducted to establish a true cause-and-effect relationship between excess weight and physical activity, lifestyle, sociocultural factors.

The narratives from the focus group discussions deepened the understanding of excess weight and weight management practices in Ghanaian postmenopausal women. Many questions (such as why, how) were answered by using a qualitative design which a quantitative design was unable to address

(Darlaston-Jones, 2007, Scotland, 2012). However, there were limitations. The study participants were postmenopausal women; thus, it is important to be careful when extending the study's conclusions to the premenopausal stage. To gain an in-depth understanding of the condition, comparative research must especially investigate the experiences of body weight among postmenopausal and premenopausal women in Ghana. To enable a variety of backgrounds and experiences to be shared, we selected a sample of postmenopausal women with varying characteristics, including age, ethnic group, religion, socioeconomic status, and educational level.

The study may seem to promote an exercise-based programmes for weight loss without emphasising an interprofessional approach such as nutritional behaviour which is among the determinants of the excess weight state in older age (Bajerska et al., 2020). A multifaceted behavioural intervention with changes in eating practices, regular exercise, and social therapy to encourage these behavioural changes constitutes the optimum weight management approach (Alamuddin et al., 2016).

Despite the study limitation stated above, the adoption of a participatory action approach was a major strength of this study. The Ghanaian postmenopausal women with excess weight were involved or contributed to the development of the culturally based exercise programme for weight loss.

10.7. Contribution to the field of research

An increasing challenge in Ghana, and for women in particular, is the prevalence of excess weight and the associated health problems (Aberman et al., 2022). This study contributes to the understanding of this emerging phenomenon in Ghanaian postmenopausal women. This study was the first study to develop and test a comprehensive culturally appropriate exercise-based programme in Ghanaian postmenopausal women.

10.8. Clinical recommendations

It is well established that Ghanaian postmenopausal women are prone to developing excess weight, so the focus needs to shift from solely weight management to being more proactive and preventative. Practical strategies that can be implemented include: A part of “screening”, clinicians who manage pre- and postmenopausal women should frequently screen for excess weight and provide appropriate weight management counselling, even if the patient has not particularly requested it. Health practitioners can provide support to help avoid weight regaining in postmenopausal women through early identification of those who are at risk. For them, a consistent follow-up routine should be taken into consideration for at least three months.

Public health professionals need to educate pre- and postmenopausal women on the usefulness of exercise and the need to adjust their diet. Women should also receive counselling regarding chronic diseases they might be at risk of which excess weight gain can be a consequence. Awareness and advocacy should be complemented by a population-based health programme that emphasize the benefits of Ghanaian traditional physical activity such as cultural dances (Adowa, Borborbor and Bamaya) and healthy eating in preventing and controlling excess weight. Research that will underpin the prevention of excess weight should be promoted.

Government investment is pivotal in facilitating the primary investigation of overweight/obesity in postmenopausal women behind public health interventions to maximize its impact. Governmental commitment will be required such as efficient allocation of resources and establishing a wider policy framework within which interventions can be carried out. To ensure sustainable funding for the management of excess weight, the Ghanaian health insurance authority can initiate options for wellness and attach reasonable premiums. Physical infrastructure such as wellness centers should be available across the sixteen regions in the country to address the management of excess weight. The

ministry of health in Ghana and the office of the presidency can initiate an overweight/obesity programme to address the issue of the epidemic that is suitable in the Ghanaian context. Implementation research to address contextual factors that influence perceptions and management of excess weight gain should be considered. Future studies should use prospective studies to evaluate the development of excess weight gain and risk factors

Future Research Recommendations

Future studies should use prospective studies to evaluate the development of excess weight gain and risk factors. Additionally, the culturally developed exercise-based programme should be implemented in other populations to test its effectiveness. Implementation research to address contextual factors that influence perceptions and management of excess weight gain, should be considered.

10.9. Conclusion

Excess weight gain is common among Ghanaian postmenopausal women due to unique contextual factors that interfere with the adoption of healthy lifestyle measures. In addition to lifestyle modification and psychological support, there was a need to address the cultural perception of excess weight gain and develop an intervention that is culturally sensitive, cost-effective, and long-lasting in Ghanaian settings. Primary health practitioner must screen menopausal women for excess weight and offer suitable referrals and advice.

REFERENCES

- Abdulnour, J., Doucet, E., Brochu, M., Lavoie, J. M., Strychar, I., Rabasa-Lhoret, R., & Prud'homme, D. (2012). The effect of the menopausal transition on body composition and cardiometabolic risk factors: a Montreal-Ottawa New Emerging Team group study. *Menopause*, 19(7), 760-767.
- Aberman, N.L., Nisbett, N., Amofo, A. and Areetey, R., 2022. Assessing the readiness of small cities in Ghana to tackle overweight and obesity. *Food Security*, 14(2), pp.381-393.
- Abrahams, Z., Mchiza, Z., & Steyn, N. P. (2011). Diet and mortality rates in Sub-Saharan Africa: Stages in the nutrition transition. *BMC Public Health* 11(1), 1–12. <https://doi.org/10.1186/1471-2458-11-801>.
- Abubakari, A. R., Lauder, W., Agyemang, C., Jones, M., Kirk, A., & Bhopal, R. S. (2008). Prevalence and time trends in obesity among adult West African populations: A meta-analysis. *Obesity Reviews*, 9(4), 297–311. <https://doi.org/10.1111/j.1467-789X.2007.00462.x>.
- Acharya, S. D., Elci, O. U., Sereika, S. M., Music, E., Styn, M. A., Turk, M. W., & Burke, L. E. (2009). Adherence to a behavioral weight loss treatment program enhances weight loss and improvements in biomarkers. *Patient preference and adherence*, 3, 151.
- Agbeko, M. P., Akwasi, K. K., Andrews, D. A., & Gifty, O. B. (2013). Predictors of overweight and obesity among women in Ghana. *The Open Obesity Journal*, 5(1).
- Agyei-Mensah, S., & de-Graft Aikins, A. (2010). Epidemiological transition and the double burden of disease in Accra, Ghana. *Journal of urban health*, 87(5), 879-897.
- Alamuddin, N., Bakizada, Z., & Wadden, T. A. (2016). Management of obesity. *Journal of Clinical Oncology*, 34(35), 4295-4305.

- Alamuddin, N., Bakizada, Z., & Wadden, T. A. (2016). Management of obesity. *Journal of Clinical Oncology*, 34(35), 4295-4305.
- Allen, L., O'Connell, A. & Kiermer, V. 2019b. How Can We Ensure Visibility and Diversity in Research Contributions? How the Contributor Role Taxonomy (Credit) Is Helping the Shift from Authorship to Contributorship. *Learned Publishing*, 32, 71-74
- Al-Safi, Z. A., & Polotsky, A. J. (2015). Obesity and menopause. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 29(4), 548-553.
- American College of Sports Medicine. (1997). ACSM's exercise management for persons with chronic diseases and disabilities. Lippincott Williams & Wilkins.
- American College of Sports Medicine. (2013). ACSM's guidelines for exercise testing and prescription. Lippincott williams & wilkins.
- Amoah, A. G. (2003). Sociodemographic variations in obesity among Ghanaian adults. *Public Health Nutrition*, 6(8), 751–757. <https://doi.org/10.1079/phn2003506>.
- Amugsi, D. A., Dimbuene, Z. T., Mberu, B., Muthuri, S., & Ezech, A. C. (2017). Prevalence and time trends in overweight and obesity among urban women: An analysis of demographic and health surveys data from 24 African countries, 1991 - 2014. *BMJ Open*, 7(10). <https://doi.org/10.1136/bmjopen-2017-017344>.
- Andersson, G., 2008. The burden of musculoskeletal diseases in the United States: prevalence, societal and economic cost. *Amer Academy of Orthopaedic*.
- Andreou, E., Philippou, C., & Papandreou, D. (2011). Effects of an intervention and maintenance weight loss diet with and without exercise on anthropometric indices in overweight and obese

healthy women. *Annals of Nutrition and Metabolism*, 59(2-4), 187-192.

Antonio, J., Pérez, M., Chavida, F., Palacios, S., & Pérez, M. (2009). Maturitas Epidemiology of risk factors and symptoms associated with menopause in Spanish women. 62, 30–36. <https://doi.org/10.1016/j.maturitas.2008.10.003>.

Appiah, C. A., Steiner-Asiedu, M., & Otoo, G. E. (2014). Predictors of overweight/obesity in urban Ghanaian women. *Int J Clin Nutr*, 2(3), 60-8.

Archer, E., Lavie, C.J., McDonald, S.M., Thomas, D.M., Hébert, J.R., Ross, S.E.T., McIver, K.L., Malina, R.M. and Blair, S.N., 2013, December. Maternal inactivity: 45-year trends in mothers' use of time. In *Mayo Clinic Proceedings* (Vol. 88, No. 12, pp. 1368-1377). Elsevier.

Armstrong, M., Paternostro-Bayles, M., Conroy, M. B., Franklin, B. A., Richardson, C., & Kriska, A. (2018). Preparticipation screening prior to physical activity in community lifestyle interventions. *Translational Journal of the American College of Sports Medicine*, 3(22), 176.

Aryeetey, R. N. O. (2016). Perceptions and Experiences of Overweight among Women in the Ga East District, Ghana. *Frontiers in Nutrition*, 3(June), 1–8. <https://doi.org/10.3389/fnut.2016.00013>.

Asare, M., & Danquah, S. A. (2015). The relationship between physical activity, sedentary behaviour and mental health in Ghanaian adolescents. *Child and adolescent psychiatry and mental health*, 9(1), 1-8.

Asosega, K. A., Adebajji, A. O., & Abdul, I. W. (2021). Spatial analysis of the prevalence of obesity and overweight among women in Ghana. *BMJ Open*, 11(1), 1–8. <https://doi.org/10.1136/bmjopen-2020-041659>.

- Avery, L., Flynn, D., Van Wersch, A., Sniehotta, F.F. and Trenell, M.I., 2012. Changing physical activity behavior in type 2 diabetes: a systematic review and meta-analysis of behavioral interventions. *Diabetes care*, 35(12), pp.2681-2689.
- Avis, N. E., Crawford, S. L., Greendale, G., Bromberger, J. T., Everson-Rose, S. A., Gold, E. B., ... & Study of Women's Health Across the Nation. (2015). Duration of menopausal vasomotor symptoms over the menopause transition. *JAMA internal medicine*, 175(4), 531-539.
- Baghianimoghadam MH, Mirzaei M, Rahimdel (2013) T. Role of health beliefs in preventive behaviors of individuals at risk of cardiovascular diseases. *Journal of Health System Research*, 8(7), 1151-1158.
- Bajerska, J., Chmurzynska, A., Muzsik-Kazimierska, A., Mądry, E., Pięta, B., Sobkowski, M. and Walkowiak, J., 2020. Determinants favoring weight regain after weight-loss therapy among postmenopausal women. *Scientific Reports*, 10(1), pp.1-9.
- Bălan, A., Moga, M. A., Dima, L., Toma, S., Elena Neculau, A., & Anastasiu, C. V. (2020). Royal jelly—A traditional and natural remedy for postmenopausal symptoms and aging-related pathologies. *Molecules*, 25(14), 3291.
- Balis, L. E., Sowatey, G., Ansong-Gyimah, K., Ofori, E., & Harden, S. M. (2019). Older Ghanaian adults' perceptions of physical activity: an exploratory, mixed methods study. *BMC geriatrics*, 19(1), 1-16.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist*, 37(2), 122.
- Baranowski, T., Cullen, K. W., Nicklas, T., Thompson, D., & Baranowski, J. (2003). Are current health behavioral change models helpful in guiding prevention of weight gain efforts?. *Obesity research*, 11(S10), 23S-43S.

- Barnes, A.S. and Kimbro, R.T., 2012. Descriptive study of educated African American women successful at weight-loss maintenance through lifestyle changes. *Journal of general internal medicine*, 27, pp.1272-1279.
- Beavers, D. P., Beavers, K. M., Lyles, M. F., & Nicklas, B. J. (2013). Cardiometabolic risk after weight loss and subsequent weight regain in overweight and obese postmenopausal women. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 68(6), 691-698.
- Benshushan, A., Rojansky, N., Chaviv, M., Arbel-Alon, S., Benmeir, A., Imbar, T., & Brzezinski, A. (2009). Climacteric symptoms in women undergoing risk-reducing bilateral salpingo-oophorectomy. *Climacteric*, 12(5), 404-409.
- Benkeser, R. M., Biritwum, R., & Hill, A. G. (2012). Prevalence of overweight and obesity and perception of healthy and desirable body size in urban, Ghanaian women. *Ghana Medical Journal*, 46(2), 66–75.
- Bierhals, C.C.B.K., Santos, N.O.D., Fengler, F.L., Raubustt, K.D., Forbes, D.A. and Paskulin, L.M.G., 2017. Needs of family caregivers in home care for older adults¹. *Revista latino-americana de enfermagem*, 25.
- Bierl, M., Marsh, T., Webber, L., Brown, M., McPherson, K. and Rtveladze, K., 2013. Apples and oranges: a comparison of costing methods for obesity. *Obesity Reviews*, 14(9), pp.693-706.
- Biritwum, R. B., Gyapong, J., Mensah, G., & Bu, K. (2005). The epidemiology of obesity in Ghana. *Obesity Reviews*, 39(3), 82–85.
- Bishop, A. C., Baker, G. R., Boyle, T. A., & MacKinnon, N. J. (2015). Using the Health Belief Model to explain patient involvement in patient safety. *Health Expectations*, 18(6), 3019-3033.

- Bishop, A. C., Baker, G. R., Boyle, T. A., & MacKinnon, N. J. (2015). Using the Health Belief Model to explain patient involvement in patient safety. *Health Expectations*, 18(6), 3019-3033.
- Blümel, J. E., Castelo-Branco, C., Rocangliolo, M. E., Bifa, L., Tacla, X., & Mamani, L. (2001). Changes in body mass index around menopause: A population study of Chilean woman. *Menopause*, 8(4), 239–244. <https://doi.org/10.1097/00042192-200107000-00004>
- Blumenthal, J. A., Babyak, M. A., Hinderliter, A., Watkins, L. L., Craighead, L., Lin, P. H., ... & Sherwood, A. (2010). Effects of the DASH diet alone and in combination with exercise and weight loss on blood pressure and cardiovascular biomarkers in men and women with high blood pressure: the ENCORE study. *Archives of internal medicine*, 170(2), 126-135.
- Borud, E. K., Alraek, T., White, A., & Grimsgaard, S. (2010). The Acupuncture on Hot Flashes Among Menopausal Women study: observational follow-up results at 6 and 12 months. *Menopause*, 17(2), 262.
- Bouchonville, M., Armamento-Villareal, R., Shah, K., Napoli, N., Sinacore, D. R., Qualls, C., & Villareal, D. T. (2014). Weight loss, exercise or both and cardiometabolic risk factors in obese
- Brantley, P.J., Stewart, D.W., Myers, V.H., Matthews-Ewald, M.R., Ard, J.D., Coughlin, J.W., Jerome, G.J., Samuel-Hodge, C., Lien, L.F., Gullion, C.M. and Hollis, J.F., 2014. Psychosocial predictors of weight regain in the weight loss maintenance trial. *Journal of behavioral medicine*, 37, pp.1155-1168.
- Brochu, M., Starling, R. D., Tchernof, A., Matthews, D. E., Garcia-Rubi, E., & Poehlman, E. T. (2000). Visceral adipose tissue is an independent correlate of glucose disposal in older obese postmenopausal women. *The Journal of Clinical Endocrinology & Metabolism*, 85(7), 2378-2384.

- Broekmans, F. J., Knauff, E. A., te Velde, E. R., Macklon, N. S., & Fauser, B. C. (2007). Female reproductive ageing: current knowledge and future trends. *Trends in Endocrinology & Metabolism*, 18(2), 58-65.
- Brown, P. J., & Konner, M. (1987). An anthropological perspective on obesity. *Annals of the New York Academy of Sciences*.
- Brzezinski, A. (2019). Menopausal symptoms: Not just estrogen deficiency. *Menopause*, 26(3), 229-230.
- Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J. P., Chastin, S., Chou, R., Dempsey, P. C., Dipietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., ... Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, 54(24), 1451–1462. <https://doi.org/10.1136/bjsports-2020-102955>
- Burgess, E., Hassmén, P. and Pumpa, K.L., 2017. Determinants of adherence to lifestyle intervention in adults with obesity: a systematic review. *Clinical obesity*, 7(3), pp.123-135.
- Calmels, P., Vico, L., Alexandre, C., & Minaire, P. (1995). Cross-sectional study of muscle strength and bone mineral density in a population of 106 women between the ages of 44 and 87 years: relationship with age and menopause. *European journal of applied physiology and occupational physiology*, 70(2), 180-186.
- Campo, M.L., Askelson, N.M., Mastin, T. and Slonske, M., 2011. The secondhand effects of college drinking: The need for media relations. *Public Relations Journal*, 5(2).
- Canoy, D., & Buchan, I. (2007). Challenges in obesity epidemiology. *Obesity Reviews*, 8(SUPPL. 1), 1–11. <https://doi.org/10.1111/j.1467-789X.2007.00310.x>.

- Caradas, A. A., Lambert, E. V., & Charlton, K. E. (2001). An ethnic comparison of eating attitudes and associated body image concerns in adolescent South African schoolgirls. *Journal of Human Nutrition and Dietetics*, 14(2), 111–120. <https://doi.org/10.1046/j.1365-277X.2001.00280>.
- Carson, V., Adamo, K. and Rhodes, R.E., 2018. Associations of parenthood with physical activity, sedentary behavior, and sleep. *American journal of health behavior*, 42(3), pp.80-89.
- Cervellati, C. and Bergamini, C.M., 2016. Oxidative damage and the pathogenesis of menopause related disturbances and diseases. *Clinical Chemistry and Laboratory Medicine (CCLM)*, 54(5), pp.739-753.
- Charan, J. and Biswas, T., 2013. How to calculate sample size for different study designs in medical research?. *Indian journal of psychological medicine*, 35(2), pp.121-126.
- Chareonsanti, J., Tiansawad, S., Chanprasit, C., Newburn-Cook, C. V., & Kushner, K. E. (2009). Health meanings and practices among midlife professional Thai women. *Pacific Rim International Journal of Nursing Research*, 13(1), 55-67.
- Chiu, H. H., Wu, S. F., & Wang, P. H. (2020). The experience of menopausal women participating in weight management program: A pilot study. *Taiwanese Journal of Obstetrics and Gynecology*, 59(5), 686-690.
- Choi, B.C.K. and Pak, A.W.P., 2005. A catalogue of biases in questionnaires. *Preventing Chronic Dis*, pp.1-13.
- Chomentowski, P., Dubé, J. J., Amati, F., Stefanovic-Racic, M., Zhu, S., Toledo, F. G., & Goodpaster, B. H. (2009). Moderate exercise attenuates the loss of skeletal muscle mass that occurs with intentional caloric restriction–induced weight loss in older, overweight to obese adults. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 64(5),

575-580.

Colombel, A., & Charbonnel, B. (1997). Weight gain and cardiovascular risk factors in the post-menopausal woman. *Human reproduction*, 12(suppl_1), 134-145.

Daddario, D. K. (2007). A review of the use of the health belief model for weight management. *Medsurg Nursing*, 16(6), 363.

Darlaston-Jones, D. 2007. Making Connections: The Relationship between Epistemology and Research Methods. Special Edition Papers, 19, 19-27.

Dansinger, M. L., Gleason, J. A., Griffith, J. L., Selker, H. P., & Schaefer, E. J. (2005). Comparison of the Atkins, Ornish, Weight Watchers, and Zone diets for weight loss and heart disease risk reduction: a randomized trial. *Jama*, 293(1), 43-53.

Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality?. *The American journal of clinical nutrition*, 87(5), 1107-1117.

Das, B. M., & Evans, E. M. (2014). Understanding weight management perceptions in first-year college students using the health belief model. *Journal of American College Health*, 62(7), 488-497.

Davenport, M. H., Ruchat, S., & Hazell, T. J. (2016). Exercise Prescription for Post-menopausal Women with Obesity. 1–8. <https://doi.org/10.2174/15734048126661608111204>

Davidson, L. E., Hudson, R., Kilpatrick, K., Kuk, J. L., McMillan, K., Janiszewski, P. M., ... & Ross, R. (2009). Effects of exercise modality on insulin resistance and functional limitation in older adults: a randomized controlled trial. *Archives of internal medicine*, 169(2), 122-131.

Davis, S. R., Castelo-Branco, C., Chedraui, P., Lumsden, M. A., Nappi, R. E., Shah, D., ... & Writing Group of the International Menopause Society for World Menopause Day 2012. (2012).

Understanding weight gain at menopause. *Climacteric*, 15(5), 419-429.

Dawkins, N., McMickens, T., Findlay, H., & Pace, R. (2010). Community leaders' knowledge and perceptions about obesity: implications for outreach educators in designing interventions. *J Ext*, 48(5), 1-13.

Deane KHO, Ellis-Hill C, Dekker K, Davies P, Clarke CE. A Delphi Survey of Best Practice Occupational Therapy for Parkinson's Disease in the United Kingdom. *Br J Occ Ther*. 2003;66(6):247-254.

Dee, A., Kearns, K., O'Neill, C., Sharp, L., Staines, A., O'Dwyer, V., Fitzgerald, S. and Perry, I.J., 2014. The direct and indirect costs of both overweight and obesity: a systematic review. *BMC research notes*, 7(1), pp.1-9.

Defo, B. K. (2014). Demographic, epidemiological, and health transitions: are they relevant to population health patterns in Africa?. *Global health action*, 7(1), 22443.

Demerath, E. W., Rogers, N. L., Reed, D., Lee, M., Choh, A. C., Siervogel, R. M., ... & Czerwinski, S. A. (2011). Significant associations of age, menopausal status and lifestyle factors with visceral adiposity in African-American and European-American women. *Annals of human biology*, 38(3), 247-256.

Deshpande, S., Basil, M. D., & Basil, D. Z. (2009). Factors influencing healthy eating habits among college students: An application of the health belief model. *Health Marketing Quarterly*, 26(2), 145–164. <https://doi.org/10.1080/07359680802619834>

Dewailly, D., Robin, G., Peigne, M., Decanter, C., Pigny, P. and Catteau-Jonard, S., 2016. Interactions between androgens, FSH, anti-Müllerian hormone and estradiol during folliculogenesis in the human normal and polycystic ovary. *Human reproduction update*, 22(6),

pp.709-724.

- Diendéré, J., Kaboré, J., Somé, J. W., Tougri, G., Zeba, A. N., & Tinto, H. (2019). Prevalence and factors associated with overweight and obesity among rural and urban women in Burkina Faso. *The Pan African Medical Journal*, 34.
- Dmitruk, A., Czezelewski, J., Czezelewska, E., Golach, J., & Parnicka, U. (2018). Body composition and fatty tissue distribution in women with various menstrual status. *Roczniki Państwowego Zakładu Higieny*, 69(1).
- Donato, G. B., Fuchs, S. C., Oppermann, K., Bastos, C., & Spritzer, P. M. (2006). Association between menopause status and central adiposity measured at different cutoffs of waist circumference and waist-to-hip ratio. *Menopause*, 13(2), 280-285.
- Doucet, E., King, N., Levine, J. A., & Ross, R. (2011). Update on exercise and weight control. *Journal of obesity*, 2011.
- Douchi, T., Yamamoto, S., Yoshimitsu, N., Andoh, T., Matsuo, T., & Nagata, Y. (2002). Relative contribution of aging and menopause to changes in lean and fat mass in segmental regions. *Maturitas*, 42(4), 301-306.
- Downs, A., & Ashton, J. (2011). Vigorous physical activity, sports participation, and athletic identity: implications for mental and physical health in college students. *Journal of Sport Behavior*, 34(3).
- Draper, C. E., Davidowitz, K. J., & Goedecke, J. H. (2016). Perceptions relating to body size, weight loss and weight-loss interventions in black South African women: a qualitative study. *Public Health Nutrition*, 19(3), 548-556.

- Dratva, J., Real, F. G., Schindler, C., Ackermann-Liebrich, U., Gerbase, M. W., Probst-Hensch, N. M., ... & Zemp, E. (2009). Is age at menopause increasing across Europe? Results on age at menopause and determinants from two population-based studies. *Menopause*, 16(2), 385-394.
- Dubnov, G., Brzezinski, A., & Berry, E. M. (2003). Weight control and the management of obesity after menopause: the role of physical activity. *Maturitas*, 44(2), 89-101.
- Durstine, J. L. (2009). ACSM's exercise management for persons with chronic diseases and disabilities. *Human Kinetics* 10%.
- Edmonds, E. T. (2009). Osteoporosis knowledge, beliefs, and behaviors of college students: utilization of the health belief model. The University of Alabama.
- Elfhag, K., & Rössner, S. (2005). Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obesity reviews*, 6(1), 67-85.
- Faber, M., & Kruger, H. S. (2005). Dietary intake, perceptions regarding body weight, and attitudes toward weight control of normal weight, overweight, and obese black females in a rural village in South Africa. *Ethn Dis*, 15(2), 238-245.
- Faghri, P.D., Omokaro, C., Parker, C., Nichols, E., Gustavesen, S. and Blozie, E., 2008. E-technology and pedometer walking program to increase physical activity at work. *The journal of primary prevention*, 29, pp.73-91.
- Faghri, P., Simon, J., Huedo-Medina, T., & Gorin, A. (2016). Effects of self-efficacy on health behavior and body weight. *Journal of Obesity & Weight Loss Therapy*, 6(6).
- Faghri, P.D. and Momeni, K., 2014. Musculoskeletal diseases, overweight and obesity, and aging

- workforce: how to encounter the problem. *J. Obes. Wt. Loss Ther. S*, 4(2).
- Flegal, K. M., Carroll, M. D., Kit, B. K., & Ogden, C. L. (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *Jama*, 307(5), 491-497.
- Flegal, K. M., Carroll, M. D., Ogden, C. L., & Johnson, C. L. (2002). Prevalence and trends in obesity among US adults, 1999-2000. *Jama*, 288(14), 1723-1727.
- Fleg, J. L., & Lakatta, E. G. (1988). Role of muscle loss in the age-associated reduction in VO₂ max. *Journal of applied physiology*, 65(3), 1147-1151.
- Franklin, J., Ingvarsson, T., Englund, M. and Lohmander, L.S., 2009. Sex differences in the association between body mass index and total hip or knee joint replacement resulting from osteoarthritis. *Annals of the rheumatic diseases*, 68(4), pp.536-540.
- Franklin, R. M., Ploutz-Snyder, L., & Kanaley, J. A. (2009). Longitudinal changes in abdominal fat distribution with menopause. *Metabolism*, 58(3), 311-315.
- Friedenreich, C. M., Neilson, H. K., O'Reilly, R., Duha, A., Yasui, Y., Morielli, A. R., ... & Courneya, K. S. (2015). Effects of a high vs moderate volume of aerobic exercise on adiposity outcomes in postmenopausal women: a randomized clinical trial. *JAMA oncology*, 1(6), 766-776.
- Frimel, T. N., Sinacore, D. R., & Villareal, D. T. (2008). Exercise attenuates the weight-loss-induced reduction in muscle mass in frail obese older adults. *Medicine and science in sports and exercise*, 40(7), 1213.
- Frimpong, N. A. K., & Vaccari, C. (2015). The internet trends and experience: The case of Ghana. *Managing Intellectual Capital and Innovation for Sustainable and Inclusive Society*, 397-405.

- Foreyt, J. P. (2005). Need for lifestyle intervention: how to begin. *The American journal of cardiology*, 96(4), 11-14.
- Galbreath, M., Campbell, B., La Bounty, P., Bunn, J., Dove, J., Harvey, T., ... & Kreider, R. B. (2018). Effects of adherence to a higher protein diet on weight loss, markers of health, and functional capacity in older women participating in a resistance-based exercise program. *Nutrients*, 10(8), 1070.
- Garcia, K., & Mann, T. (2003). From “I wish” to “I will”: Social-cognitive predictors of behavioral intentions. *Journal of Health Psychology*, 8(3), 347–360.
<https://doi.org/10.1177/1359105303008003005>.
- GSS, G., 2009. Ghana statistical service (GSS), Ghana health service (GHS), and ICF macro. Accra: Ghana Demogr Health Surv, 2008, pp.79-96.
- Ghana, S. (2004). Service (GSS), Noguchi Memorial Institute of Medical Research ORC Macro: Ghana Demographic and Health Survey 2003.
- Ghana Statistical Service. (2015). Ghana Demographic Health Survey. Ghana Statistical Service, 530.
- Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). *Health behavior and health education: theory, research, and practice*. John Wiley & Sons.
- Goedecke, J. H., & Jennings, C. L. (2006). Lambert (2006) Obesity in South Africa-Chronic disease of lifestyle in South Africa since 1995–2005. Medical Research Council Technical Report.
- Goel, R. K. (2006). Obesity: An economic and financial perspective. *Journal of Economics and Finance*, 30, 317–324.

- Gold, E. B., Bromberger, J., Crawford, S., Samuels, S., Greendale, G. A., Harlow, S. D., & Skurnick, J. (2001). Factors associated with age at natural menopause in a multiethnic sample of midlife women. *American journal of epidemiology*, 153(9), 865-874.
- Gold, M.R., Siegel, J.E. and Russell, L.B. eds., 1996. *Cost-effectiveness in health and medicine*. Oxford university press.
- Gravena, A. A. F., Brischiliari, S. C. R., Lopes, T. C. R., Agnolo, C. M. D., Carvalho, M. D. B., & Pelloso, S. M. (2013). Excess weight and abdominal obesity in postmenopausal Brazilian women: A population-based study. In *BMC Women's Health* (Vol. 13, Issue 1). <https://doi.org/10.1186/1472-6874-13-46>.
- Greaney, M. L., Less, F. D., White, A. A., Dayton, S. F., Riebe, D., Blissmer, B., ... & Greene, G. W. (2009). College students' barriers and enablers for healthful weight management: a qualitative study. *Journal of nutrition education and behavior*, 41(4), 281-286.
- Greendale, G. A. (2012). Do changes in sex steroid hormones precede or follow increases in body weight during the menopause transition? Results from the Study of Women's Health Across the Nation. *The Journal of Clinical Endocrinology & Metabolism*, 97(9), E1695-E1704.
- Grilo, C. M., Masheb, R. M., Wilson, G. T., Gueorguieva, R., & White, M. A. (2011). Cognitive-behavioral therapy, behavioral weight loss, and sequential treatment for obese patients with binge-eating disorder: A randomized controlled trial. *Journal of consulting and clinical psychology*, 79(5), 675.
- H Davenport, M., May Ruchat, S. and J Hazell, T., 2017. Exercise Prescription for Post-Menopausal Women with Obesity. *Current Women's Health Reviews*, 13(1), pp.17-24.
- Hammond, R.A. and Levine, R., 2010. The economic impact of obesity in the United States.

- Diabetes, metabolic syndrome and obesity: targets and therapy, pp.285-295. GSS, G. (2014).
- ICF International (2015). Ghana demographic and health survey 2014.
- Helou, K., El Helou, N., Mahfouz, M., Mahfouz, Y., Salameh, P. and Harmouche-Karaki, M., 2018. Validity and reliability of an adapted arabic version of the long international physical activity questionnaire. *BMC public health*, 18(1), pp.1-8.
- Hilbert, A., Bishop, M. E., Stein, R. I., Tanofsky-Kraff, M., Swenson, A. K., Welch, R. R., & Wilfley, D. E. (2012). Long-term efficacy of psychological treatments for binge eating disorder. *The British Journal of Psychiatry*, 200(3), 232-237.
- Hill, J. O., & Peters, J. C. (1998). Environmental contributions to the obesity epidemic. *Science*, 280(5368), 1371-1374.
- Hodgson, T.A., 1994. Costs of illness in cost-effectiveness analysis: a review of the methodology. *Pharmacoeconomics*, 6, pp.536-552.
- Hosseini, H., Moradi, R., Kazemi, A., & Shahshahani, M. S. (2017). Determinants of physical activity in middle - aged woman in Isfahan using the health belief model. 1–7. <https://doi.org/10.4103/jehp.jehp>
- Huang, H. T., Kuo, Y. M., Wang, S. R., Wang, C. F., & Tsai, C. H. (2016). Structural factors affecting health examination behavioral intention. *International journal of environmental research and public health*, 13(4), 395.
- Hughes, V. A., Frontera, W. R., Roubenoff, R., Evans, W. J., & Singh, M. A. F. (2002). Longitudinal changes in body composition in older men and women: role of body weight change and physical activity. *The American journal of clinical nutrition*, 76(2), 473-481.

- Im, E. O., Im Lee, B., Chee, W., Dormire, S., & Brown, A. (2010). A national multiethnic online forum study on menopausal symptom experience. *Nursing research*, 59(1), 26.
- Janssen, I., Heymsfield, S. B., Wang, Z. M., & Ross, R. (2000). Skeletal muscle mass and distribution in 468 men and women aged 18-88 yr. *Journal of Applied Physiology*, 89(1), 81–88. <https://doi.org/10.1152/jappl.2000.89.1.81>
- James, D. C. S., Pobee, J. W., Oxidine, D., Brown, L., & Joshi, G. (2012). Using the Health Belief Model to Develop Culturally Appropriate Weight-Management Materials for African-American Women. *Journal of the Academy of Nutrition and Dietetics*, 112(5), 664–670. <https://doi.org/10.1016/j.jand.2012.02.003>.
- Jebb, S. A. (1999). Obesity: from molecules to man. *Proceedings of the Nutrition Society*, 58(1), 1-14.
- Jeffery, R. W., Wing, R. R., Sherwood, N. E., & Tate, D. F. (2003). Physical activity and weight loss : does prescribing higher physical activity goals improve outcome ? 1 – 3. 684–689.
- Jensen, M. D., Ryan, D. H., Apovian, C. M., Ard, J. D., Comuzzie, A. G., Donato, K. A., ... & Yanovski, S. Z. (2014). 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *Journal of the American college of cardiology*, 63(25 Part B), 2985-3023.
- Jo, C., 2014. Cost-of-illness studies: concepts, scopes, and methods. *Clinical and molecular hepatology*, 20(4), p.327.
- Jones, T., Fowler, M. C., & Hubbard, D. (2000). Refining a tool to measure cues to action in encouraging health-promoting behavior—the CHAQ. *American Journal of Health Promotion*,

14(3), 170-173.

- Jung, S. Y., Vitolins, M. Z., Fenton, J., Frazier-Wood, A. C., Hursting, S. D., & Chang, S. (2015). Risk profiles for weight gain among postmenopausal women: a classification and regression tree analysis approach. *PLoS One*, 10(3), e0121430.
- Kapoor, E., Collazo-Clavell, M. L., & Faubion, S. S. (2017, October). Weight gain in women at midlife: a concise review of the pathophysiology and strategies for management. In *Mayo Clinic Proceedings* (Vol. 92, No. 10, pp. 1552-1558). Elsevier.
- Karvonen-Gutierrez, C., & Kim, C. (2016, July). Association of mid-life changes in body size, body composition and obesity status with the menopausal transition. In *Healthcare* (Vol. 4, No. 3, p. 42).
- Keating, X. D., Guan, J., Piñero, J. C., & Bridges, D. M. (2005). A meta-analysis of college students' physical activity behaviors. *Journal of American college health*, 54(2), 116-126.
- Kelly, T., Yang, W., Chen, C. S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *International journal of obesity*, 32(9), 1431-1437.
- Kemmler, W., von Stengel, S., Engelke, K., Häberle, L., Mayhew, J. L., & Kalender, W. A. (2010). Exercise, body composition, and functional ability: a randomized controlled trial. *American journal of preventive medicine*, 38(3), 279-287.
- Kesten, J. M., Cameron, N., & Griffiths, P. L. (2013). Assessing community readiness for overweight and obesity prevention in preadolescent girls : A case study. *BMC Public Health*. Curioni, C. C., & Lourenco, P. M. (2005). Long-term weight loss after diet and exercise: a systematic review. *International journal of obesity*, 29(10), 1168-1174.

- Kim, S. A., Yount, K. M., Ramakrishnan, U., & Martorell, R. (2007). The relationship between parity and overweight varies with household wealth and national development. *International Journal of Epidemiology*, 36(1), 93-101.
- King, A. C., Haskell, W. L., Young, D. R., Oka, R. K., & Stefanick, M. L. (1995). Long-term effects of varying intensities and formats of physical activity on participation rates, fitness, and lipoproteins in men and women aged 50 to 65 years. *Circulation*, 91(10), 2596-2604.
- Kip, K. E., McCreath, H. E., Roseman, J. M., Hulley, S. B., & Schreiner, P. J. (2002). Absence of risk factor change in young adults after family heart attack or stroke: the CARDIA Study. *American journal of preventive medicine*, 22(4), 258-266.
- Knight, M. G., Anekwe, C., Washington, K., Akam, E. Y., Wang, E., & Stanford, F. C. (2021). Weight regulation in menopause. *Menopause (New York, NY)*, 28(8), 960.
- Ko, S.H. and Jung, Y., 2021. Energy metabolism changes and dysregulated lipid metabolism in postmenopausal women. *Nutrients*, 13(12), p.4556.
- Koeze, E. and Popper, N., 2020. The virus changed the way we internet. *The New York Times*, 7.
- Kohrt, W. M., Obert, K. A., & Holloszy, J. O. (1992). Exercise training improves fat distribution patterns in 60-to 70-year-old men and women. *Journal of gerontology*, 47(4), M99-M105.
- Kozakowski, J., Gietka-Czernel, M., Leszczyńska, D., & Majos, A. (2017). Obesity in menopause—our negligence or an unfortunate inevitability?. *Menopause Review/Przegląd Menopauzalny*, 16(2), 61-65.
- Kracht, C.L., Romain, J.S., Hardee, J.C., Santoro, N., Redman, L.M. and Marlatt, K.L., 2022. “It just seems like people are talking about menopause, but nobody has a solution”: A qualitative

- exploration of menopause experiences and preferences for weight management among Black women. *Maturitas*, 157, pp.16-26.
- Kriplani, A., & Banerjee, K. (2005). An overview of age of onset of menopause in northern India. *Maturitas*, 52(3-4), 199-204.
- Kroemeke, A., Zając-Gawlak, I., Pośpiech, D., Gába, A., Přidalová, M., & Pelclová, J. (2014). Postmenopausal obesity: 12,500 steps per day as a remedy? Relationships between body composition and daily steps in postmenopausal women. *Menopause Review/Przegląd Menopauzalny*, 13(4), 227-232.
- Krueger, P. M., Coleman-Minahan, K., & Rooks, R. N. (2014). Race/ethnicity, nativity and trends in BMI among US adults. *Obesity*, 22(7), 1739-1746.
- Kulavic, K., Hultquist, C. N., & McLester, J. R. (2013). A comparison of motivational factors and barriers to physical activity among traditional versus nontraditional college students. *Journal of American College Health*, 61(2), 60-66.
- Kwan, M. Y., Cairney, J., Faulkner, G. E., & Pullenayegum, E. E. (2012). Physical activity and other health-risk behaviors during the transition into early adulthood: a longitudinal cohort study. *American journal of preventive medicine*, 42(1), 14-20.
- Laranjo, L. (2016). Social media and health behavior change. In *Participatory health through social media* (pp. 83-111). Academic Press.
- Landgren, B. M., Collins, A., Csemiczky, G., Burger, H. G., Baksheev, L., & Robertson, D. M. (2004). Menopause transition: annual changes in serum hormonal patterns over the menstrual cycle in women during a nine-year period prior to menopause. *The Journal of Clinical Endocrinology & Metabolism*, 89(6), 2763-2769.

- Lavery, M. A., & Loewy, J. W. (1993). Identifying predictive variables for long-term weight change after participation in a weight loss program. *Journal of the American Dietetic Association*, 93(9), 1017-1024.
- Lawton, B.A., Rose, S.B., Elley, C.R., Dowell, A.C., Fenton, A. and Moyes, S.A., 2008. Exercise on prescription for women aged 40-74 recruited through primary care: two year randomised controlled trial. *Bmj*, 337.
- Lazzeretti, L., Rotella, F., Pala, L., & Rotella, C. M. (2015). Assessment of psychological predictors of weight loss: how and what for?. *World journal of psychiatry*, 5(1), 56.
- Leeners, B., Geary, N., Tobler, P. N., & Asarian, L. (2017). Ovarian hormones and obesity. *Human reproduction update*, 23(3), 300-321.
- Lehnert, T., Sonntag, D., Konnopka, A., Riedel-Heller, S. and König, H.H., 2013. Economic costs of overweight and obesity. *Best practice & research Clinical endocrinology & metabolism*, 27(2), pp.105-115.
- Lentz, G. M., Lobo, R. A., Gershenson, D. M., & Katz, V. L. (2012). *Comprehensive gynecology e-book*. Elsevier Health Sciences.
- Levin, K. A. 2006. Study design III: Cross-sectional studies. *Evidence-based dentistry*, 7(1), 24-25.
- Lindle, R. S., Metter, E. J., Lynch, N. A., Fleg, J. V., Fozard, J. L., Tobin, J., ... & Hurley, B. F. (1997). Age and gender comparisons of muscle strength in 654 women and men aged 20–93 yr. *Journal of applied physiology*, 83(5), 1581-1587.

- Lobo, R. A., Davis, S. R., De Villiers, T. J., Gompel, A., Henderson, V. W., Hodis, H. N., Lumsden, M. A., Mack, W. J., Shapiro, S., & Baber, R. J. (2014). Prevention of diseases after menopause. *Climacteric*, 17(5), 540–556. <https://doi.org/10.3109/13697137.2014.933411>
- Lovejoy, J. C., Champagne, C. M., De Jonge, L., Xie, H., & Smith, S. R. (2008). Increased visceral fat and decreased energy expenditure during the menopausal transition. *International journal of obesity*, 32(6), 949-958.
- Lovre, D., Lindsey, S. H., & Mauvais-Jarvis, F. (2017). Effect of menopausal hormone therapy on components of the metabolic syndrome. *Therapeutic Advances in Cardiovascular Disease*, 11(1), 33-43.
- Lurati, A. R. (2017). Menopause and exercise intolerance. *Nursing for Women's Health*, 21(2), 130-136.
- Mancini, J. G., Filion, K. B., Atallah, R., & Eisenberg, M. J. (2016). Systematic review of the Mediterranean diet for long-term weight loss. *The American journal of medicine*, 129(4), 407-415.
- Mann, T., Tomiyama, A. J., Westling, E., Lew, A. M., Samuels, B., & Chatman, J. (2007). Medicare's search for effective obesity treatments: diets are not the answer. *American Psychologist*, 62(3), 220.
- Marinou, K., Tousoulis, D., Antonopoulos, A. S., Stefanadi, E., & Stefanadis, C. (2010). Obesity and cardiovascular disease: from pathophysiology to risk stratification. *International journal of cardiology*, 138(1), 3-8.
- McARDLE, A.N.N.E. and Jackson, M.J., 2000. Exercise, oxidative stress and ageing. *The Journal of Anatomy*, 197(4), pp.539-541.

- McCormick, B., Stone, I. and Corporate Analytical Team, 2007. Economic costs of obesity and the case for government intervention. *Obesity reviews*, 8, pp.161-164.
- McDonald, M. T., Siebert, S., Coulter, E. H., McDonald, D. A., & Paul, L. (2019). Level of adherence to prescribed exercise in spondyloarthritis and factors affecting this adherence: a systematic review. *Rheumatology International*, 39(2), 187–201. <https://doi.org/10.1007/s00296-018-4225-8>
- McFarlane, S. I., Banerji, M., & Sowers, J. R. (2001). Insulin resistance and cardiovascular disease. *The Journal of Clinical Endocrinology & Metabolism*, 86(2), 713-718.
- McGuire, M. T., Wing, R. R., Klem, M. L., & Hillf, J. O. (1999). Behavioral strategies of individuals who have maintained long-term weight losses. *Obesity research*, 7(4), 334-341.
- McTiernan, A., Stanford, J. L., Daling, J. R., & Voigt, L. F. (1998). Prevalence and correlates of recreational physical activity in women aged 50–64 years. *Menopause*, 5(2), 95-101
- Micklesfield, L. K., Lambert, E. V., Hume, D. J., Chantler, S., Pienaar, P. R., Dickie, K., ... & Puoane, T. (2013). Socio-cultural, environmental and behavioural determinants of obesity in black South African women: Review articles. *Cardiovascular journal of Africa*, 24(9), 369-375.
- Mijatovic, V., Van der Mooren, M.J., Stehouwer, C.D.A., Netelenbos, J.C. and Kenemans, P., 1999. Postmenopausal hormone replacement, risk estimators for coronary artery disease and cardiovascular protection. *Gynecological Endocrinology*, 13(2), pp.130-144.
- Mulugeta, W., Desalegn, H., & Solomon, S. (2021). Impact of the COVID -19 pandemic lockdown on weight status and factors associated with weight gain among adults in Massachusetts . *Clinical Obesity*, 11(4), 1–8. <https://doi.org/10.1111/cob.12453>

- Mumusoglu, S. and Yildiz, B.O., 2019. Metabolic syndrome during menopause. *Current Vascular Pharmacology*, 17(6), pp.595-603.
- Nicklas, B. J., Wang, X., You, T., Lyles, M. F., Demons, J., Easter, L., Berry, M. J., Lenchik, L., & Carr, J. J. (2009). Effect of exercise intensity on abdominal fat loss during calorie restriction in overweight and obese postmenopausal women: A randomized, controlled trial. *American Journal of Clinical Nutrition*, 89(4), 1043–1052. <https://doi.org/10.3945/ajcn.2008.26938>
- Nordmann, A. J., Nordmann, A., Briel, M., Keller, U., Yancy, W. S., Brehm, B. J., & Bucher, H. C. (2006). Effects of low-carbohydrate vs low-fat diets on weight loss and cardiovascular risk factors: a meta-analysis of randomized controlled trials. *Archives of internal medicine*, 166(3), 285-293.
- O’connell, J. K., Price, J. H., Roberts, S. M., Jurs, S. G., & Mckinley, R. (1985). Utilizing the Health Belief Model to Predict Dieting and Exercising Behavior of Obese and Nonobese Adolescents. *Health Education & Behavior*, 12(4), 343–351. <https://doi.org/10.1177/109019818501200401>
- Ofori-Asenso, R., Agyeman, A. A., Laar, A., & Boateng, D. (2016). Overweight and obesity epidemic in Ghana - A systematic review and meta-analysis. *BMC Public Health*, 16(1). <https://doi.org/10.1186/s12889-016-3901-4>
- Ofori-Asenso, R., & Garcia, D. (2016). Cardiovascular diseases in Ghana within the context of globalization. *Cardiovascular Diagnosis and Therapy*, 6(1), 67.
- Ogwumike, O. O., Arowojolu, A. O., & Sanya, A. O. (2011). Effects of a 12-week endurance exercise program on adiposity and flexibility of Nigerian perimenopausal and postmenopausal women. *Nigerian Journal of Physiological Sciences*, 26(2), 199-206.
- Ojowu, O.H., Bulus and B.Omonona (2007). Nigeria Poverty Assessment.Mimeo, National Bureau

- of Statistics, Nigeria. Retrieved in December 2022 from <http://ageconsearch.umn.edu/bitstream>
- Okop, K. J., Mukumbang, F. C., Mathole, T., Levitt, N., & Puoane, T. (2016). Perceptions of body size, obesity threat and the willingness to lose weight among black South African adults: A qualitative study. *BMC Public Health*, 16(1), 1–13. <https://doi.org/10.1186/s12889-016-3028-7>.
- Omari, R., Jongerden, J., Essegbey, G.O., Frempong, G.K. and Ruivenkamp, G., 2013. Fast food in the Greater Accra Region of Ghana: Characteristics, availability and the cuisine concept.
- Omoniyi, M. M., Daniel, A. F. I. F. A., Anthony, A. M., Priscilla, S. A. R. P. O. N. G., Emmanuel, S. A. R. P. O. N. G., Opoku, A. P., & Francisca, A. K. O. T. O. (2020). “AMPE” exercise programme has positive effects on anthropometric and physiological parameters of school children: a pilot study. *Ethiopian Journal of Health Sciences*, 30(1).
- Pampel, F. C., Denney, J. T., & Krueger, P. M. (2012). Obesity, SES, and economic development: a test of the reversal hypothesis. *Social science & medicine*, 74(7), 1073-1081.
- Park, D. Y. (2011). Utilizing the Health Belief Model to predicting female middle school students' behavioral intention of weight reduction by weight status. *Nutrition research and practice*, 5(4), 337-348.
- Park, S., Yang, M. J., Ha, S. N., & Lee, J. S. (2014). Effective anti-aging strategies in an era of super-aging. *Journal of menopausal medicine*, 20(3), 85-89.
- Pawlak, R. and Colby, S., 2009. Benefits, barriers, self-efficacy and knowledge regarding healthy foods; perception of African Americans living in eastern North Carolina. *Nutrition research and practice*, 3(1), pp.56-63.

- Perry, J. R., Murray, A., Day, F. R., & Ong, K. K. (2015). Molecular insights into the aetiology of female reproductive ageing. *Nature Reviews Endocrinology*, 11(12), 725-734.
- Peterson, J.A. and Ward-Smith, P., 2012. Choose to move for positive living: physical activity program for obese women. *Holistic Nursing Practice*, 26(3), pp.120-128.
- Pittler, M.H., Schmidt, K. and Ernst, E., 2005. Adverse events of herbal food supplements for body weight reduction: systematic review. *obesity reviews*, 6(2), pp.93-111.
- Poehlman, E. T., Toth, M. J., Bunyard, L. B., Gardner, A. W., Donaldson, K. E., Colman, E., ... & Ades, P. A. (1995). Physiological predictors of increasing total and central adiposity in aging men and women. *Archives of internal medicine*, 155(22), 2443-2448.
- Porter, G., Hampshire, K., Abane, A., Munthali, A., Robson, E., & Mashiri, M. (2017). Beyond the School and Working Day: Building Connections Through Play, Leisure, Worship and Other Social Contact. In *Young People's Daily Mobilities in Sub-Saharan Africa* (pp. 123-152). Palgrave Macmillan, New York.
- Pradeilles, R., Holdsworth, M., Olaitan, O., Irache, A., Osei-Kwasi, H. A., Ngandu, C. B., Cohen, E. (2021). Body size preferences for women and adolescent girls living in Africa: A mixed-methods systematic review. *Public Health Nutrition*, 1–22.<https://doi.org/10.1017/S1368980021000768>
- Price, A. J., Crampin, A. C., Amberbir, A., Kayuni-Chihana, N., Musicha, C., Tafatatha, T., ... & Nyirenda, M. (2018). Prevalence of obesity, hypertension, and diabetes, and cascade of care in sub-Saharan Africa: a cross-sectional, population-based study in rural and urban Malawi. *The lancet Diabetes & endocrinology*, 6(3), 208-222.
- Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: important considerations for public health.

American journal of public health, 100(6), 1019-1028.

Puoane, T., Steyn, K., Bradshaw, D., Laubscher, R., Fourie, J., Lambert, V., & Mbananga, N. (2002).

Obesity in South Africa: the South African demographic and health survey. *Obesity research*, 10(10), 1038-1048.

Puoane, T., Tsolekile, L. and Steyn, N., 2010. Perceptions about body image and sizes among black African girls living in Cape Town. *Ethnicity & disease*, 20(1), pp.29-34.

Puoane, T., Fourie, J. M., Shapiro, M., Rosling, L., Tshaka, N. C., & Oelefse, A. (2005). 'Big is beautiful'-an exploration with urban black community health workers in a South African township. *South African Journal of Clinical Nutrition*, 18(1), 6-15.

Ranjan, P., Vikram, N. K., Choranur, A., Pradeep, Y., Ahuja, M., Meeta, Puri, M., Malhotra, A., Kumari, A., Chopra, S., Batra, A., Balsalkar, G., Goswami, D., Guleria, K., Sarkar, S., Kachhawa, G., Verma, A., Kumari, M. K., Madan, J., ... Guleria, R. (2022). Executive summary of evidence and consensus-based Clinical Practice Guidelines for management of obesity and overweight in midlife women: An AIIMS-DST initiative. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 16(3), 102426. <https://doi.org/10.1016/j.dsx.2022.102426>.

Rebbeck, T. R., Su, H. I., Sammel, M. D., Lin, H., Tran, T. V., Gracia, C. R., & Freeman, E. W. (2010). Effect of hormone metabolism genotypes on steroid hormone levels and menopausal symptoms in a prospective population-based cohort of women experiencing the menopausal transition. *Menopause (New York, NY)*, 17(5), 1026.

Reid, R., Abramson, B. L., Blake, J., Desindes, S., Dodin, S., Johnston, S., ... & Soares, C. N. (2014). Managing menopause abstract and summary statement. *Journal of obstetrics and gynaecology Canada*, 36(9), S1-S5.

- Reichert, F. F., Barros, A. J., Domingues, M. R., & Hallal, P. C. (2007). The role of perceived personal barriers to engagement in leisure-time physical activity. *American journal of public health*, 97(3), 515-519.
- Remais, J. V., Zeng, G., Li, G., Tian, L., & Engelgau, M. M. (2013). Convergence of non-communicable and infectious diseases in low-and middle-income countries. *International journal of epidemiology*, 42(1), 221-227.
- Rice, D.P., 2000. Cost of illness studies: what is good about them?. *Injury Prevention*, 6(3), pp.177-179.
- Roffey, D.M., Ashdown, L.C., Dornan, H.D., Creech, M.J., Dagenais, S., Dent, R.M. and Wai, E.K., 2011. Pilot evaluation of a multidisciplinary, medically supervised, nonsurgical weight loss program on the severity of low back pain in obese adults. *The spine journal*, 11(3), pp.197-204.
- Roubenoff, R. (2004). Sarcopenic obesity: the confluence of two epidemics. *Obesity*, 12(6), 887.
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social Learning Theory and the Health Belief Model. *Health Education & Behavior*, 15(2), 175–183. <https://doi.org/10.1177/109019818801500203>.
- Rousham, E. K., Pradeilles, R., Akparibo, R., Aryeetey, R., Bash, K., Booth, A., Muthuri, S. K., Osei-Kwasi, H., Marr, C. M., Norris, T., & Holdsworth, M. (2020). Dietary behaviours in the context of nutrition transition: A systematic review and meta-analyses in two African countries. *Public Health Nutrition*, 23(11), 1948–1964. <https://doi.org/10.1017/S1368980019004014>.
- Sacks, F. M., Bray, G. A., Carey, V. J., Smith, S. R., Ryan, D. H., Anton, S. D., ... & Williamson, D. A. (2009). Comparison of weight-loss diets with different compositions of fat, protein, and carbohydrates. *New England Journal of Medicine*, 360(9), 859-873.

- Saghafi-Asl, M., Aliasgharzadeh, S., & Asghari-Jafarabadi, M. (2020). Factors influencing weight management behaviour among college students: An application of the Health Belief Model. *PLoS ONE*, 15(2), 1–16. <https://doi.org/10.1371/journal.pone.0228058>
- Schunkert, H., Markus, M. R. P., & Stritzke, J. (2012). Waist circumference and cardiovascular risk. In *Handbook of Anthropometry* (pp. 2137-2153). Springer, New York, NY.
- Scotland, J. 2012. Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms. *English Language Teaching*, 5, 9-16.
- Sehl, M. E., & Yates, F. E. (2001). Kinetics of human aging: I. Rates of senescence between ages 30 and 70 years in healthy people. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(5), B198-B208.
- Seiler, J., Libby, T. E., Jackson, E., Lingappa, J. R., & Evans, W. D. (2022). Social Media–Based Interventions for Health Behavior Change in Low- and Middle-Income Countries: Systematic Review. *Journal of Medical Internet Research*, 24(4), 1–14. <https://doi.org/10.2196/31889>.
- Serretti, A., Mandelli, L., & Laura, M. (2010). Antidepressants and body weight: a comprehensive review and meta-analysis. *The Journal of clinical psychiatry*, 71(10), 979.
- Sharifi, K., Tagharrobi, Z., & Sooki, Z. (2020). Quality of Life among Iranian Postmenopausal Women: A Systematic Review and Meta-Analysis. *Galen Medical Journal*, 9, 1649. <https://doi.org/10.31661/gmj.v9i0.1649>.
- Skrzypczak, M., Szwed, A., Pawlińska-Chmara, R. and Skrzypulec, V., 2007. Assessment of the BMI, WHR and W/Ht in pre-and postmenopausal women. *Anthropological review*, 70, pp.3-13.

- Solimanian, A., NIKNAMI, S., Hajizadeh, I., Shojaeezadeh, D., & Tavousi, M. (2014). Predictors of physical activity to prevent osteoporosis based on extended health belief model.
- Sotoudeh, G., Khosravi, S., Karbakhsh, M., Khajehnasiri, F., & Khalkhali, H. R. (2008). What women think about their husbands' opinions might influence women's body image: An explorative study. *Indian journal of medical sciences*, 62(3), 98-104.
- Specchia, M.L., Veneziano, M.A., Cadeddu, C., Ferriero, A.M., Mancuso, A., Ianuale, C., Parente, P., Capri, S. and Ricciardi, W., 2015. Economic impact of adult obesity on health systems: a systematic review. *The European Journal of Public Health*, 25(2), pp.255-262.
- Stachowiak, G., Pertyński, T., & Pertyńska-Marczewska, M. (2015). Metabolic disorders in menopause. *Menopause Review/Przegląd Menopauzalny*, 14(1), 59-64.
- Stanford, F. C., Cena, H., Biino, G., Umoren, O., Jimenez, M., Freeman, M. P., ... & Manson, J. E. (2020). The association between weight-promoting medication use and weight gain in postmenopausal women: findings from the Women's Health Initiative. *Menopause*, 27(10), 1117-1125.
- Sternfeld, B., Wang, H., Quesenberry Jr, C. P., Abrams, B., Everson-Rose, S. A., Greendale, G. A., ... & Sowers, M. (2004). Physical activity and changes in weight and waist circumference in midlife women: findings from the Study of Women's Health Across the Nation. *American journal of epidemiology*, 160(9), 912-922.
- Stevens, G. A., Singh, G. M., Lu, Y., Danaei, G., Lin, J. K., Finucane, M. M., ... & Ezzati, M. (2012). National, regional, and global trends in adult overweight and obesity prevalences. *Population health metrics*, 10(1), 1-16.
- Steyn, N. P., & Mchiza, Z. J. (2014). Obesity and the Nutrition Transition in Sub-Saharan Africa.,

1311, 88–101. <https://doi.org/10.1111/nyas.12433>

- Strychar, I. M., Champagne, F., Ghadirian, P., Bonin, A., Jenicek, M., & Lasater, T. M. (1998). Impact of receiving blood cholesterol test results on dietary change. *American Journal of Preventive Medicine*, 14(2), 103-110.
- Stubbs, J., Whybrow, S., Teixeira, P., Blundell, J., Lawton, C., Westenhoefer, J., ... & Raats, M. (2011). Problems in identifying predictors and correlates of weight loss and maintenance: implications for weight control therapies based on behaviour change. *Obesity reviews*, 12(9), 688-708.
- Stutts, W. C. (2002). Physical activity determinants in adults: perceived benefits, barriers, and self efficacy. *Aaohn Journal*, 50(11), 499-507.
- Seguin, R., Buchner, D. M., Liu, J., Allison, M., Manini, T., Wang, C. Y., ... & LaCroix, A. Z. (2014). Sedentary behavior and mortality in older women: the Women's Health Initiative. *American journal of preventive medicine*, 46(2), 122-135.
- Sun, Y., Ling, C., Liu, L., Zhang, J., Wang, J., Tong, X., ... & Yang, J. (2022). Effects of Whey Protein or Its Hydrolysate Supplements Combined with an Energy-Restricted Diet on Weight Loss: A Randomized Controlled Trial in Older Women. *Nutrients*, 14(21), 4540.
- Te Velde, E. R., & Pearson, P. L. (2002). The variability of female reproductive ageing. *Human reproduction update*, 8(2), 141-154.
- Thom, G., & Lean, M. (2017). Is there an optimal diet for weight management and metabolic health?. *Gastroenterology*, 152(7), 1739-1751.
- Thompson, W. G., Cook, D. A., Clark, M. M., Bardia, A., & Levine, J. A. (2007, January). Treatment

- of obesity. In Mayo Clinic Proceedings (Vol. 82, No. 1, pp. 93-102). Elsevier.
- Tran, B.X., Nair, A.V., Kuhle, S., Ohinmaa, A. and Veugelers, P.J., 2013. Cost analyses of obesity in Canada: scope, quality, and implications. *Cost Effectiveness and Resource Allocation*, 11(1), pp.1-9.
- Tremmel, M., Gerdtham, U.G., Nilsson, P.M. and Saha, S., 2017. Economic burden of obesity: a systematic literature review. *International journal of environmental research and public health*, 14(4), p.435.
- Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: review and update. *Medicine & science in sports & exercise*, 34(12), 1996-2001.
- Tuoyire, D. A., Kumi-Kyereme, A., Doku, D. T., & Amo-Adjei, J. (2018). Perceived ideal body size of Ghanaian women: “Not too skinny, but not too fat.” *Women and Health*, 58(5), 583–597. <https://doi.org/10.1080/03630242.2017.1321607>.
- Uauy, R., Albala, C., & Kain, J. (2001). Obesity trends in Latin America: transiting from under-to overweight. *The Journal of nutrition*, 131(3), 893S-899S.
- Ulijaszek, S. J., & Kerr, D. A. (1999). Anthropometric measurement error and the assessment of nutritional status. *British Journal of Nutrition*, 82(3), 165-177.
- Utian, W. H. (2005). Psychosocial and socioeconomic burden of vasomotor symptoms in menopause: a comprehensive review. *Health and Quality of Life outcomes*, 3(1), 1-10.
- Van Der Sande, M. A., Ceesay, S. M., Milligan, P. J., Nyan, O. A., Banya, W. A., Prentice, A., ... & Walraven, G. E. (2001). Obesity and undernutrition and cardiovascular risk factors in rural and

- urban Gambian communities. *American journal of public health*, 91(10), 1641-1644.
- Van Der Merwe, M. T., & Pepper, M. S. (2006). Obesity in South Africa. *Obesity reviews*, 7(4), 315-322.
- van Gemert, W. A., Schuit, A. J., van der Palen, J., May, A. M., Iestra, J. A., Wittink, H., ... & Monninkhof, E. M. (2015). Effect of weight loss, with or without exercise, on body composition and sex hormones in postmenopausal women: the SHAPE-2 trial. *Breast Cancer Research*, 17(1), 1-12.
- van Hout, G., Verschure, S. K., & Van Heck, G. L. (2005). Psychosocial predictors of success following bariatric surgery. *Obesity surgery*, 15(4), 552-560.
- Velthuis, M.J., Schuit, A.J., Peeters, P.H. and Monninkhof, E.M., 2009. Exercise program affects body composition but not weight in postmenopausal women. *Menopause*, 16(4), pp.777-784.
- von Lengerke, T. and Krauth, C., 2011. Economic costs of adult obesity: a review of recent European studies with a focus on subgroup-specific costs. *Maturitas*, 69(3), pp.220-229.
- Walker, A. R. P., Adam, F., & Walker, B. F. (2001). World pandemic of obesity: the situation in Southern African populations. *Public health*, 115(6), 368-372.
- Walsh, N.E., Brooks, P., Hazes, J.M., Walsh, R.M., Dreinhöfer, K., Woolf, A.D., Åkesson, K. and Lidgren, L., 2008. Standards of care for acute and chronic musculoskeletal pain: the Bone and Joint Decade (2000–2010). *Archives of physical medicine and rehabilitation*, 89(9), pp.1830-1845.
- Wang, Q., Hassager, C., Ravn, P., Wang, S., & Christiansen, C. (1994). Total and regional body-composition changes in early postmenopausal women: age-related or menopause-related?. *The*

- American journal of clinical nutrition, 60(6), 843-848.
- Westenhoefer, J. (2001). The therapeutic challenge: behavioral changes for long-term weight maintenance. *International Journal of Obesity*, 25(1), S85-S88.
- Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Journal of personality and social psychology*, 70(1), 115.
- Williamson, D. F., Madans, J. A. R. F., Anda, R. F., Kleinman, J. C., Kahn, H. S., & Byers, T. (1993). Recreational physical activity and ten-year weight change in a US national cohort. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*, 17(5), 279-286.
- Wilson, G. T., & Shafran, R. (2005). Eating disorders guidelines from NICE. *The Lancet*, 365(9453), 79-81.
- Wilson, G. T., Wilfley, D. E., Agras, W. S., & Bryson, S. W. (2010). Psychological treatments of binge eating disorder. *Archives of general psychiatry*, 67(1), 94-101.
- Wiklund, P., 2016. The role of physical activity and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, 5(2), pp.151-154.
- Wing, R. R., Matthews, K. A., Kuller, L. H., Meilahn, E. N., & Plantinga, P. L. (1991). Weight gain at the time of menopause: *Arch. Intern. Med.* 1991 151/1 (97–102). *Maturitas*, 13(4), 339-340.
- Witham, M. D., & Avenell, A. (2010). Interventions to achieve long-term weight loss in obese older people: a systematic review and meta-analysis. *Age and ageing*, 39(2), 176-184.
- World Health Organization. (2016). Obesity: Situation and trends-Global Health Observatory (GHO)

data. Geneva: WHO. (Accessed 18 December 2022).

World Health Organization. The World Health Report 1998: Life in the 21st century a vision for all.

In The world health report 1998: life in the 21st century A vision for all 1998 (pp. 241-241).

World Health Organization. (2018). [www. Who. Int/mediacentre/factsheets/fs317/en](http://www.who.int/mediacentre/factsheets/fs317/en). [Accessed November 22 2022].

World Health Organization. (2020). WHO tools to prevent and control noncommunicable diseases. [Last accessed on 2022 November 22]

World Health Organization. (2000). Obesity: preventing and managing the global epidemic.

World Health Organization. (2014). Obesity and Overweight (Fact sheet No. 311).

World Health Organization. (2000). Obesity: preventing and managing the global epidemic.

World Health Organization. (2018). [www. who. int/mediacentre/factsheets/fs317/en](http://www.who.int/mediacentre/factsheets/fs317/en). [Accessed November 22 2022].

World Health Organization. (2020). WHO tools to prevent and control noncommunicable diseases. [Last accessed on 2022 November 22]

Wyatt, H. R., Grunwald, G. K., Mosca, C. L., Klem, M. L., Wing, R. R., & Hill, J. O. (2002). Long-term weight loss and breakfast in subjects in the National Weight Control Registry. *Obesity research*, 10(2), 78-82.

Yoshida, T., Takahashi, K., Yamatani, H., Takata, K., & Kurachi, H. (2011). Impact of surgical menopause on lipid and bone metabolism. *Climacteric*, 14(4), 445-452

APPENDIX A: ETHICS CLEARANCE



Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Mr I Mensah Bonsu
School of Therapeutic Sciences
Department of Physiotherapy
Medical School
University

E-mail: piceabc@yahoo.com

CC: Supervisor: Professor H Myeza and Dr C Brandt
<Hellen.Myezwa@wits.ac.za>
and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2019/07/31

REF: R14/49

PROTOCOL NO: **M190467** (This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)

PROJECT TITLE: Exercise in Ghanaian postmenopausal women with increased BMI, above 25

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

A handwritten signature in black ink, appearing to be 'Iain Burns', is written over a faint, larger signature.

MSWorks2000/Iain0007/Clearscan.wps

R14/49 Mr I Mensah Bonsu

**HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M190467**

NAME: Mr I Mensah Bonsu
(Principal Investigator)
DEPARTMENT: School of Therapeutic Sciences
Department of Physiotherapy
Medical School
University

PROJECT TITLE: Exercise in Ghanaian postmenopausal women with
increased BMI, above 25

DATE CONSIDERED: 2019/04/26

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Professor H Myeza and Dr C Brandt

APPROVED BY: 
Dr CB Penny, Chairperson, HREC (Medical)

DATE OF APPROVAL: 2019/07/31

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. I **agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **April** and will therefore reports and re-certification will be due early in the month of **April** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date

PLEASE QUOTE THE CLEARANCE CERTIFICATE NUMBER IN ALL ENQUIRIES



KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS



Our Ref: CHRPE/AP/596/19

4th October, 2019.

Mr. Isaac Mensah Bonsu
Department of Physiotherapy
University of Witwatersrand
SOUTH AFRICA.

Dear Sir,

LETTER OF APPROVAL

Protocol Title: *"Exercise in Ghanaian Postmenopausal Women with an Increased Body Mass Index, Above 25."*

Proposed Site: *Techiman Municipality.*

Sponsor: *Principal Investigator.*

Your submission to the Committee on Human Research, Publications and Ethics on the above-named protocol refers.

The Committee reviewed the following documents:

- A notification letter of 12th June, 2019 from the Techiman Municipal Health Directorate (study site) indicating approval for the conduct of the study at the Municipality.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning 4th October, 2019 to 3rd October, 2020 renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you, Sir for your application.

Yours faithfully,


Osomfo Prof. S. J. W. Acheampong MD, FWACP
Chairman

Room 7 Block J, School of Medical Sciences, KNUST, University Post Office, Kumasi, Ghana
Phone: +233 3220 63248 Mobile: +233 20 5453785 Email: chrpe.knust.kath@gmail.com / chrpe@knust.edu.gh



Kwame Nkrumah
University of Science
and Technology, Kumasi

College of Health Sciences
SCHOOL OF MEDICINE AND DENTISTRY

COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

23rd December 2021.

Our Ref: CHRPE/AP/621/21

Mr. Isaac Mensah Bonsu
Department of Physiotherapy
University of Witwatersrand
SOUTH AFRICA.

Dear Sir,

LETTER OF APPROVAL

Protocol Renewal: "Exercise in Ghanaian Postmenopausal Women with an Increased Body Mass Index, Above 25."

Proposed Site: Techiman Municipality.

Sponsor: Principal Investigator.

Your submission to the Committee on Human Research, Publication and Ethics on renewal to protocol No. CHRPE/AP/596/19 dated 4th October, 2019 refers.

The Committee reviewed the following documents:

- A notification letter of 12th June, 2019 from the Techiman Municipal Health Directorate (study site) indicating approval for the conduct of the study at the Municipality.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your proposed renewal and approved it. The approval is for a fixed period of one year, beginning 23rd December 2021 to 22nd December 2022 renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee expects a report on your study annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you, Sir for your application.

Yours faithfully,

Rev. Prof. John Appiah-Poku

CamScanner

APPENDIX B: PERMISSION LETTER

In case of reply the number
and the date of this letter
should be quoted

CORE VALUES

- People centered
- Professionalism
- Team Work
- Innovation/Excellence
- Discipline/Integrity



MUNICIPAL HEALTH DIRECTORATE
GHANA HEALTH SERVICE
P.O. BOX 109
TECHIMAN B/E

12TH JUNE , 2019

TELEPHONE: +233-3520-91078

Our Ref No:
Your Ref No:

Email: techmhd@yahoo.com

+233-3520-93923

TO WHOM IT MAY CONCERN

PERMISSION TO CONDUCT RESEARCH – ISAAC MENSAH-BONSU

STAFF ID: 865907

With reference to a letter requesting to conduct research in Ghana on “EXERCISE IN GHANAIAN POSTMENOPAUSAL WOMEN WITH AN INCREASED BODY MASS INDEX, ABOVE 25” by the named officer, permission has been granted and all facilities in the Techiman municipal are entreated to accord the researcher the necessary support.

Thank you for your cooperation.

FLORENCE IDDRISAH
MUNICIPAL DIRECTOR OF HEALTH SERVICES

APPENDIX C: INFORMATION SHEET AND CONSENT FORMS

Phase 1

Study title: **Exercise in Ghanaian, postmenopausal women with an increased body mass index, above 25**

Dear Madam

Introduction: I, Isaac Mensah Bonsu am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing research on exercise in Ghanaian, postmenopausal women with an increased body mass index (BMI), above 25. Participants get to have a clearer understanding of the risk factors associated with increased BMI at the postmenopausal stage. This research will be used to determine which exercises will be easy and good for them to do and help them lose weight

What is involved in the study?

Participants will be asked to do the following:

1. Undergo body measurement of weight, height, waist and hip circumference
2. Complete a self-administered questionnaire with questions on their lifestyle, sociocultural and physical activity level and demographics. It takes about 30 minutes and will be paper-based and will be interview based.
3. To be part of Focus Group discussion to explore the current weight management practice. It takes about 45 minutes to 1 hour to complete. The study site will be a comfortable and easily accessible venue, convenient to the participants.

Purpose

To determine the prevalence of excess weight gain, the lifestyle, sociocultural and physical activity level and explore the current weight management practices among postmenopausal women in Ghana.

Benefits

Participants get to have a clearer understanding about risk factors associated with increased BMI at the postmenopausal stage.

Voluntary Participation

Participation in this study is voluntary and refusal to participate has no negative effects. Participants may discontinue participation at any time.

The participant will be given pertinent information on the study while involved in the project and after the results are available.

There will be appropriate reimbursements for out of pocket expenses, such as travel allowances to the site of study which will be Ghc 10. Beyond this, there is neither payment nor cost in taking part in the study.

Confidentiality

In the case of the questionnaire, your personal information will be treated as confidential and only be available to me, as principal investigator, and to my PhD supervisors, Professor Hellen Myezwa and Dr Corlia Brandt

As regards the Focus Group, confidentiality cannot be guaranteed as participants may recognize one another, although I will request that participants do not disclose the content of the discussions outside of the meeting.

The only exceptions - and all of them are rare - would normally be:

1. Personal information may be disclosed if required by law
2. The Human Research Ethics Committees of the University may exceptionally require personal data to respond to a formal complaint, or for a compliance audit
3. Municipal Health Directorate (Techiman) an authority in Ghana may have access to the data for any reference.

Contact details of the researcher

For further information, please contact:

Principal Investigator: Mr Isaac Mensah Bonsu, on telephone number 0452546187, or by email at Piceabc@yahoo.com

Supervisors: Professor Hellen Myezwa and Dr Brandt Corlia by telephone number +27 11.717 2064, or by e-mail at Hellen.Myezwa@wits.ac.za and brandt.corlia@wits.ac.za

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (“Committee”). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concerns over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted by telephone number +27 11 717 2301, or by e-mail at Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are +27 11 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

APPENDIX D: PARTICIPANTS INFORMATION SHEET

Phase 2

Study title: **Exercise in Ghanaian, postmenopausal women with an increased body mass index, above 25**

Dear Madam

Introduction

I, Isaac Mensah Bonsu am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing research on exercise in Ghanaian, postmenopausal women with an increased body mass index (BMI), above 25. This research will be used to determine which exercises will be easy and good for them to do and help them lose weight

What is involved in the study?

This is the second phase of my study and you are being invited to participate in the validation of developed exercise programmes for weight loss.

This phase of the study involves the development of an exercise program using the Delphi technique. All participating experts with knowledge in exercise, obesity, and women in the postmenopausal stage will be asked to complete an online questionnaire anonymously and will then debate online each other's knowledge and views. A total number of thirteen participants across the country will be used for this study. They will not know each other and will not know who else is on the panel of experts. An online questionnaire, using the Red Cap database, will be used to distribute detailed information to the experts through E-mailing

When consensus is reached, which, as you probably know, takes two or sometimes three iterations, I will move on to trialling the programme with the group of female participants. I will be pleased to inform you of the results on request, in due course.

Payment

I am not in a position to pay you for participation. I will acknowledge your contribution in my thesis and in any resulting publications or presentations, unless you ask me not to.

Benefit

There will be no direct benefit to you for participating in this study.

Risk

There is no foreseeable risk to you in participating in this study.

Contact details of the researcher

For further information, please contact:

Principal Investigator: Mr Isaac Mensah Bonsu, on telephone number 0452546187, or by email at Piceabc@yahoo.com

Supervisor: Professor Hellen Myezwa, by telephone number +27 11.717 2064, or by e-mail at Hellen.Myezwa@wits.ac.za and Dr Brandt Corlia at corlia.brandt@wits.ac.za

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (“Committee”). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project

and the integrity of the research. If you have any concerns over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted by telephone number +27 11 717 2301, or by e-mail at Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are +27 11 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

APPENDIX E: PARTICIPANTS INFORMATION SHEET

Phase 3 (randomised control trials, RCT)

Study title: **Exercise in Ghanaian, postmenopausal women with an increased BMI, above 25**

Good day Madam

Introduction: I, Isaac Mensah Bonsu am researching exercise in Ghanaian, postmenopausal women with an increased body mass index, above 25. This research will be used to determine which exercises will be easy and good for them to lose weight

Purpose

The purpose you are being invited to participate in is to test effectiveness of a culturally develop exercise programme for weight loss.

I am inviting you to take part in this study.

In this phase of the study, participants will be invited to undergo exercise regimen to test the effectiveness of the culturally developed exercise programme. Participants will be randomly selected into intervention and control groups using a computer-generated random allocation sequence. Random allocation will be conducted by the block method.

Benefits

Participation in this study is voluntary and refusal to participate has no negative effects. Participants may discontinue participation at any time.

The participant will be given pertinent information on the study while involved in the project and after the results are available.

There will be reimbursements for out of pocket expenses such as travel allowances to and from the site of study.

Confidentiality

Efforts will be made to keep personal information confidential. Absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law.

Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the Research Ethics Committee.

If results are published, may lead to individual / cohort identification.

Contact details of the researcher

For further information, please contact:

Principal Investigator: Mr Isaac Mensah Bonsu, on telephone number 0452546187, or by email at Piceabc@yahoo.com

Supervisors: Professor Hellen Myezwa and Dr Brandt Corlia by telephone number +27 11.717 2064, or by e-mail at Hellen.Myezwa@wits.ac.za and brandt.corlia@wits.ac.za

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (“Committee”). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concerns over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted by telephone number +27 11 717 2301, or by e-mail at Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are +27 11 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet

**APPENDIX F: INVITATION TO PARTICIPATE IN A FOCUS GROUP DISCUSSION TO
EXPLORE CURRENT WEIGHT MANAGEMENT PRACTICES AMONG
POSTMENOPAUSAL WOMEN WITH EXCESS WEIGHT.**

Re: Invitation to participate in a group discussion to explore current weight management practices among postmenopausal women with excess weight.

Good day

My name is Isaac Mensah Bonsu, my overall study focus is on exercise in Ghanaian, postmenopausal women with an increased BMI, above 25.

Brief Background

Postmenopausal women with excess weight develop related chronic diseases such as cardiovascular and type 2 diabetes decreasing quality of life. There is a need to intervention to manage the excess weight gain in this population. The current study aims to develop culturally appropriate exercise-based program for weight loss in postmenopausal women with excess weight.

I am asking for your input/recommendations/ideas to explore weight management approaches in postmenopausal women with excess weight in Ghana.

Participation is voluntary and you may withdraw from the discussion at any stage or choose not to participate without any penalty. The discussion will be kept confidential and the information gathered will be used for research only and scientific publication.

This study has ethical clearance from the Human Research Ethics Committee, University of the Witwatersrand and Human Ethic committee, KNUST

If you have any questions concerning this study, contact: Mr Isaac Mensah Bonsu Tel: 0542546187
1389584@students.wits.ac.za

Supervisors: Professor Hellen Myezwa and Dr Brandt Corlia by telephone number +27 11.717 2064,
or by e-mail at Hellen.Myezwa@wits.ac.za and brandt.corlia@wits.ac.za

Human Research Ethics Committee, University of the Witwatersrand 011 717-700/2656/1234/1252
zanele.ndlovu@wits.ac.za

Please complete the following section if you are willing to participate

I hereby volunteer to take part in this study.

Participant: _____ (Signature)

Date: _____

Audio recording permission

I agree that Mr. Isaac Mensah Bonsu may tape record my group discussion and he will take out any
name and places that we talk about when the interview is typed up.

(Signature of participant)

Date.....

APPENDIX G : INFORMED CONSENT FORMS FOR CROSS SECTIONAL STUDY

I..... (Full names of participant) here by
confirm that I understand the nature of the research project, and I consent to participating in this
study. Questionnaires will be coded and there will be no identifiers. I understand that I can withdraw
from the project at any time, should I so desire.

Signature Participant

Date:.....

APPENDIX H: THE CONTRIBUTOR ROLES TAXONOMY (CREDIT)

The Contributor Roles Taxonomy (CRediT) (Allen et al., 2019b) was used to outline the authors' contribution to the study. The full explanation of the terms:

Term	Definition
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims
Methodology	Development or design of methodology; creation of models
Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data
Data curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse
Writing – original draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)
Writing – review and editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages
Visualization	Preparation, creation and/or presentation of the published work, specifically, visualization/data presentation
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team
Funding acquisition	Acquisition of the financial support for the project leading to this publication

**APPENDIX I : DATA COLLECTION TOOL FOR THE PREVALENCE
STUDY**

Section A: Demographic information

1. Age:

Religion:

Christian ☐ Muslim ☐ Others ☐ Specify.....

2. Marital status

Married ☐ widow ☐ single ☐ divorce ☐

3. Do you live with?

☐
Spouse or Partner Other Family ☐ Alone ☐ Others? ☐

4. How long have you being in postmenopausal stage?

5. How would you describe your ethnic origin?

Northerner ☐ Akan Ga ☐ Voltarian ☐ Others

Specify.....

6. What is the highest level of education, you have attained? Tick as appropriate.

Primary ☐ High School ☐ Tertiary ☐ Others ☐

3. Parity (number of births).....

ANTHROPOMETRIC MEASUREMENTS

8. Weight.....

9. Height.....

10. Waist circumference....

11. hip circumference...

12. BMI....

13. WHR...

14. WHtR.....

SELF ADMINISTER QUESTIONNAIRE

Thank you for your participation in this study, which aims to develop a structured exercise program for postmenopausal women with an increased BMI, above 25. All information on this survey is confidential and will be used for research purposes only. Thank you for taking the time to answer these questions. Please place an “x” in the box where appropriate and fill in the spaces provided.

Section A: Demographic information

1. Age:

Religion:

Christian ☐ Muslim ☐ Others ☐ Specify.....

2. Marital status

Married ☐ widow ☐ single ☐ divorce ☐

3. Do you live with?

Spouse or Partner ☐ Other Family ☐ Alone ☐ Others? ☐

4. How long have you being in postmenopausal stage?

5. How would you describe your ethnic origin?

Northerner ☐ Akan Ga ☐ Voltarian ☐ Others

Specify.....

6. What is the highest level of education, you have attained? Tick as appropriate.

Primary ☐ High School ☐ Tertiary ☐ Others ☐

7. Parity (number of births)

Section B: Information on sociocultural

8. What is your average income level.....

9. Occupation.....

10. Employment status:

Employed ☐ Retired ☐ Housewives ☐ Unemployed ☐

Others ☐ specify.....

11. Do you consider yourself overweight?

Yes ☐ No ☐ Not sure ☐

12. What is your understanding of overweight?

Absence of disease ☐ Present of disease ☐ Not sure/don't know ☐

13. What does the society view your current weight?

Attractive ☐ Not attractive ☐ Not sure ☐

14. In your customs, do you think overweight woman will be recognized?

Yes ☐ No ☐ Don't know/Not sure ☐

15. Cultural background and beliefs may prevent me from losing weight.

☐ Yes ☐ No

Section C: Information on physical activity

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.

Think only about those physical activities that you did for at least 10 minutes at a time.

16. During the last 7 days, how often have you participated in some kind of vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

☐ 1 to 2 times per week

☐ 3 to 4 times per week

☐ Not at all

17. How much time did you usually spend doing vigorous physical activities on one of those days?

☐ 1 to 10 minutes.....

☐ 15 to 30 minutes.....

☐ More than 30 minutes....

☐ Don't know/Not sure.....

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

Think only about those physical activities that you did for at least 10 minutes at a time

18. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, gardening, or cleaning house?

☐ 1 to 2 days per week

☐ 3 to 4 days per week

☐ Don't know/Not sure.....

19. How much time did you usually spend doing moderate physical activities on one of those days?

☐ 1 to 20 minutes per day

☐ 30 to 60 minutes per day

☐ More than 1 hour

☐ Others

Think about the time you spent walking in the last 7 days. This includes at work and home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure

20. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

☐ 1 to 3 days per week

☐ 4 to 7 days per week

☐ No walking

21. How much time did you usually spend walking on one of those days?

☐ 1 to 20minutes per day

☐ 30 to 60 minutes per day

☐
More than 1 hour

☐ Don't know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

22. During the last 7 days, how much time did you spend sitting on a week day?

☐ 1 to 20minutes per day

☐ 30 to 60 minutes per day

☐ More than 1 hour

☐ Don't know/Not sure

23. How many hours do you spend on the computer or watching TV?

☐

1–2h a day ☐ 3–4h a day ☐ 5–6h a day ☐ More than 6h a d

Section D: Information on diet

24. Do you usually eat breakfast, lunch and dinner every day?

☐

Yes

☐

No

☐

Not sure

25. Your diet:

☐

Is different every day

☐

Is different only sometimes during a week

☐

Is different only during the weekend days

☐

Is the same every day

26. Tick the diet you eat

☐

High protein content foods (meat, fish, eggs, cheese, dried legumes)

☐

High fat content foods (sausages, fried egg, cakes with butter and cream)

☐ High carbohydrate content foods (bread, yaw, rice, banku, fufu, tuozafo, biscuits)

☐ High vegetable food content (carrot, cucumber, green pepper and beans, etc.)

☐ Different foods every day

27. Over the past 7 days, how often do you eat the above diets?

☐ 1 to 3 days

☐ 4 to 7 days

☐ Don't know/Not sure

28. Which beverages do you usually drink between meals?

☐ Mineral water ☐ Soft drinks (cola, orange, soda, iced tea, tonic water, etc.)

☐ Alcoholic drinks (pito, wine, beer, etc.) ☐ Fruit/fruit juice

29. Do you take these beverages in all your meals?

☐ All the times

☐ Sometimes

☐ Don't know/Not sure

30. Do you drink at least 1–1.5L of water every day?

☐ Yes

☐ No

☐

Don't know/Not sure

Section E: Information on lifestyle

31. Smoking status:

☐ Never

☐ Former

☐ Current

32. Alcohol intake:

☐ Yes

☐ No

33. Which of the following describe your lifestyle?

☐ Very sedentary ☐ Sedentary ☐ Moderately active ☐ Very active

34. What do you prefer to do during free time?

☐ Watching TV ☐ Listening to music ☐ Sleeping ☐ Reading a book

☐ Others specify.....

35. How many hours do you spend on watching TV?

☐

1–2h a day ☐ 3–4h a day ☐ 5–6h a day

36. I will never lose weight due to my lifestyle

☐ Yes

☐ No

Section F: Information on quality of life

37. What area does your weight affect?

☐ Self-image

☐ Social life

☐ Others specify.....

38. Does your weight have impact in your life positively or negatively?

☐ Positively

☐ Negatively

39. Does your weight affect your self-esteem?

☐ Yes

☐ No

40. Do you feel satisfy about your body size?

☐ Yes

☐ No

41. Does your weight limit your social functioning?

☐ Yes

☐ No

42. Do you believe there are any health risks to being overweight?

☐ Yes ☐ No

43. Do you know the effects of being overweight?

☐ Yes ☐ No

44. Losing weight according to a specific program is my biggest hope

☐ Yes ☐ No

45. I will look better physically if I lose weight

☐ Yes ☐ No

46. I believe that my social relationship will change in a positive direction if I lose weight

☐ Yes ☐ No

47. Whatever I do, I will never lose weight or reach the weight I aim at

☐ Yes ☐ No

48. Do you feel pressure from the media to decrease your body fat level?

☐ Yes ☐ No

49. Do you feel pressure from the media to look in better shape?

☐ Yes ☐ No

50. Do you feel pressure from the media to improve your appearance?

☐ Yes ☐ No

51. Do you feel pressure from your friends to look in better shape?

☐ Yes ☐ No

52. Do your family members or friends encourage you to decrease your level of body fat?

☐ Yes ☐

APPENDIX J: INTERVIEW GUIDE FOR FOCUS GROUP DISCUSSION

Introduction

I would like to thank you for participating in this focus group discussion. The objective will be to explore current weight management practices among postmenopausal women. You have been asked to participate in this focus group discussion. I expect this discussion to last for about 45 minutes to 1 hour.

Demographic data and anthropometrics

Age.....

Religion.....

Marital status.....

Educational background.....

Ethnicity.....

Height.....

Weight.....

Waist circumference.....

Hip circumference.....

BMI.....

WHR.....

WHtR.....

Questions

1. What are your thoughts regarding your current weight?
2. Are you concerned about your current weight?

If you are concerned, why

If you are not concerned, why

3. What are the things you do to manage your weight?

Probe question

1. How often?

2. When do you do these?

3. How do you do these?

4. Why?

4. What type of support would help you to adhere to a weight management programme?

APPENDIX K: DEVELOPED EXERCISE PROGRAMME

The development of a culturally based exercise program is presented. The exercise-based program is divided into four sections; (1) Health assessment, (2) Pre-exercise parameters, (3) Exercise dosage, and (4) Physician Referral Form. Figure 1-7 outlines the components and exercise dosage of the exercise program

10.2. Section 1: Health assessment

Assess your health needs by marking all appropriate statements

1. Has a doctor ever recommended that you can only participate in medically supervised exercise due to a heart or other condition?

☐Yes ☐No

2. Do you experience chest discomfort with physical exertion?

☐Yes ☐No

3. Do you have pain in joints (back, knee, hip or other joints) that could be aggravated by physical activity?

☐Yes ☐No

4. Do you have pain when performing the following physical activity? (Tick appropriate option)

Squatting ☐

Walking ☐

Lifting ☐

Jumping ☐

None of the above ☐

Others ☐ specify.....

5. Have you on one or more occasions lost consciousness or fallen over as a result of dizziness?

☐Yes ☐No

6. Do you have blood pressure or a heart condition?

☐Yes ☐No

7. Has a doctor ever recommended medication for your blood pressure or a heart condition?

☐Yes ☐No

8. Are you aware, through your own experience or a doctor's advice, of any other risk factors that would prohibit you from exercising without medical supervision?

☐Yes ☐No

10.3. SECTION TWO: Pre-exercise parameters

Pre-exercise parameters for Low impact-cardio exercise

Step test will be used to measure aerobic fitness

Result.....

10.3.1. Pre-exercise parameters for resistance exercise

2. The senior Fitness Test (SFT) will be used to assess key physiological parameters (e.g. strength, endurance, agility, balance)

Result.....

3. What is your nutritional status?

Obesity ☐

Overweight ☐

Underweight ☐

Short stature ☐

4. What time of the day do you prefer to exercise? (Please tick appropriate)

Morning ☐

Afternoon ☐

Evening ☐

Night ☐

5. knowing your maximum heart rate can help determine exercise intensity.

To calculate your maximum heart rate, subtract your age from 220 = maximum heart rate.

.....

6. What is your physical activity status?

Sedentary ☐

Moderately active ☐

Active ☐

7. Which of the following means will serve as a preferred reminder for you to engage in exercises?

(Please tick appropriate)

Visual (posting quotes or notes, text or email messages etc.) prompts ☐

Telephone call ☐

Others ☐ Specify...

8. A house-hold indigenous recreational physical activity that involves a combination of good physical workout, social bonding and combines moderate to high intensity aerobic movements with intermittent active rest patterns can aid in weight reduction, do you prefer locally designed exercise programme?

Yes ☐

No ☐

9. What will motivate you to adhere to an exercise program? (**Tick appropriate**)

Reward/ incentives ☐

Family/ peers encouragement ☐

Improved health status ☐

Weight lose/reduction ☐

Improve self-esteem ☐

10. Indicate the mode of exercise programme delivery (Tick the appropriate box)

Written ☐

Video ☐

Demonstration and explanation ☐

Other ☐ Specify.....

11. What support do you need to achieve your exercise program goal? (Please tick appropriate)

Community support ☐

Family support ☐

Others ☐ Specify....

12. How would you prefer to receive support and advice when you are exercising? (Please tick the appropriate box)

Telephone ☐

Face-to-face ☐

Others ☐ Specify....

10.4. Basic education/instructions

1. Ensure you wear loose-fitting clothes to perform the following activities. Remain hydrated during the period of the exercise programme (it is suggested that drinking 2.7 litres of water per day is good for the body).

Ghanaian indigenous physical activity (Ampe) exercise dosage

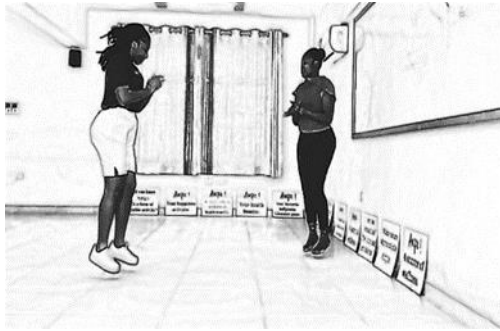


Figure 10.1.: Photograph showing Ampe exercise with two individuals in jumping ascending and descending movement.

Exercise Dosage: Moderate-intensity Ampe exercise of 3-4 sets, 3-4 times/week and 10-15 repetitions for 10-15 minutes

Theraband exercise (Resistance exercise)

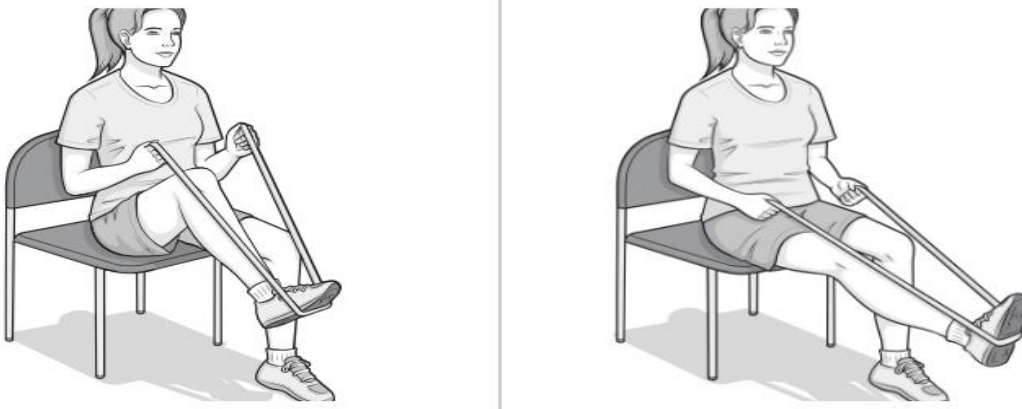


Figure 10.2. : Photograph showing exercise set-up with the patient seated in a chair with hand support, holding the theraband and performing exercise by extension and flexion of the elbow and knee

Exercise Dosage: 4 sets, 3-5 times/ week and 10 repetitions for 15-30 minutes

Squat to chair exercise (Resistance exercise)

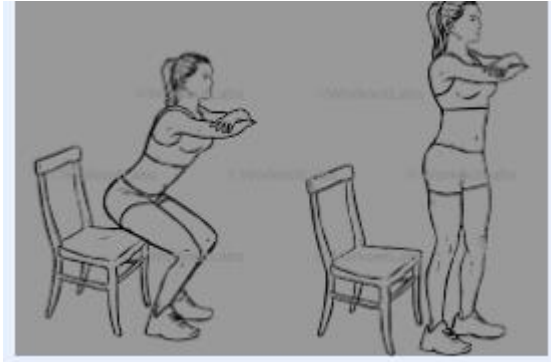


Figure 10.3: Photograph showing exercise set-up with the patient performing exercise by sitting and standing

Exercise Dosage: 3 sets, 3-5 times/ week and 10 repetitions for 5-10 minutes

Wall Push-ups (Resistance exercise)



Figure 10.4.: Photograph showing exercise set-up with the individual pushing the wall with the forearm and performing exercise by extension and flexion of the elbow

Exercise Dosage: 3 sets, 3- 5 times/week of 10 repetitions for 5-10 minutes

The Water Bottle Exercise (Resistance exercise)

Water-Bottle-floor Chest Press



Figure10.5. Photograph showing exercise set-up with an individual lying on the back and holding a plastic container with a specified amount of water and performing exercise by lifting and lowering the container by extension or flexion of the elbow joint

Exercise Dosage: 4 sets, 3-5times / week of 10 repetitions for 5-10 minutes

Water-bottle-overhead press



Figure 10.6: Photograph showing exercise set-up with an individual standing and holding a plastic container with a specified amount of water and performing exercise by lifting and lowering the container by extension and flexion of the shoulder joint

Exercise Dosage: 4 sets, 3-5times / week of 10 repetitions for 5-10 minutes

Standing water bottle biceps curls

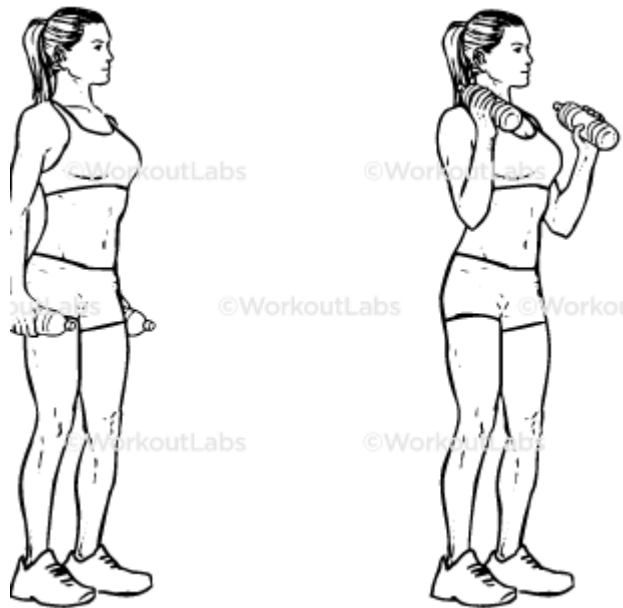


Figure 10.7.: Photograph showing exercise set-up with an individual standing and holding a plastic container with a specified amount of water and performing exercise by lifting and lowering the container by extension and flexion of the elbow joint

Exercise Dosage: 4 sets, 3-5times / week of 10 repetitions for 5-10 minutes

10.5. SECTION FOUR: Physician Referral Form

Dear Dr:

Your patient (name of patient) would like to begin an exercise program. After reviewing her responses to our cardiovascular screening questionnaire, we would appreciate your medical opinion and recommendations concerning her participation in an exercise program. Please provide the following information and return this form to us (name, address, telephone, fax of health/fitness facility co):

1. Are there specific concerns or conditions we should be aware of before this individual engages in an exercise program? **Yes/No**

If yes, please specify.....

2. If this individual has completed any exercise test, please provide the following:

a. Date of test.....

b. A copy of the final exercise test report and interpretation

c. Your specific recommendations for exercise training, including heart rate limits during exercise:

3. Please provide the following information so that we may contact you if we have any further questions:

.....I AGREE to the participation of this individual in an exercise program at any health/fitness facility.

.....I DO NOT AGREE that this individual is a candidate to exercise at any health/fitness facility because.....

Physician's signature.....

Physician's name.....

Address.....

Telephone Fax.....

Thank you for your help.

The elements of the culturally developed exercise program will be discussed briefly in the following section

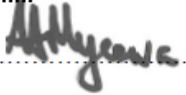
APPENDIX L: DECLARATION STUDENT'S CONTRIBUTION TO ARTICLE (S) AND AGREEMENT OF CO-AUTHOR(S)

Declaration: Student's contribution to article(s) and agreement of co-author(s)

I, ISAAC MENSAH BONSU, student number 1389584, declare that this Thesis/Dissertation/Research Report is my own work and that I contributed adequately towards research findings published in the article(s) stated below which are included in my Thesis/Dissertation/Research Report.

Signature of Student  Date: 20 March 2023

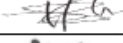
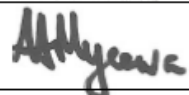
Name of Primary Supervisor: Professor Hellen Myezwa

Signature of Primary Supervisor  Date: 23-03-2023

Agreement by co-authors: By signing this declaration, the co-authors listed below agree to the use of the article(s) by the student as part of his/her Thesis/Dissertation/Research Report. In cases where the student is not the 1st author of a published article, the primary supervisor must explain (under comments) why the student is entitled to use the paper for his/her degree purposes.

Article 1: Title: Prevalence of excess weight and associated socio-demographic factors among postmenopausal women: A population-based study in Ghana

Journal name, year, volume and page numbers: African Journal of Primary Health Care & Family Medicine, 2023, 15(1), p.7. <https://doi.org/10.4102/phcfm.v15i1.3781>

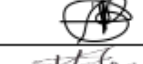
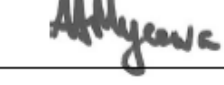
Authors	Name	Signature	Date
1 st author	Mensah Bonsu Isaac		20 March 2023
2 nd author	Brandt Corlia		23 March 2023
3 rd author	Adedayo Tunde Ajidahun		23-March 2023
4 th author	Moses Monday Omoniyi		20 March 2023
5 th author	Myezwa Hellen		23-03-2023
6 th author			

Comments by primary supervisor:

.....
.....

Article 2: Title: An exploratory study on excess weight gain: Experiences of Postmenopausal Women in Ghana

Journal name, year, volume and page numbers: Plos one, 2023, 18(1), p.e02789352023, <https://doi.org/10.1371/journal.pone.0278935>

Authors	Name	Signature	Date
1 st author	Mensah Bonsu Isaac		20 March 2023
2 nd author	Asamoah Benjamin		20 March 2023
3 rd author	Brandt Corlia		23 March 2023
4 th author	Adedayo Tunde Ajidahun		23-March 2023
5 th author	Moses Monday Omoniyi		20 March 2023
6 th author	Myezwa Hellen		23-03-2023

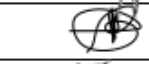
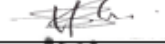
Comments by primary supervisor:

.....

.....

Article 3: Title: Physical activity, lifestyle, sociocultural factors and prevalence of excess weight gain among postmenopausal women: a cross-sectional study. Under review

Journal name, year, volume and page numbers: BMC Women's Health

Authors	Name	Signature	Date
1 st author	Isaac Mensah Bonsu		20 March 2023
2 nd author	Brandt Corlia		23 March 2023
3 rd author	Adedayo Tunde Ajidahun		23-March-2023
4 th author	Moses Monday Omoniyi		20 March 2023
5 th author	Myezwa Hellen		23-03-2023
6 th author			

Comments by primary supervisor:

.....

.....

APPENDIX M: PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Isaac Mensah Bonsu (Student number: 1389584

am a student registered for the degree of PhD in

the academic year 4TH.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or Without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

- I have included as an appendix a report from “Turnitin” (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: 

Date: 15/08/2023

APPENDIX N: TURNITIN REPORT



Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author: Isaac Mensah
Assignment title: Playground 2 Part 1 (Moodle TT)
Submission title: FINAL THESIS
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