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DIETARY AND LIFESTYLE PRACTICES IN RURAL AND URBAN SOUTH AFRICAN ADOLESCENTS

by

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A THESIS

Submitted to the Faculty of Health Sciences, University of the Witwatersrand, in fulfilment of the requirements for the degree

of

Doctor of Philosophy

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Declaration

I Modiehi Heather Sedibe declare that this thesis is my original work. Where there have been contributions from other people, this has been duly acknowledged. This thesis is being submitted for the degree of Doctor of Philosophy in the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any degree or examination at this or any other university.

Name: Modiehi Heather Sedibe

Signature: _____ day of

_____, 2016.

Dedication

I dedicate this work to my Heavenly Father, with you nothing is impossible, to my family: my daughter Lesedi, for always dreaming big; my son, Khutso for sacrificing not having me at home just so I could work and study. Know that you can be and do anything that God says you can do. To my husband Mothusi, thank you for the prayers, support, and for giving me the space and time to finish this.

To my parents, Albert and Bushy Legodi, and my siblings thank you for believing and encouraging me. To the Chitwoods and Meadows; Heidi, Charles, Grace, Luke and Ben, you are my family, thank you for seeing the potential in me and always supporting me, I appreciate you. To all who have contributed to this journey, friends who prayed and motivated me along the way, I wouldn't have made it without you.

Publications and presentations arising from this thesis

During the course of this PhD, four manuscripts have been produced, three have been published, and one is in review. Research findings have also been presented at conferences and at a research day. Funding grants were also attached to the study.

Original Publications

I. Voorend, C. G., Norris, S. A., Griffiths, P. L., Sedibe, M. H., Westerman, M. J., & Doak, C. M. (2013). 'We eat together; today she buys, tomorrow I will buy the food': adolescent best friends' food choices and dietary practices in Soweto, South Africa. *Public health nutrition*, *16*(03), 559-567.

Student's contribution to the paper

Design of the study, conducted literature search, conceptualized the paper, project management, training and supervision of fieldworkers, data collection, data management including cleaning and analysis, reviewing of the manuscript.

II. Sedibe, M. H., Feeley, A. B., Voorend, C., Griffiths, P. L., Doak, C. M., & Norris, S. A. (2014). Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment: original research. *South African Journal of Clinical Nutrition*, *27*(3), 114-119.

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Abstract

Introduction: Among adolescents, the occurrence of overweight and obesity has become a crucial public health challenge, in high-income and low- and middle-income settings. It is a phenomenon that has been strongly associated with environmental factors, particularly modifiable lifestyle factors and behaviours linked to diet and physical activity. Dietary practices and habits developed in childhood and usually maintained into adulthood, are said to predispose individuals to obesity and increased risk of metabolic diseases. South Africa is also undergoing rapid nutrition transition, which is associated with changes in dietary and physical activity patterns. Recent national findings have shown onsets of obesity among African children as early as 2-5 years of age, and the combined prevalence of overweight and obesity of 22.3% and 10.2% among 10-14 year old female and male adolescents, respectively. Not much is known about dietary, eating and physical activity practices of urban and rural South African adolescents, and the social factors that influence these practices within the home, community, and school environments. Research is needed to help inform interventions that curtail the burgeoning obesity epidemic among South African adolescents.

Aims: This thesis aimed to explore and compare dietary practices, eating practices, and lifestyle practices of adolescents across various levels of social influences including the household, school and community in rural vs urban adolescents.

Methods: This study employed a mixed methods study design, using both qualitative in-depth interviews and retrospective cross-sectional data. There are four studies to the thesis, with study components one, two, and three employing qualitative research, in both an urban and rural setting. **Firstly** a qualitative exploratory multiple case study approach was used to explore eating patterns, friendship and social interactions around dietary habits among 58 female adolescents (29 friend pairs) still in high school (mean age =18 years) in an urban Soweto setting; **secondly** narratives pertaining to dietary and physical activity

practices among 58 female adolescents (29 friend pairs) still in high school (mean age =18 years) in an urban Soweto setting; **thirdly** semi-structured duo-interviews to explore perceptions, attitudes, barriers and facilitators related to healthy eating and physical activity practices among 22 female adolescents (11 pairs) still in high school (aged 16-19 years) in rural Agincourt Health and Socio-demographic Surveillance System (AHDSS); **lastly** a cross-sectional quantitative assessment and comparison of dietary habits, eating practices, and anthropometric measurements were performed on rural (n=392, mean age=13 years) and urban (n=3098, mean age=14 years) South African adolescents.

Results: In **study 1**, among urban female friends, food sharing and money pooling was common. Joint food choices at school were mostly unhealthy, influenced by availability, prices and quality. Within shopping malls, food preference influenced joint food choices. In **study 2**, which was conducted on the same sample as study 1, majority of the urban girls were purchasing locally prepared convenience foods from school vendors instead of home-prepared breakfast, and most preferred to purchase food from the school tuck shop instead of using lunch boxes. “Kotas”, “fat” cakes and snacks were popular lunch choices because of their affordability, convenience, and popularity. Respondents engaged in minimal active recreational activities due to lack of facilities and safety concerns.
Findings of **study 3**, among rural adolescent girls, majority of participants considered locally grown and traditional foods to be healthy, but their consumption was limited due to availability. Female caregivers and school meal programmes were the main promoters of healthy eating practices. Limited food within the household was a barrier to eating breakfast before going to school, majority cited limited accessibility to healthy foods as a major barrier to healthy eating, and noted the increasing intake of “convenient and less healthy foods”. Girls were aware of the benefits of physical activity and engaged in various physical activities within the home, community, and schools.

According to **study 4** findings, there were differences in dietary habits and eating practices by gender and between urban and rural adolescents within the home, community, and school. After adjusting for gender, and site, irregular and regular frequency of consuming family meals, and irregular frequency of consuming breakfast on weekdays were all associated with increased risk of being overweight or obese. For mid-adolescent participants, irregular frequency of consuming breakfast on weekends within the home environment was associated with increased risk of being overweight and obese. For both early- and mid-adolescent participants, being male and residing in a rural setting were associated with reduced risk of being overweight and obese.

Conclusion: In conclusion, interventions aimed at reducing the increasing prevalence of overweight and obesity among adolescents in particular, have to be sensitive to socio-cultural contexts and specific realities within the different settings. Our findings suggest that future research aimed at addressing the increasing risk of overweight and obesity among rural, and especially urban adolescents; should investigate interventions to: (i) improve the availability and access to healthier breakfast options within the home; (ii) healthier and affordable fast food options within the community; (iii) subsidising good quality food, with the involvement of school vendors and tuck shops within school environments and (iv) improving dietary habits and eating practices within the home environment in order to reduce the risk of being overweight and obese among adolescents.

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Table of contents

Declaration i

Dedication ii

Publications and presentations arising from this thesis iii

Abstract vii

Acknowledgements x

Table of contents xi

List of tables xv

List of figure xvi

PREFACE xviii

PART 1: Literature Review and Study Context xxii

Chapter 1 Literature Review 1

1.1 INTRODUCTION 1
1.2 BACKGROUND 1
1.2.1 Nutrition transition 1
1.2.2 Non-communicable diseases (NCDs) 2
1.2.3 Association of dietary practices with NCDs 3
1.2.4 Obesity 4
1.2.5 Obesity prevalence among adolescents 5
1.2.6 Dietary practices of adolescents 7
1.2.7 Dietary Practices within the household environment 8
1.2.8 Dietary practices within the community environment 10
1.2.9 Dietary practices within the school environment 11
1.2.10 Physical activity practices of adolescents 12
1.3.2 Conceptual framework 18
1.4 GAPS IN LITERATURE 21
1.4.1 Thesis aim, specific objectives and hypothesis 22
1.4.2 Study Hypothesis (for the qualitative studies) 22

Chapter 2: Study Context and sampling 24

Chapter 2 Study context and sampling 24

2.1 SOUTH AFRICA 24
2.2 MIGRATION 24
2.3 HEALTH SYSTEMS CONTEXT 25
2.4 SOWETO 26

2.4.1 Socio-economic status *27*
2.4.2 Birth to Twenty Cohort *28*
2.4.3 Recruitment *28*
2.5 AGINCOURT HDSS: BACKGROUND 30
2.5.1 Setting *30*
2.5.2 Socio-economic status *31*
2.5.3 Health *31*
2.6 STUDY DESIGN 32
2.7 SYNOPSIS OF METHODS USED IN EACH STUDY COMPONENT 34
2.8 PILOTING OF THE STUDY INSTRUMENTS 36
2.8.1 Qualitative Interview Guides *36*
2.8.2 Quantitative Questionnaires *36*
2.9 DEPENDABILITY AND CREDIBILITY OF THE QUALITATIVE INTERVIEW SCHEDULES 37
2.10 RELIABILITY OF THE QUANTITATIVE QUESTIONNAIRE 38
2.11 ETHICAL APPROVAL AND CONSENT 38

PART 2: EMPIRICAL PAPERS 40

Chapter 3 40

Chapter 3 Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment 41

3.1 INTRODUCTION 41
3.2 METHODS 43
3.2.1 Recruitment and study design *43*
3.2.2 Conceptual framework and development of a semi-structured interview schedule *44*
3.2.3 Interview procedure *45*
3.2.4 Analysis *46*
3.3 RESULTS 47
3.3.1 Food and activities *48*
3.3.2 Individual factors that influence food choices *51*
3.3.3 Behaviour relating to dieting and physical activity *52*
3.4 DISCUSSION 53
3.4.1 Dietary practices *53*
3.4.2 Physical activity *54*
3.5 CONCLUSION 55

Chapter 4 56

Chapter 4 Qualitative study exploring healthy eating practices 56

and physical activity among adolescent girls in rural South 56

Africa 56

4.1 INTRODUCTION 56
4.2 METHODS 58
4.2.1 Study setting *58*
4.2.2 Study design and data collection *59*

4.2.3 Data handling and analysis *60*
4.3 RESULTS 61
4.3.1 Perceptions related to healthy eating practices *61*
4.3.2 Factors facilitating healthy eating practices *63*
4.3.3 Factors acting as barriers to healthy eating practices *65*
4.3.4 Perceptions related to physical activity *68*
4.3.5 Practices and factors facilitating physical activity *68*
4.3.6 Factors acting as barriers to physical activity *70*
4.4 DISCUSSION 70
4.6 CONCLUSIONS 74

Chapter 5 76

Chapter 5 Dietary habits and eating practices and how they associate with obesity in urban and rural black South African adolescents undergoing a health transition 76

5.1 INTRODUCTION 76
5.2 METHODS 77
5.2.1 Setting and study population *77*
5.2.2 Urban site: Soweto – Birth to Twenty cohort (BT20) *77*
5.2.3 Rural site: Agincourt – Health and Demographic Surveillance System (AHDSS) *77*
5.2.4 Dietary habits and eating practices assessment *79*
5.3.5 Anthropometry *81*
5.2.6 Statistical analysis *81*
5.3 RESULTS 82
5.3.1 Dietary habits and eating practices *85*
5.3.2 Association of dietary habits and eating practices with overweight and obesity risk *90*
5.4 DISCUSSION 99
5.4.1 Dietary habits and eating practices at home *99*
5.4.2 Dietary habits and eating practices in the community *102*
5.4.3 Dietary habits and eating practices at school *102*
5.4.4 Association of dietary habits and eating practices with the risk of being overweight and obese *104*
5.5 CONCLUSION 107
5.6 LIMITATIONS 107

PART 3: DISCUSSION AND CONCLUSION 108

Chapter 6 Discussion 108

6.1 INTRODUCTION 108
6.2 CONSOLIDATED FINDINGS 108
6.3 EMERGING THEMES 111
6.3.1 Applying mixed methods *111*
6.3.2 Cultural, peer influences, and site influences on dietary habits and eating practices *112*
6.3.3 The obesogenic environment *115*
6.4 THEORETICAL RELEVANCE 119
6.5 REFLEXIVITY 122
6.6 LIMITATIONS 123
6.7 FUTURE STUDIES 123

6.8 CONCLUSION 125

REFERENCES 126

APPENDICES 139

APPENDIX A: ETHICS CLEARANCE CERTIFICATE – SOWETO (QUALITATIVE) 140
APPENDIX B: ETHICS CLEARANCE CERTIFICATE – MPUMALANGA (QUALITATIVE) 142
APPENDIX C: INFORMATION SHEET – QUALITATIVE STUDIES 143
APPENDIX D1: CAREGIVER CONSENT FORM (FRIEND A) – QUALITATIVE STUDIES 146
APPENDIX D2: CAREGIVER CONSENT FORM (FRIEND B) – QUALITATIVE STUDIES 149
APPENDIX E: PARTICIPANT CONSENT – QUALITATIVE STUDIES 152
APPENDIX F: INTERVIEW GUIDE – QUALITATIVE STUDIES 155
APPENDIX G: ETHICS CLEARANCE CERTIFICATE – SOWETO (QUANTITATIVE) 159
APPENDIX H: ETHICS CLEARANCE CERTIFICATE – MPUMALANGA (QUANTITATIVE STUDY) 160
APPENDIX I: ETHICS CLEARANCE CERTIFICATE - MPUMALANGA 161
APPENDIX J: PARTICIPANT INFORMATION SHEET AND CONSENT FORM (QUANTITATIVE STUDY) 163
APPENDIX K: QUESTIONNAIRE (AGINCOURT AND BIRTH-TO-TWENTY) 166
ORIGINAL PAPERS 174
APPENDIX L: PAPER 1 175
'WE EAT TOGETHER; TODAY SHE BUYS, TOMORROW I WILL BUY THE FOOD': ADOLESCENT BEST FRIENDS' FOOD CHOICES AND DIETARY PRACTICES IN SOWETO, SOUTH AFRICA 176
APPENDIX M: PAPER 2 185
NARRATIVES OF URBAN FEMALE ADOLESCENTS IN SOUTH AFRICA: DIETARY AND PHYSICAL ACTIVITY PRACTICES IN AN OBESOGENIC ENVIRONMENT 186
APPENDIX N: PAPER 3 193
QUALITATIVE STUDY EXPLORING HEALTHY EATING PRACTICES AND PHYSICAL ACTIVITY AMONG ADOLESCENT GIRLS IN RURAL SOUTH AFRICA 194

List of tables

TABLE1.3.1: SUMMARY OF OVERWEIGHT AND OBESITY PREVALENCE AMONG CHILDREN, BASED ON RECENT SOUTH AFRICAN STUDIES 15
TABLE 2.1: CHARACTERISTICS OF THE BT20 COHORT(RICHTER ET AL., 2007) 29
TABLE 2.8.1: SUMMARY OF STUDY METHODS EMPLOYED IN THE STUDY COMPONENTS. 35
TABLE 3.3.1: ANTHROPOMETRIC CHARACTERISTICS OF THE PARTICIPANTS (N=58) 48
TABLE 5.3.1: ANTHROPOMETRIC CHARACTERISTICS OF EARLY-ADOLESCENT (Y13) BOYS VS GIRLS IN RURAL AND URBAN PARTICIPANTS (MEANS AND CIS WHERE APPROPRIATE) 83
TABLE 5.3.2: ANTHROPOMETRIC CHARACTERISTICS OF MID-ADOLESCENT (Y15) BOYS VS GIRLS IN RURAL AND URBAN PARTICIPANTS (MEANS AND CIS WHERE APPROPRIATE) 84
TABLE 5.3.3: COMPARISON OF DIETARY PRACTICES AND EATING HABITS BETWEEN GENDERS WITHIN SAME SITE IN THE EARLY-ADOLESCENCE (Y13) GROUP 87
TABLE 5.3.4: COMPARISON OF DIETARY PRACTICES AND EATING HABITS BETWEEN GENDERS WITHIN THE SAME SITE IN THE Y15 GROUP 88
TABLE 5.3.5: COMPARISONS OF DIETARY PRACTICES AND EATING HABITS BETWEEN SITES FOR Y13 AND Y15 AGE GROUPS 89
TABLE 5.3.6: MULTIPLE LOGISTIC REGRESSION ANALYSIS FOR RISK OF BEING OVERWEIGHT OR OBESE (BMI FOR AGE Z SCORES CUT OFFS), GENDER, SITE AND DIETARY PRACTICES IN DIFFERENT SETTINGS BY ADOLESCENCE STAGE 93
TABLE 5.3.7: MULTIPLE LOGISTIC REGRESSION ANALYSIS FOR RISK OF BEING OVERWEIGHT OR OBESE (BMI FOR AGE Z SCORES CUT OFFS), GENDER, SITE AND DIETARY PRACTICES IN DIFFERENT SETTINGS BY ADOLESCENCE STAGE 96
TABLE 6.2.1: CONSOLIDATED FINDINGS OF THIS THESIS 109

List of figure

FIGURE 1.2.5: WHO ESTIMATES OF THE WORLDWIDE PREVALENCE OF OBESITY IN WOMEN AGED 18 AND ABOVE (2015). 7
FIGURE 1.2.9: WHO ESTIMATES OF THE WORLDWIDE PREVALENCE OF INSUFFICIENT PHYSICAL ACTIVITY AMONG ADULTS 18 YEARS AND OLDER (2015). 14
FIGURE 1.3.1: THEORY OF TRIADIC INFLUENCE ON BEHAVIOUR (FLAY ET AL., 1995B) 19
FIGURE 1.3.2: THEORY OF TRIADIC INFLUENCE ON BEHAVIOUR (WHERE THE THESIS FITS IN) 20
FIGURE 2.4.1: MAP SHOWING REGIONAL LOCATION OF SOWETO-JOHANNESBURG, WHERE THE BT20 RESEARCH PROGRAMME IS LOCATED 27
FIGURE 2.5.1: MAPS SHOWING REGIONAL LOCATION OF THE AGINCOURT HEALTH AND DEMOGRAPHIC SURVEILLANCE SITE (KAHN ET AL., 2012) 31
FIGURE 2.7.1: MIXED METHODS STUDY DESIGN 33
FIGURE 3.2.1: EXAMPLES OF INTERVIEW QUESTIONS 46
FIGURE 3.3.1: AN EXAMPLE OF A SOWETAN KOTA(FEELEY A ET AL., 2009) 49
FIGURE 6.4.1: ADAPTED CONCEPTUAL FRAMEWORK 121

Nomenclature

BMI	Body mass index
DoH	Department of Health
FAO	Food and Agriculture Organisation
HST	Health Systems Trust
HICs	High-income countries
Kota	A South African fast food, composed of ¼ loaf of white bread filled with a range of ingredients (fried chips, cheese, processed meats, a fried egg and sauces)
LICs	Low-income countries
LMICs	Low-middle-income countries
MICs	Middle-income countries
Miroho	Green leafy vegetables
NCDs	Non-communicable diseases
NFCS	National food composition Survey
Quarter	see ‘Kota’
Samp	dried corn kernels that have been stamped and chopped until broken but not as fine as mealie-meal or mealie rice
SES	Socio-economic status
SSA	Sub-Saharan countries
UICs	Upper-income countries
UK	United Kingdom
US	United States
Vetkoek	Dough shaped into a ball and deep fried
WHO	World Health Organisation

PREFACE

As a girl who grew up in the dusty township streets of Tembisa, our family had few dietary choices, due to both our family income and to the limited availability of healthy food options at our local markets. Since my early high school years, I have been interested in nutrition, and in the role that healthy eating habits contribute to overall wellbeing. I obtained my BSc degree in Dietetics from MEDUNSA University (UL), and was blessed with the privilege of studying overseas, where I obtained my MSc in Nutrition from the Alabama A&M University.

After returning to South Africa, I was employed on a contract as a Researcher within the MRC/Wits Mineral Metabolism Research Unit at Wits. As a researcher, I was invited to participate in a Birth to Twenty (BT20) cohort study: “The Social Paradox of Obesity: Understanding the Impact of Poverty and the Urban Environment on Obesity Risk in Young Women”. I joined the BT20 study in 2008, after the study focus had transitioned to the adolescent participants. My qualifications as a daughter of the township environment, a student of dietetics and nutrition and as a PhD researcher made this assignment a perfect fit for me. From the first pilot interview with a pair of female teenagers from different local schools in Soweto, my heart was hooked. I was getting answers to questions and concerns I had personally been grappling with for a long time. I believed people’s dietary and eating patterns tell a thousand stories. And I have had the opportunity to capture those stories as part of the BT20 study and narrative, as well as to share the findings in my PhD thesis.

I was also able to bring a unique perspective to the study and analysis. My ability to re-word English queries into the home languages of the girls allowed me to capture

responses that were richer and deeper than simple replies. My cultural understanding of townships allowed me to recognize subtle contributing factors. For instance, food choices – and snack choices in particular – are often made with a sense of sharing in mind. Nutritionally poorer food choices, such as fatcakes, may be chosen over healthier choices, such as a piece of fruit, because fatcakes are cheaper, and can be shared among friends. “Bana ba motho ba ngwathelana hlogo ya tsie”, directly translates as “Siblings share a locust’s head”. In the township environment, whatever is eaten, however small it may be is to be shared with a friend, neighbour or family member. My knowledge of township shopping habits helped me understand some of the difficulties of our adolescent study participants. Not only are healthier items like fruits and vegetables more expensive, but they are also heavy and spoil more quickly. They can often only be purchased during once-monthly trips to the grocery store, and must be carried home on public transportation. Including them as a regular part of the family diet is a multi-faceted challenge.

I was also able to interview girls in the area of rural Agincourt Health and Socio-demographic Surveillance System (AHDSS), South Africa. I heard their stories and compared their lives, experiences, and health statistics to those of the girls I had interviewed in Soweto. I tailored some questions for the rural participants and asked them about inclusion of their traditional foods, their role in growing and cooking these foods, and what they choose to eat and why. Data related to physical activity and dietary and eating practices were also collected and analysed for both groups of girls. Quantitative data related to dietary habits and eating practices and associated obesity risk factors of female and male adolescents from the rural and urban sites were also analyses and compared.

The PhD journey of protocol development, literature review, data cleaning, management and analysis, and writing scientific papers has enlightened me. This PhD thesis is presented 'with publications' and contains a series of four manuscripts. All articles have either been published in or are currently under review by peer-reviewed journals. The format is divided into four parts:

- Part 1:
    - Chapters 1 and 2 contain the literature review and the contextual relevance of the work undertaken, and give details of the two study settings.
- Part 2:
    - Chapters 3-5 contain the three studies undertaken for this project: a) a qualitative study exploring narratives of urban female adolescents in Soweto, South Africa, about their dietary and physical activity practices in an obesogenic environment ; b) a qualitative study assessing facilitators and barriers to healthy eating practices and physical activity among adolescent girls in rural Agincourt Health and Socio-demographic Surveillance System (AHDSS), South Africa; c) a quantitative survey comparing dietary habits and eating practices and their associations with obesity among urban (Soweto) Birth to Twenty Cohort (Bt20) vs rural Agincourt Health and Socio-demographic Surveillance System (AHDSS), South African adolescents. The researcher used data that was collected in the set study settings.
    - The forth study undertaken as part of the thesis is attached as Appendix L, as the researcher was not the first author of the publication, but she mainly involved in conceptualising the study, collecting and analysing data, and editing of the manuscript. The study sample was the same as for study 1. This was a qualitative study exploring how best friend pairs of female adolescents at the verge of adulthood engage in shared eating and joint food choices in the context of living in Soweto, South Africa.

- Part 3:
    - Chapter 6 consolidates and discusses the results of the four studies and includes a conclusion and recommendations for further work.

PART 1: Literature Review and Study Context

Chapter 1 Literature Review

1.1 Introduction

This chapter presents a brief introduction and literature review on nutrition transition, non-communicable disease (NCDs) and modifiable risk behaviours for NCDs (with particular focus on overweight, obesity and physical inactivity), and dietary and lifestyle practices of adolescents.

1.2 Background

1.2.1 Nutrition transition

South Africa is not excluded from the rapid transition which is being experienced by Sub-Saharan African (SSA) countries. With the increasing urbanization and changing lifestyle factors, is nutrition transition, and economic development which are characterised by changes in diet and physical activity patterns (Abrahams et al., 2011). There is an overall increase in the consumption of an energy-dense diet high in fat, particularly saturated fat, and high in carbohydrates. This in addition to a decline in energy expenditure related to a sedentary lifestyle, motorized transport, labour-saving devices at home and at work largely, and leisure time often being dominated by physical un-demanding pastimes, are physically un-demanding tasks.. An increasing trend of chronic energy deficiency coexisting with obesity is also evident in many low- and middle- income countries (LMICs)(China, South Africa, Vietnam, Brazil) (Wang et al., 2002, Popkin, 2001). These transitions create public health challenges, whereby SSA is accelerating from the stage of receding famine to nutrition related NCDs stage, and failure to address the problem may impose significant burden for the health sector and the economy of SSA countries (Asfaw A, 2005), with increasing households experiencing the dual burden of underweight and obesity simultaneously (Collaboration, 2004, Doak et al., 2004). There is increased access to a

broader range of food products that are high in fat and sugar, especially among urban residents, and therefore within the same country, rural and urban areas may be at different stages of nutrition transition. At the same time, families rely more on processed foods, as more women are working, which leaves less time for growing and making food, shopping for ingredients and the preparation of energy-dense staple traditional diets. This reliance on processed foods, is one factor in the development of obesity (Popkin, 2006). In slowing down the rising increase in obesity, dietary practices and exercise are the key modifiable risk factors. A number of authors argued that urban residents of low- and middle-income countries (LMICs) are more likely to engage in sedentary lifestyles and consume Westernized diets, and as a result, their mean BMI is likely to increase as compared to their rural counterparts (Lopez et al., 2006, WHO, 2000, Mathers and Loncar, 2006). In a study conducted within 38 LMICs, where the role of socioeconomic status in the association between urban and rural residences and BMI was investigated, it was found that the mean BMI and prevalence of overweight in these countries was generally higher within the urban vs rural areas, but the individual and household level SES measures were responsible for much of the differences (Neuman et al., 2013).

1.2.2 Non-communicable diseases (NCDs)

Based on World Health Organization (WHO) report in 2011, NCDs contributed to deaths in excess of 36 million annually and just over 63% of the world's deaths (Alwan, 2011). By 2020, global chronic disease related deaths will worsen by at least 15 to 20%. According to WHO, by 2030, the total number of deaths from NCD will reach 55 million, with cardiovascular, cancer, diabetes and chronic respiratory disease estimated as the four major leading causes that will contribute to 75% of the deaths worldwide (Alwan, 2011). Eighty percent of these deaths occur in LMICs (WHO, 2009a, WHO, 2000), and they are preventable. These are populations with the least financial cushion to withstand the economic consequence of NCDs (WHO, 2009a), as they mostly have to pay for health care privately or directly out of their pocket, which will hinder economic development in many of

these countries. Achieving the anti-poverty Millennium Development Goals will be hindered if NCDs are not addressed, as they are an under-appreciated cause of poverty and a major barrier to economic development around the world (Yach et al., 2004, Beaglehole et al., 2011, Tunstall-Pedoe, 2006).

Globally, 44% of deaths caused by NCDs were in people younger than 70 years, whereas in high-income countries (HICs) the rate was less at 26%, and 48% in LMICs within the same age group. Sub-Saharan Africa (SSA), is currently experiencing one of the most rapid epidemiological transitions whereby mortality from infectious diseases and nutritional deficiencies is decreasing while mortality from NCDs is increasing (Mayosi et al., 2009). In South Africa, consensus was reached at the South African Summit on the Prevention and Control of NCDs in Gauteng on 12 and 13 September 2011 that NCDs require intensified national action including a strategic plan that addresses prevention, early detection, behavioural change and universal treatment (Participants in the South African summit on the Prevention and Control of Non-Communicable diseases, 2011).

1.2.3 Association of dietary practices with NCDs

Due to changes in dietary and lifestyle patterns, diet-related diseases such as obesity, diabetes mellitus, cardiovascular diseases, hypertension and stroke, and different forms of cancer, are causing disability and premature death in LMICs. The prevalence of obesity in both high-income and low- and middle-income country populations, is on the rise (Abegunde et al., 2007, Vorster, 2002), and a recent estimate predicted that in 2030 an estimated 2.16 billion adults globally will be overweight and 1.12 billion will be obese (Kastorini et al., 2011). Unhealthy dietary practices, obesity, hypertension, tobacco use, risky drinking, and sedentary lifestyle are risk factors leading to morbidity, mortality and impaired function (WHO, 2002), with unhealthy dietary practices being a modifiable risk behaviour and a major risk factor for most NCDs.

Being overweight and/or obese during childhood and adolescence, has been shown to increase one's risk of developing NCDs in their corresponding adulthood (Singh et al., 2008). Eating behaviours that have been linked to overweight and obesity include snacking/eating frequency, binge-eating patterns, eating out, and (protectively) exclusive breastfeeding. Nutrient factors under investigation include fat, carbohydrate type (including refined carbohydrates such as sugar), the glycaemic index of foods, and fibre. Environmental issues are clearly important, especially as many environments become increasingly ''obesogenic'' (obesity-promoting).

1.2.4 Obesity

Globally, 2.8 million people die annually as a result of being overweight (BMI >25kg/m^2) and obese (BMI >30 kg/m^2) (Icks et al., 2009, Resnikoff et al., 2004), which are preventable risk factors for NCDs. Increasing body mass index (BMI) increases the risks of coronary heart diseases, ischaemic stroke and type II diabetes mellitus. Between 1980 and 2008, the prevalence of obesity had nearly doubled, where 10% of men and 14 % women were obese. In 2004, increased BMI alone was estimated to account for 2.8 million deaths worldwide, while the combined total with physical inactivity was 6.0 million. In 2008, 35% of adults aged 20 years and older were overweight (34% men and 35 % women) (WHO, 2009b) . Six percent of children in preschools had a weight-for-height above >2 standard deviations (SD) of the WHO child growth median (WHO, 2009b) . Obesity rates have doubled in HICs, and MICs had more than twice the prevalence of overweight than lower-income countries (LICs), and women were twice as obese as men in LICs. The prevalence of obesity was more than three times in both sexes from 7% in LICs to 24% in upper income countries (UICs). While the highest prevalence was seen in UICs, the LICs where having the fastest increase in overweight prevalence (Alwan, 2011).

1.2.5 Obesity prevalence among adolescents

A drastic increase in the prevalence of overweight and obesity has been mainly seen among adolescent individuals over the past twenty years in UICs, MICs, and LICs (De Onis and Blössner, 2000, Samuelson, 2000), a phenomenon that has been strongly associated with environmental factors, particularly modifiable lifestyle factors and behaviours linked to diet and physical activity(Eisenberg et al., 2005) . The risk of overweight and obese youth becoming overweight adults has been demonstrated in a review study(Singh et al., 2008), and the tracking of both physical activity and diet between childhood and adulthood has also been confirmed (Craigie et al., 2011).

In a pooled sample of urban African adolescent females aged 15 years and older, from 6 countries (Burkina Faso, Ghana, Malawi, Niger, Senegal, and Tanzania), obesity rates increased from 17.9% to 25.4% in a period of just over a decade (1992-2003) (Ziraba et al., 2009), whereas in Ghana the prevalence of overweight adolescent girls aged 15-19 years rose from 8% to 10.3% between 2003 and 2008 (Organization, 2006). In South Africa, research has indicated that childhood and adolescent obesity has become a major public health problem (Demographic, 2003, Reddy et al., 2012a, Shisana et al., 2013). This could be attributed mainly to the current food environment that has changed over the last decade (Bourne et al., 2002) in accordance with the health transition in LMICs that has also seen a move away from prudent, low-energy, low-fat diets traditionally followed in rural areas, to more Westernised high-energy, high-fat diets (Bourne et al., 2002, Vorster, 2002). Very early onset of obesity has been confirmed among African female and male children aged 2-5 years of age in the recent South African National Health and Nutrition Examination Survey (Shisana et al., 2013), where the combined prevalence of overweight and obesity was found to be 23.8% and 21.9% respectively; among African females and males aged between 2-14 years of age, this prevalence was also high at 28.1% and 12% respectively, and among adolescents aged 15 to 17 years of age, it was 27.3% in females and 8.8% in males, and among young females and males 15-24 years of age, 40.9% and 9.5% respectively

(Shisana et al., 2013). These are comparable to findings from the second national South African Youth Risk Behaviour Survey (SAYRBS) conducted among adolescents aged 13 to 19 years (n=9224), the combined overweight and obesity prevalence almost doubled in black males (6.9% to 11.5%). Among female participants, the prevalence of combined overweight and obesity increased significantly from 30% to 37.6% between the 1st and 2nd SAYRBS (Reddy et al., 2012a).

Previously in urban Soweto, within the Birth to 20 cohort, at age 17 years, the combined prevalence of overweight and obesity among girls and boys was 27.3% and 6.9%, correspondingly (Feeley A et al., 2009). The WHO map (Figure 1.2.5) shows the worldwide distribution of obesity in women; it can be seen that in countries marked with the darkest colour/green (including USA, few countries in South America and South Africa), the prevalence of obesity is 30% or more.

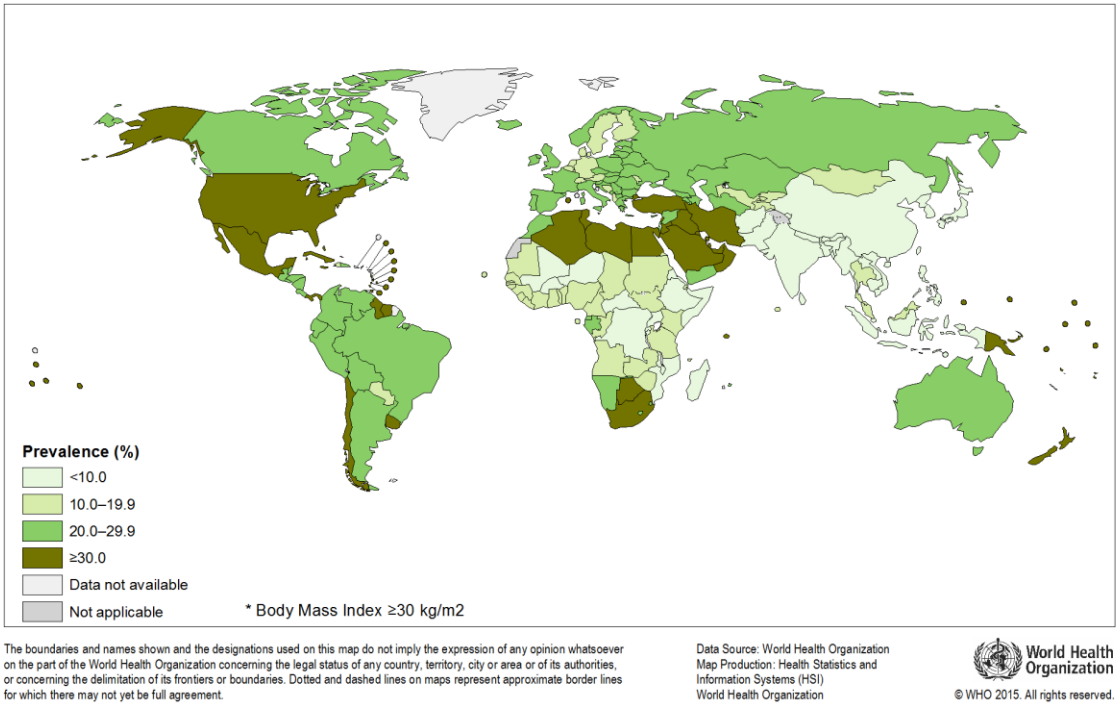

Figure 1.2.5: WHO estimates of the worldwide prevalence of obesity in women aged 18 and above (2015).

1.2.6 Dietary practices of adolescents

Adolescence, is a critical phase in human development, characterised by increased vulnerability and exposure to different types of stress, including nutritional insults (malnutrition)(Delisle et al., 2005a), and is regarded as one of the most difficult life periods. During this period, adolescents undergo many changes on several levels (psychological, physical, environmental and social) and take on the responsibility for their own health-related behaviours, including dietary and eating practices (Casey et al., 2010). These practices seem to already be established during adolescent years and are mostly associated with obesity risk factors due to high energy density diets, high consumption of sugar-sweetened beverages, large portion sizes, poor eating patterns (such as meal-skipping), high levels of sedentary behaviour and low levels of physical activity (Eisenberg et al., 2005). Within the Soweto cohort, poor eating habits were found to be already established by 13 years of age, within the home, adolescent girls and boys from age 13 to 17 years old showed a decrease

in regular breakfast consumption practices (76.4 to 65.3%, respectively) (Feeley et al., 2012). Interestingly, there was an increase in the consumption of snack food items such as chocolate, cakes, and fried chips, while watching TV. Also with increasing age, there was a 27% decline in girls who consumed the main meal with the family. In the school setting, lunch box usage was not common at any age, and it declined from 17% to 8.6% by 17 years of age. Significantly more females were found to bring lunch boxes to school than boys (Feeley et al., 2012). More than 80% of participants bought food from the tuck-shop, with the five most popular purchases at all ages being sweets, crisps, cold drinks, fried chips, and white bread, which accounted for 62% of purchases. Within the community environment, female participants consumed more confectionary options than males, with the three most popular confectionary/beverage items being sweets, crisps, and soft drinks, accounting for >65% of items consumed at all time points. From rural South Africa, findings from a cross sectional study in Mpumalanga showed combined overweight and obesity prevalence from age 14, averaging 18% in females and 4% in males and reaching 25% at 18 years in girls (Kimani-Murage et al., 2010).

1.2.7 Dietary Practices within the household environment

The frequency of breakfast eating in children and adolescents as part of dietary behaviour has public health and developmental consequences, as breakfast is recommended as part of a healthy diet because of its association with healthier macro and micronutrient intakes, BMI and lifestyle (Ruxton and Kirk, 1997). In a number of recent European studies, eating breakfast regularly was associated with a reduced risk of becoming overweight and obese, and a reduction in BMI in children and adolescents (Szajewska and Ruszczyński, 2010).

In a study where regular breakfast consumption and its benefits were reported among adolescents, the consumption of a healthful breakfast that doesn't provide excess energy was important, breakfast consumers were more likely to have better overall diet quality, and skipping breakfast was found to be common behaviour in overweight and obese adolescents

(O'Dea, 2003a). Regular breakfast consumption has also been positively linked to children and adolescents cognitive function, school performance, and school attendance (Pollitt et al., 1981, Pollitt, 1995, Murphy et al., 1998, Michaud et al., 1991, Conners and Blouin, 1983).

European review studies showed that even when breakfast eaters consumed more calories daily, their likelihood of being overweight was less (Rampersaud et al., 2005). Regular breakfast consumption has been found in 76-88% Swedish adolescents aged 15-19 years of age (Sjöberg et al., 2003). Among US adolescents, breakfast consumption has been on a decline with recent estimates of 20-30% of them skipping breakfast, and the risk of breakfast skipping being higher among female adolescents, those from lower socio-economic backgrounds, and increasing with age of children and adolescents (Siega-Riz et al., 1998, Haines et al., 1996, Morgan et al., 1986). In a USA based study which investigated eating patterns and nutrient intakes of adolescents, 34% skipped breakfast (Deflandre et al., 2004). Common barriers cited to eating breakfast regularly encompassed lack of time, not feeling hungry in the morning, and concerns about weight (Reddan et al., 2002).

Looking at the South African context, there has been an emergence of poor breakfast habits among urban males and females adolescents as observed within the Birth to 20 cohort, with girls and boys aged between 13, 15, and 17 years old showing a decrease in regular breakfast consumption as a practice (76.4%, 63.8%, and 65.3% accordingly) (Feeley et al., 2012), indicating an increase in breakfast skipping. In the recent SANHANES-1, among children aged 10-14 years of age, 68.4% indicated that they ate breakfast before school; 19% did not eat breakfast before school, and 12.9% consumed it sometimes. The majority of participants reported to not being hungry in the early morning (39.2%), not having enough food in the house (33.9%) or people within the household not having breakfast (33%) as the most common reasons for skipping breakfast (Shisana et al., 2013). More children from formal urban than from rural informal communities consumed breakfast at home

sometimes(14.2% vs 9.8%, respectively) (Shisana et al., 2013). In a Cape Town based study among adolescents 12-17 years of age, 22% did not have breakfast before school (Patnode et al., 2010).

In the Birth to 20 cohort, a 27% decline was found in females adolescents who consumed the main meal with the family (Feeley et al., 2012), with increasing age. In Minnesota, USA study, school-based intervention study, "Teens Eating for Energy and Nutrition at School (TEENS)", which involved parents of junior high and middle school adolescents, parents often allowed their teens to eat dinner separately from the rest of the family, the adolescent would be in the house but in a different room, or eat at a different time such as is possible (Boutelle et al., 2003).

1.2.8 Dietary practices within the community environment

Within the community environment, in the state of Minnesota, more than 20% of adolescents (mean age=25.9 years) had consumed fast food items on three or more occasions in the previous week, with 75% eating fast foods once a week (Allison et al., 1999). Interestingly, compared to findings of the South African Human Sciences Research Council (HSRC) national survey 2009 conducted among participants 16 years and older; 18.1% of the participants consumed street foods and fast foods frequently (2 or more times) in a week (Steyn et al., 2011). . The majority of the black participants spent less than R20 ($2.90) on street food per week, which comprised the bigger percentage of their fast food and street food consumption (6.9%). The odds of purchasing fast foods and street foods frequently was also positively linked to improved SES indicators such as: employment, living in a formal house, living in a formal house with water and electricity in the home, in possession of home assets such as refrigerator, freezer and microwave oven, electric stove, TV, having a motor vehicle and DVD player (Steyn et al., 2011). Also among the Birth to 20 adolescents, there was some increase in the consumption of food items such as chocolate,

cakes, fried chips, fruit, and snacks, whilst watching TV (Feeley et al., 2012). Feeley A et al, 2009 found that the most frequently consumed fast food items among Sowetan adolescents were the local energy dense kota (quarter-loaf of white bread filled with fried potato chips, processed cheese and any other processed meats and sauces) (30.7%), chips (21.8%), and vetkoek (fried dumpling made from wheat)(12%) (Feeley A et al., 2009). Sowetan females were found to consume more confectionary options than males, with the three most popular confectionary/beverage items being sweets, crisps, and soft drinks, accounting for >65% of items consumed at all-time points (Feeley et al., 2012). In the Agincourt (rural) community, findings of a pilot study identified the most common available and consumed fast foods were the vetkoek fried chips, and the kota (Feeley et al., 2011).

1.2.9 Dietary practices within the school environment

The different social environments shape school eating practices, with factors such as peer influence, personal preference, food availability, and cost of food at school, but the home environment can strongly impact on food consumed if adolescents take lunch boxes to school. In a cross sectional survey of 20 high schools in USA, among Grade 9-12 adolescents, 72% did not use lunch boxes in the previous week, and 31% reported to purchasing snacks from the school vending machine (Neumark-Sztainer et al., 2005). Findings of the SANHANES-1 survey, revealed that more than half (51.1%) of children aged 10–14 years did not take a lunch box to school whereas only 37.6% of them did. Those in rural informal setting were significantly less likely (25.3%) to take lunch boxes to school than ones from urban formal (47.6%) and urban informal (40%) settings, with no significant differences in gender (Shisana et al., 2013). Overall, the most common reason indicated for not taking a lunch box to school was that the food at school was enough for the whole day (37.2%), followed by nothing at home to put in the lunchbox (29.8%), no one at home to help make lunch (18.3%), other children will want their food (18%) and lastly not having a nice container (17.1%) (Shisana et al., 2013).

Among Sowetan adolescents, lunch box usage at school was not common at any age, and it declined from 17% to 12% and 8.6% for each age group, 13,15, and 17 years, respectively, but significantly more females brought lunch boxes to school than boys in each age group (Feeley et al., 2012). Earlier findings showed that more than 80% of Sowetan adolescents bought food from the tuck-shop, with the five most popular purchases at all ages being sweets, crisps, cold drinks, fried chips, and white bread, which accounted for 62% of purchases, and in the same population, overweight and obesity prevalence were found to be on the increase among female vs male (20.9% vs 4.4%; and 6.3% vs 2.5) adolescents, respectively and more than 35% of adolescents reported to eating more than eight fast food items per week (Feeley A et al., 2009).

Of Capetonian adolescents, 41-56% of the students were found to bring food to school, even though most of the items were unhealthy, and 69.3% of the participants had purchased food at school (school store or local vendor) on the previous day, with 73% of the purchases being of two or more unhealthy items. Significantly more girls (74.6%) than boys (62.9%) bought food from school, and majority (85.7%) of the purchases were considered as unhealthy (Temple et al., 2006).

1.2.10 Physical activity practices of adolescents

Evidence shows that engagement in physical activity may be a proxy for a generally healthier lifestyle; in addition, with physical fitness (which relates to the ability to perform physical activity), they are important modifiers of mortality and morbidity related to overweight and obesity in adulthood. Physical activity is an important determinant of body weight, and a sedentary lifestyle has been shown to be a strong convincing etiological factor in increasing the risk of weight gain and obesity (Fogelholm and Kukkonen-Harjula, 2000). There is firm evidence that moderate to high fitness levels provide a substantially reduced risk of cardiovascular disease and all-cause mortality and that these benefits apply to all BMI levels (Fogelholm and Kukkonen-Harjula, 2000). As a lifestyle, physical inactivity is a key

determinant of overweight and obesity (Lee et al., 2012, Reddy et al., 2010). In a study including data from 22 African countries, a high proportion of men 84% vs 76% women were meeting the global physical activity recommendations (Cook, 2012). Leisure time activity at 5% was consistently low across genders, and work activity (moderate or vigorous combined) contributed the most (49%) to total physical activity time, followed by transport relate activity (46%), even though levels of physical activity varied significantly across the different countries and sub-groups (Cook, 2012).

Within the South African context, physical inactivity has been described as a “major public health problem” that has a substantial contribution to the growing national NCD epidemic (Reddy et al., 2010); and among females aged 15 to 55 years, where the rate of obesity was 28.9%, women with lower physical activity were found to be at greatest risk for increased body mass index (Feeley A et al., 2009). Also according to the South African National Health and Nutrition Examination Survey (SANHANES-1), 50.2% of participants aged 18–24 years of age were reported to be inactive(Shisana et al., 2013). In a recent survey conducted by the WHO in 51 mainly low- and middle-income countries, the prevalence of physical inactivity was higher among women, older people, and those living in urban areas, and participants aged 18 to 29 years had inactivity prevalence that was higher among females at 19.1% vs 13.2% males (Guthold et al., 2008). Recent studies that focused on overweight and obesity prevalence among South African children are summarised in Table 1.3.1.

The WHO map (Figure 1.2.9) shows the worldwide distribution of insufficient physical activity in women over 18 years of age; it can be seen that South Africa (marked with the darkest colour), is among the very few countries with the highest prevalence (≥50%) of insufficient physical activity in females.

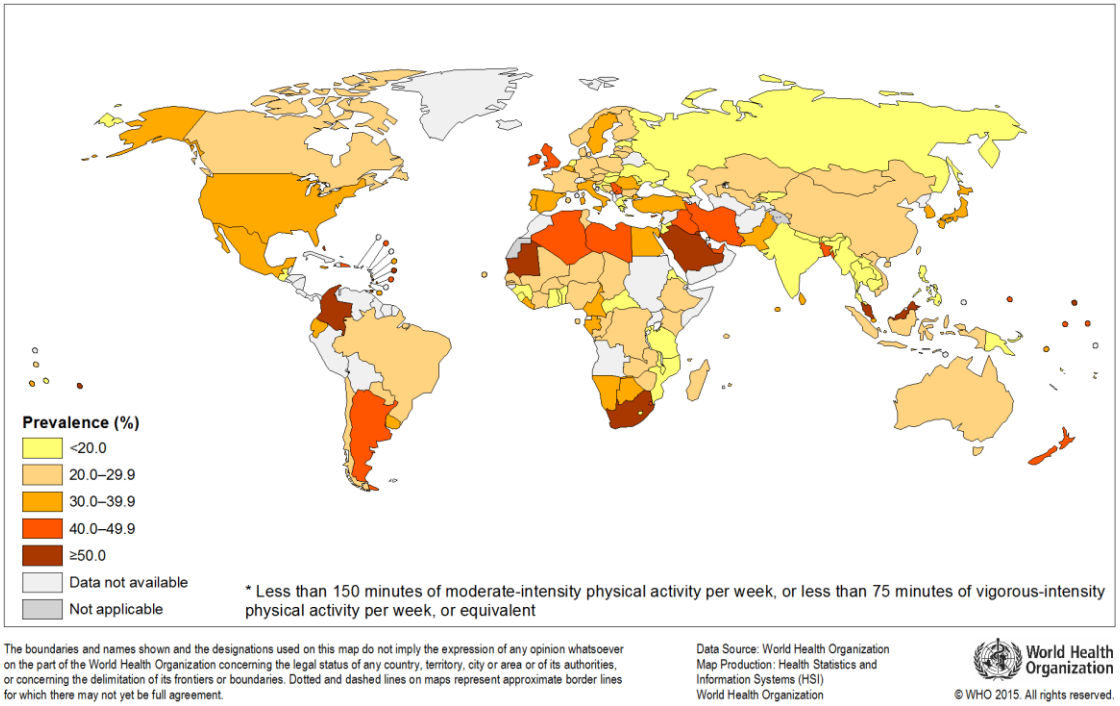

Figure 1.2.9: WHO estimates of the worldwide prevalence of insufficient physical activity among adults 18 years and older (2015).

Table1.3.1: Summary of overweight and obesity prevalence among children, based on recent South African studies

Source	**Title**	**Year of Study**	**Coverage**	**Age/schooling of group**	**Ethnic group**	**Area**	**Sample size**	**findings**
Department of Health, Republic of South Africa & Department of Health, Medical Research Council, OrcMacro	South Africa Demographic and Health Survey	1998	national	≥ 15 yrs	All	rural & urban	males = 1772; females = 2016	Men obese or overweight - 29.2%; women obese or overweight -56.6%;
Steyn et al. (2005)	NFCS	1999	national	1-9 yrs	All	rural & urban	n=2894	Overweight and obesity prevalence - 17.1%; Urban dwellers highest prevalence; Lower SES associated with decreased risk
Armstrong et al. (2006)	Health of the Nation Study	2001 - 2004	national	6-13 yrs	Mixed	Random sample of primary schools within each province and SE category; Rural/urban	n=10195	Prevalence of overweight and obesity 14%, 3.2% for boys and 17.9%, 4.9% for girls
Jinabhai et al. (2005)	Review of 4 cross-sectional studies	1994-1998		2-5; 4-11; 2-5; 8-11 yrs	Mixed	KwaZulu-Natal Rural/urban	n=18823	Overweight and obesity prevalence between 7% and 34.1%; Overweight more prevalent in girls than boys

Monyeki et al. (1999)[1]	Ellisras Longitudinal Investigation	1996	Limpopo	3-10 yrs	Black	Limpopo Rural	n=1336	0-2.5% in males and 0-4.3% in females had BMI above NHANES III 85th percentile
Kruger et al. (2006)	THUSA Bana	2000-2001	North West	10-15 yrs	Mixed	North West Province, Rural/urban	n=1257	Overweight and obesity prevalence 7.8%. More prevalent in girls than boys. White children: highest prevalence (14.2%), followed by black (7.1%), Indian (6.4%), Mixed Ancestry (2.9%)
Reddy SP et al, 2012	Rapid Increases in Overweight and Obesity Among South African Adolescents: Comparison of Data From the South African National Youth Risk Behaviour Survey in 2002 and 2008	2008	national	G 8-11; mean age(16.2 yrs)	mixed	rural & urban	males n=4870 females n= 5058	overweight prevalence total 20.2%; in males 11% females 29%; obesity prevalence total 5.5%; in males 3.3% females 7.5%

Reddy SP et al, 2008	NYRBS 2008.	2002	national	mean age(16.7 yrs)	mixed	rural & urban	males n=4757 ; females n=5458	overweight prevalence total 16.4%; in males 6.3% females 24.3%; obesity prevalence total 3.5%; in males 1.6% females 5.0%
Parker W et al, 2013	the SANHANES-1 Team (2013) South African National Health and Nutrition Examination Survey (SANHANES-1)	2012	national	2-14 yrs	African	rural & urban	males n=1629; females n = 1681	Males: overweight 11.9%; obesity 4.8%; Females: overweight 16.2%, obesity 7.3%
Parker W et al, 2013	the SANHANES-1 Team (2013) South African National Health and Nutrition Examination Survey (SANHANES-1)	2012	national	15-24 yrs	mixed	rural & urban	males n=784; females n=1218	Males: overweight 13.1%; obesity 5.7%; Females: overweight 44.6%, obesity 29.7%

1 Monyeki et al. (1999) used 85th percentiles of the NHANES III to estimate overweight, the remaining studies used IOTF (93) cut-off points to estimate overweight and obesity.

1.3.2 Conceptual framework

Conceptual models are useful in understanding and explaining the dynamics of health behaviours, the processes for changing behaviours, and the effects of external influences on the behaviours (Chopra M, 2009,). The majority of ecological models mainly explain behaviour, but the Triadic model of influence is one of the few recent ones that apply specifically to health behaviour and health promotion. The Triadic model of influence on behaviour framework (Flay et al., 1995, O'Dea, 2002) as illustrated in figure 1.3.1 has influenced the framework of this PHD. According to the model, genes and the environment are assumed to affect all behaviour, with the three main streams of influence on the behaviour being intra-personal, social, and cultural (Flay and Petraitis, 1994). It was also deemed ideal to the different environments within which the study was conducted, as it provides a framework for exploring the influence of the broader cultural environment (family cultural beliefs) and the social context of the school, peers and the community in relation to dietary and lifestyle practices, as a behaviour, while taking into account personal characteristics. Cultural factors represent the broad macro-environment, including factors such as religion and ethnicity. The social situation represents the immediate micro-environment, including influences such as household structure, parenting, peers, community, and factors that relate to the physical environmental. Biological and personality factors represent stable intrapersonal influences, originating from an inherited disposition (gender and age) and personality characteristics. Understanding these practices among adolescents and the influences of the different streams of influence, will also help inform interventions targeted at modifying these practices. Small modifications have been made to the model to adapt it to the study context (Figure 1.3.2).

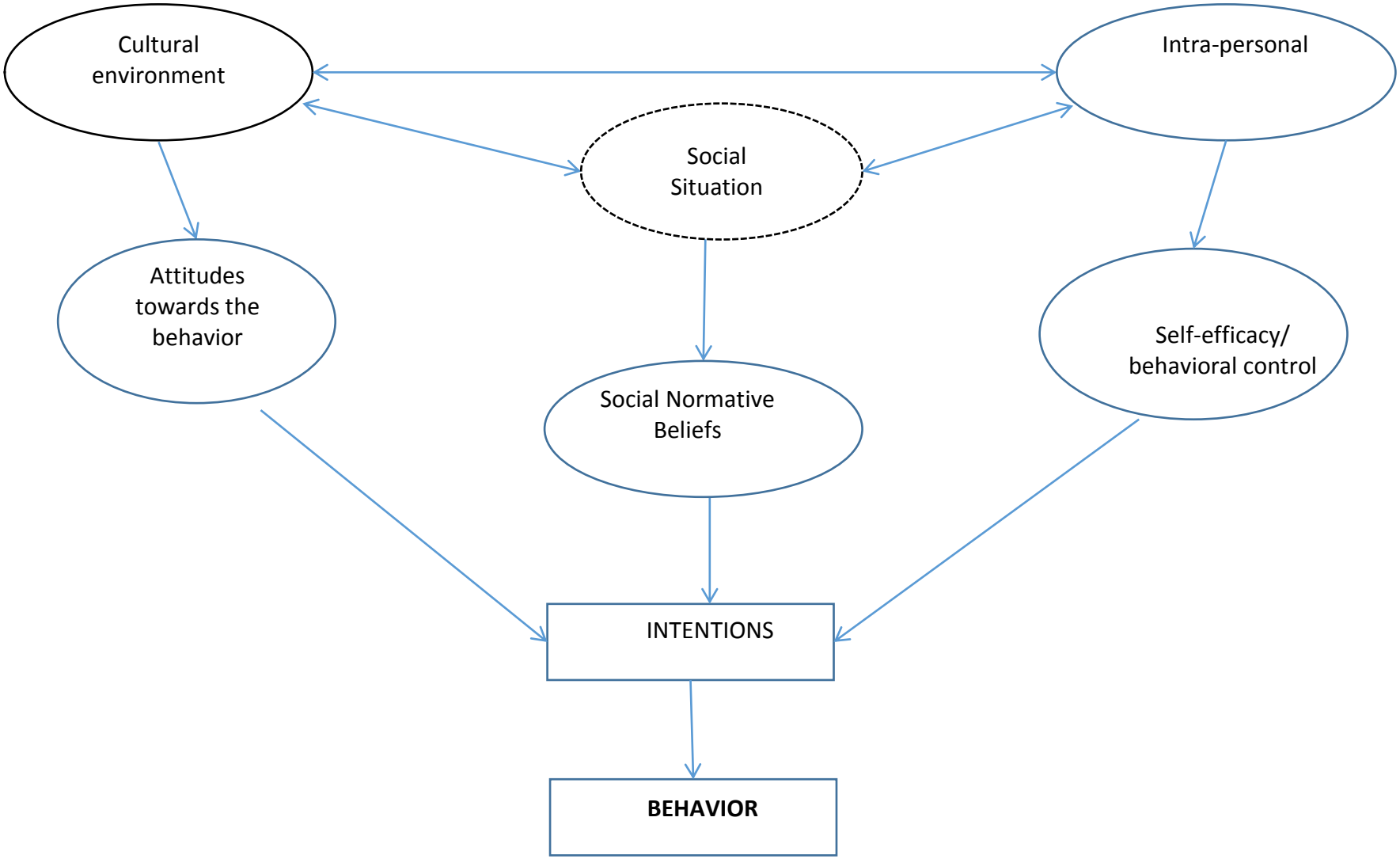

Figure 1.3.1: Theory of Triadic Influence on behaviour (Flay et al., 1995b)

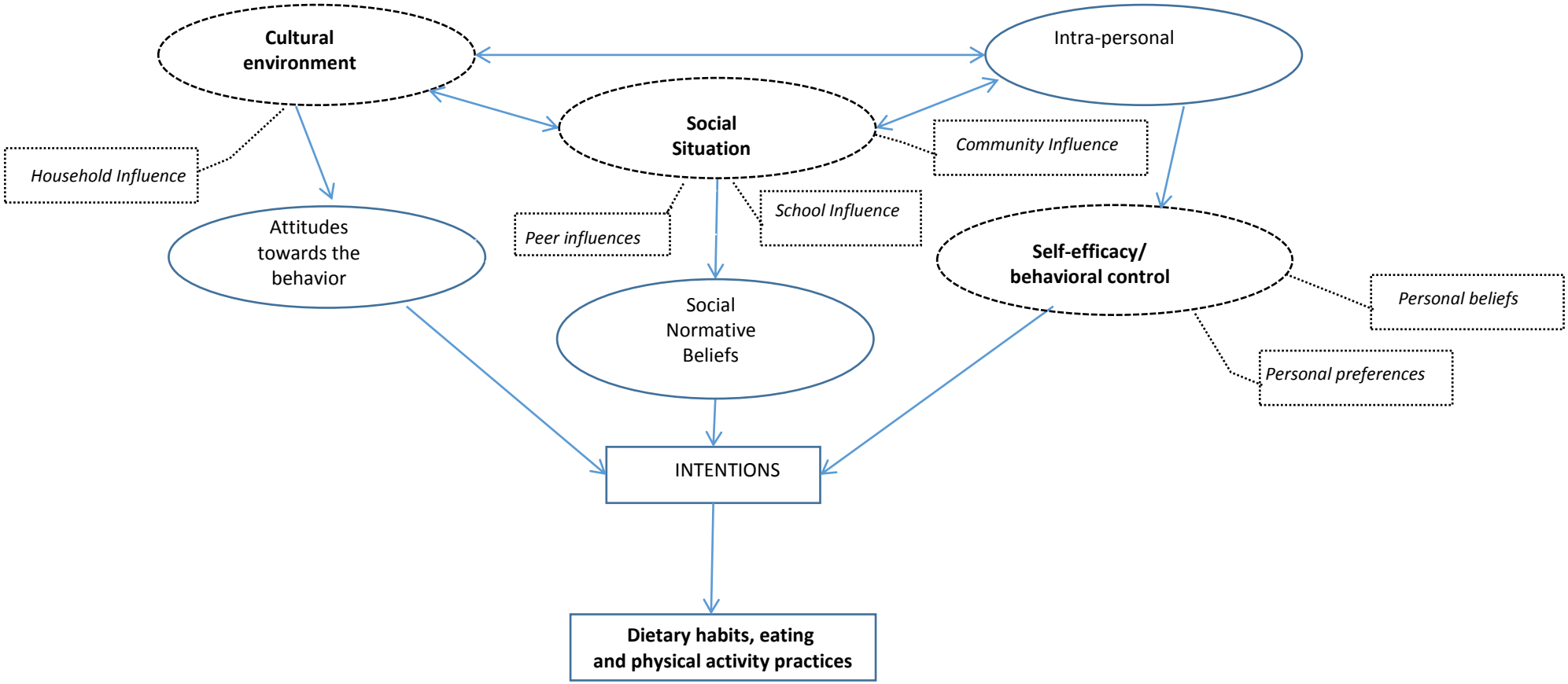

Figure 1.3.2: Theory of Triadic Influence on behaviour (where the thesis fits in)

1.4 Gaps in literature

The effects of urbanisation trends are likely to differ between specific populations even within the same country, which means it might not be safe to generalise the health effects of urbanisation nationally and globally.

- As South Africa is in the process of nutrition and lifestyle transition, it is necessary to study rural and urban settings, which may be at different stages of transition, even within the same country. Sub-Saharan African adolescents, taking into context their specific environment, seem to be undergoing a peculiar and different form of nutrition and lifestyle transition. For this reason, it is important to study nutrition and lifestyle transitions among the South African adolescent population, more specifically, the differences and similarities in dietary habits, eating and physical activity practices in urban and rural African adolescents.
- Although many quantitative studies have focused on adolescents' dietary and lifestyle behaviour, relatively few studies have combined qualitative and quantitative methods, to better understand this phenomenon and the social environments within which it happens, in rural vs urban settings.

This thesis proposes to explore similarities and differences in dietary habits, eating and lifestyle activity practices in the rural and urban setting and the aspects that influence these practices within the influential settings of home, community and school.

Findings of this study will help expand the necessary and growing knowledge about nutrition and lifestyle practices in LMICs. Findings will inform interventions that target adolescents, in

developing specific public health strategies aimed to improve their dietary and physical activity practices with a vision to lower the risk and ease the nation's burden of NCDs.

1.4.1 Thesis aim, specific objectives and hypothesis

Overall aim:

To investigate the dietary and lifestyle practices of adolescents in rural AND urban South African adolescents

Specific objectives (for qualitative and quantitative studies):

1. To explore if and how adolescent girls engage in shared eating and joint food choices with best friends within the context of living in Soweto, South Africa.

2. To investigate the narratives pertaining to dietary and physical activity practices among adolescent girls in Soweto.

3. To explore perceptions and attitudes of adolescent girls in rural South Africa regarding healthy eating practices and physical activities.

4. To compare dietary habits and eating practices between rural and urban adolescent boys and girls and their associations with obesity risk.

1.4.2 Study Hypothesis (for the qualitative studies)

Specific research questions and hypotheses are as follows:

1. Is there a difference in the dietary habits and eating practices of rural vs urban adolescents?

H0: There is no difference in dietary habits and eating practices of urban vs rural adolescents.

2. Is there a difference in the dietary habits and eating practices of adolescent boys vs girls within the same (rural/urban) setting?

H0: There is no difference in dietary habits and eating practices of adolescent girls and boys within the same setting.

3. Is there an association between dietary habits and eating practices within the home, community and school, and the risk of being overweight and obese?

H0: There is no association between dietary habits and eating practices within the home, community and school, and the risk of being overweight and obese.

Chapter 2: Study Context and sampling

Chapter 2 Study context and sampling

This chapter describes the research design, study population, exploratory sampling, selection and recruitment of study participants, and also explains the different methods used for each study component. This is followed by the tools used in the studies. This thesis comprises of four studies: Study one and two used data collected from Grade 12 urban adolescent girls, who represented the 16-18 years age group, attending high schools in and around Soweto, Johannesburg. Study three used data collected from female adolescents from the Agincourt DHSS aged 16-19 years of age. Study four comprises data from male and female adolescents in early- and mid-adolescence from urban (Birth-to-20 cohort) and rural (Agincourt DHSS) settings.

2.1 South Africa

South Africa is closely connected to global markets through commodities trading. It could be called a second-world country, but enormous socio-economic contradictions and imbalances exist between race and gender groups. This is partly due to the legacy of apartheid (Coovadia et al., 2009), but is also the result of the failure of the current democratic government to remedy the problems (Chopra et al., 2009) . South Africa experiences large disparities in income distribution – one of the most unequal in the world, with a Gini coefficient of 0.65 in 2011 (0 represents total equality and 1 represents total inequality) (SA, 2014).

2.2 Migration

The apartheid legislation played a major role in shaping household structures and patterns of movement. Historically, population movements took on a particular form and significance in response to the country's political and economic conditions. South African 'blacks' were forced by government policies, to abide in rural 'homelands' (Kok, 2003, Gelderblom et al., 1994). This resulted in a pattern of recurrent circulation between rural homes and urban places of work (Murray, 1981) . The labour migration system created during the apartheid era has been a

profound force of instability and change in South African family life. An extensive literature documented the effects of government policies on family-building, living and care arrangements, and livelihoods (Jones, 1992, Mayer, 1980, Murray, 1980, Murray, 1981).

A large number of women came from rural areas to deliver their children in the cities, as a result of the fragmentation of the health services between the homelands and 'white' South Africa, and the underdevelopment of homeland services. This pattern could also have been due to a number of other reasons, including better services in urban centres, to ensuring that the child had a birth certificate entitling them to live and work in an urban area under apartheid law, to wanting the child's father, a migrant labourer, to witness his child's birth and thus secure support for the child (Richter et al., 2006).

The 1952 Pass Laws Act which was in effect until 1986, made it illegal for African adults to stay in an urban area without employment and accommodation (Maharaj, 1992). The chaotic, harsh, and insecure conditions in which families lived were explained in ethnographic studies of family life under apartheid conditions (Jones, 1993). The result of men's absence from the rural family home, the trials encountered by families in urban areas, and the high levels of female engagement in the labour market worsened the poor quality of gender relationships in South Africa (Mamphele-Ramphele, 1993).

2.3 Health Systems Context

As a result of past racial discrimination and segregation of health care services, the health care sector disintegrated. The health care sector of that period was defined as inequitable, inefficient and expensive (Coovadia et al., 2009, Schneider et al., 2007). In the early 1990s, Soweto clinics still administered a full range of services including- family planning, antenatal care, acute and chronic diagnosis/treatment, social work facilities, labour wards, casualty wards, immunisation programmes and elderly care – even with a generally poor infrastructure, including water supply

and ablution. In addition, clinics were largely under-resourced with regard to medical supplies and transport facilities. Furthermore, many clinics were unable to operate overnight due to security concerns for staff travelling to and from clinics (Rispel et al., 1996).

After 1994, health services improved, with free access to health care services for children and pregnant women. The post-apartheid government successfully implemented a clinic infrastructure renewal programme in which 1 345 new clinics were built and 263 upgraded nationally. Primary health care was made available without cost to users and the availability of key drugs in public health care facilities was improved (Chopra et al., 2009).

While substantial advances were made in the formulation of policy and the formal integration of the health system, by 2007, inequalities in total national health expenditure between public and private expenditure had marginally increased, rather than decreased. The inequality in expenditure was reflected in the exodus of doctors (24%) and professional nurses (16%) from the public provincial health structures (Coovadia et al., 2009).

Health care expenditure was reduced (due to inflation and underfunding) concurrently with an increasing burden of disease within the country – which fell mainly upon the poorer segments of the population (Coovadia et al., 2009). It was said that while South Africa spent more on health than any other African country, mortality in children younger than five years actually increased since 1990 (mainly due to HIV/AIDS) (Kleinert and Horton, 2009).

2.4 Soweto

Soweto (an acronym for 'South Western Townships'), an urban environment, is located 15 km southwest of Johannesburg's central business district, (see figure 2.4.1). It was established in the 1950's with the aim of housing black labour employed in the mining industry. Soweto was the largest black residential area in South Africa, with an estimated population of 1.3 million in 2007 (Soweto, 2015). Soweto consisted of 34 suburbs and covered an area of 150 km^2 (Stats

SA, 2008). All indigenous groups were represented in Soweto although Zulus, Xhosas and Sothos predominated.



Figure 2.4.1: Map showing regional location of Soweto-Johannesburg, where the Bt20 research programme is located

2.4.1 Socio-economic status

Research commissioned by the Department of Finance and Economic Development showed that there were 301 000 households in Soweto; with two-thirds of houses constructed from bricks. Twenty-eight percent of households had a combined income of <R800 per month (PDG, 2005). Although 97% of Soweto-Johannesburg had access to piped water, it might have been that residents had access to an outside tap (50%) (Ramachander P, 2004). Most of Sowetan residents had access to electricity by 1988 but many households struggled to pay for it (Ramachander P, 2004).

In the Johannesburg area which Soweto is encompassed, 35% of residents (aged 20 and above) had high school education, and 7% were illiterate (Ramachander P, 2004). National unemployment was recently 24.3% (SA, 2014) however it was believed that this figure could be much higher in Soweto .

2.4.2 Birth to Twenty Cohort

Birth to Twenty (Bt20) was both the largest and longest-running longitudinal birth cohort study of child health and development in Africa (Cameron et al., 1998). Born in 1990, the children's lives spanned the transition to a democratic South Africa from a system of legalised racial segregation and discrimination called apartheid. These years marked the beginning of wide-ranging legislative, political, social, economic, and cultural transformation in South Africa. Four years after their birth, Nelson Mandela became the first democratically elected (by universal suffrage) president of South Africa, as well as the country's first black African president. While the release of Mandela from prison in 1990 seemed to promise a hopeful future for democratic transition in South Africa, the early 1990s before the election were undermined by political violence and anxiety about the future stability of the country.

2.4.3 Recruitment

Recruitment for the study occurred in several waves; at antenatal clinics, hospitals and clinics at time of delivery, and at 'well-baby' services where immunisations were given during the first 18 months of the child's life (Richter et al., 2004). The first 10 years (Bt10) of the study broadly collected data on children's health and development (growth, health, well-being and educational progress) while the second phase, Bt20, encompassed the same aspects but in addition sought to target, risks associated with life-style, including sexual and reproductive health, cardiovascular disease and diabetes (Cameron et al., 2005). It was during years 9 and 10 that a new sub-study was introduced to assess bone health development (Bone Health Study) (Hawley et al., 2009, Richter et al., 2007).

All major South African ethnic groups were represented in the study, but due to logistical and political reasons, at initial enrolment, middle class 'white' children were under-represented (Richter et al., 2004). Under the previous apartheid government the private health service consumed up to 60% of resources that largely catered to the middle classes, who only made up

23% of the population (Buthelezi et al., 2002). However, in the subsequent sub-study (the *Bone Health* study), white children (n=120) were over-sampled retrospectively in order for ethnic comparisons to be made. These participants were also born during the initial cohort enrolment dates but they did not reside in the same areas as the rest of the cohort (Richter et al., 2004). Further information about recruitment is covered in study 3 (chapter 5). Some demographic and health characteristics of the participants are outlined in Table 2.1. Recruitment procedures for the Sowetan qualitative studies are detailed in chapters 3 and Appendix L.

Table 2.1: Characteristics of the Bt20 cohort(Richter et al., 2007) .

Characteristics	**Bt20 Cohort (n=3 273)**
Ethnic Group	
African (black)	2 568 (78%)
White	207 (6%)
Mixed ancestry	383 (12%)
Indian	115 (4%)
Maternal Age at birth of index child	
<17 years	92 (3%)
17 – 19	392 (12%)
20 – 38	2 692 (82%)
+39	95 (3%)
Gravidity	
1	1 094 (33%)
2 – 4	1 875 (57%)
≥5	304 (9%)
Gestational age	
<37 weeks	388 (12%)
37–41	2 773 (85%)
42+	11 (0.3%)
Birth weight	
<1500 g	30 (1%)
1500 – 2499 g	322 (10%)
2500 – 3999 g	2 827 (86%)
4000+ g	89 (3%)

2.5 Agincourt HDSS: Background

2.5.1 Setting

Data for paper three and paper four were collected in Agincourt which was part of the Agincourt health and socio-demographic surveillance system (AHDSS), run by the MRC/Wits Rural Public Health and Health Transitions Research Unit. Agincourt is a sub-district of Bushbuckridge, Mpumalanga province, northeast South Africa. The study site lies close to the border with Mozambique, bordering the Kruger National Park conservation area (see Figurggghe 2.5.1). It provided the foundation for the Rural Public Health and Health Transitions Research Unit of the Medical Research Council (MRC) and University of the Witwatersrand, South Africa (the MRC/Wits-Agincourt Unit). The Agincourt Health and Socio-Demographic Surveillance System (AHDSS) spanned an area of 420 km^2 comprising a sub-district of 27 villages with traditional and elected leadership. This setting was in stark contrast to Soweto as a rural semi-arid environment, giving rise to plots of land too small to support subsistence farming. The AHDSS was established in the early 1990s with an initial focus on district health systems development, sub-district health centre networks and referral systems, and training of clinically oriented primary health care nurses (Tollman and Zwi, 2000, Tollman et al., 1993). Infrastructure was much more restricted than in Soweto; however, development has seen improved electrification to most households and improved road networks, with a recent programme to tar all main roads. However, water piping was still problematic and was obtained from communal taps.

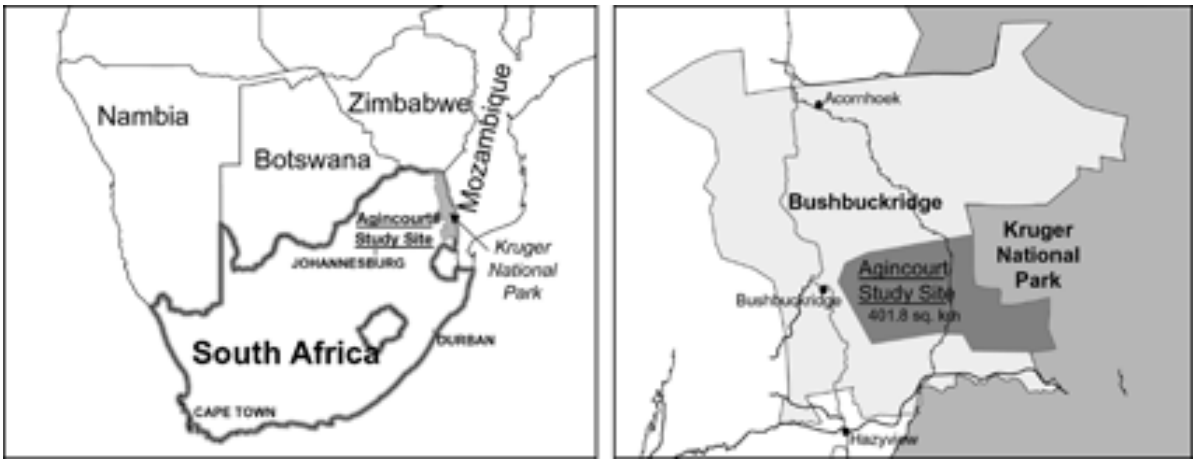

Figure 2.5.1: Maps showing regional location of the Agincourt Health and Demographic Surveillance Site (Kahn et al., 2012)

2.5.2 Socio-economic status

In this region, there were high levels of unemployment (between 40 and 50%), low income levels and a high proportion of the population on government support grants, including child support grant and pensions (Kahn et al., 2007). Housing types ranged from traditional mud structures to brick houses built on plots of farm land that were generally insufficient to support subsistence farming. Consequently, crops grown mostly supplemented the family diet (Kimani-Murage et al., 2010). Illiteracy remained high among older populations (80%) but had improved post-apartheid in the younger generations, mainly due to an increased number of primary and secondary schools.

2.5.3 Health

Health care in this area was restricted, with the five primary care clinics being staffed by nurses that provided free services. These five clinics referred to three district hospitals (25 – 60 km away). Traditional medicine played a role in health care here. The quadruple burden of disease was also apparent in this area: high malnutrition prevalent in children and infants, NCDS, HIV-related disease including TB, and high levels of violence and accident-related trauma. Stunting affected 18% of 1-4 year olds, while the prevalence of combined overweight and obesity was

25% among 18 year old girls but was almost non-existent among boys (Kimani-Murage et al., 2010).

2.6 Study design

The thesis employed the mixed methods design, where quantitative and qualitative methods were used to collect and analyse data separately in order to investigate a common phenomenon (Dahlgren et al., 2007, Creswell and Clark, 2007) of dietary and lifestyle practices of urban and rural adolescents within their different social environments. The qualitative and quantitative findings were interpreted separately as individual studies in the following chapters, but these findings are integrated in the discussion section of this PhD. The study design used is summarised in figure 2.7.1 Qualitative research methodology has been successfully used to gather information about food choice and factors influencing this process among adult (Falk et al., 1996) and adolescent (Neumark-Sztainer D et al., 1999) population groups.

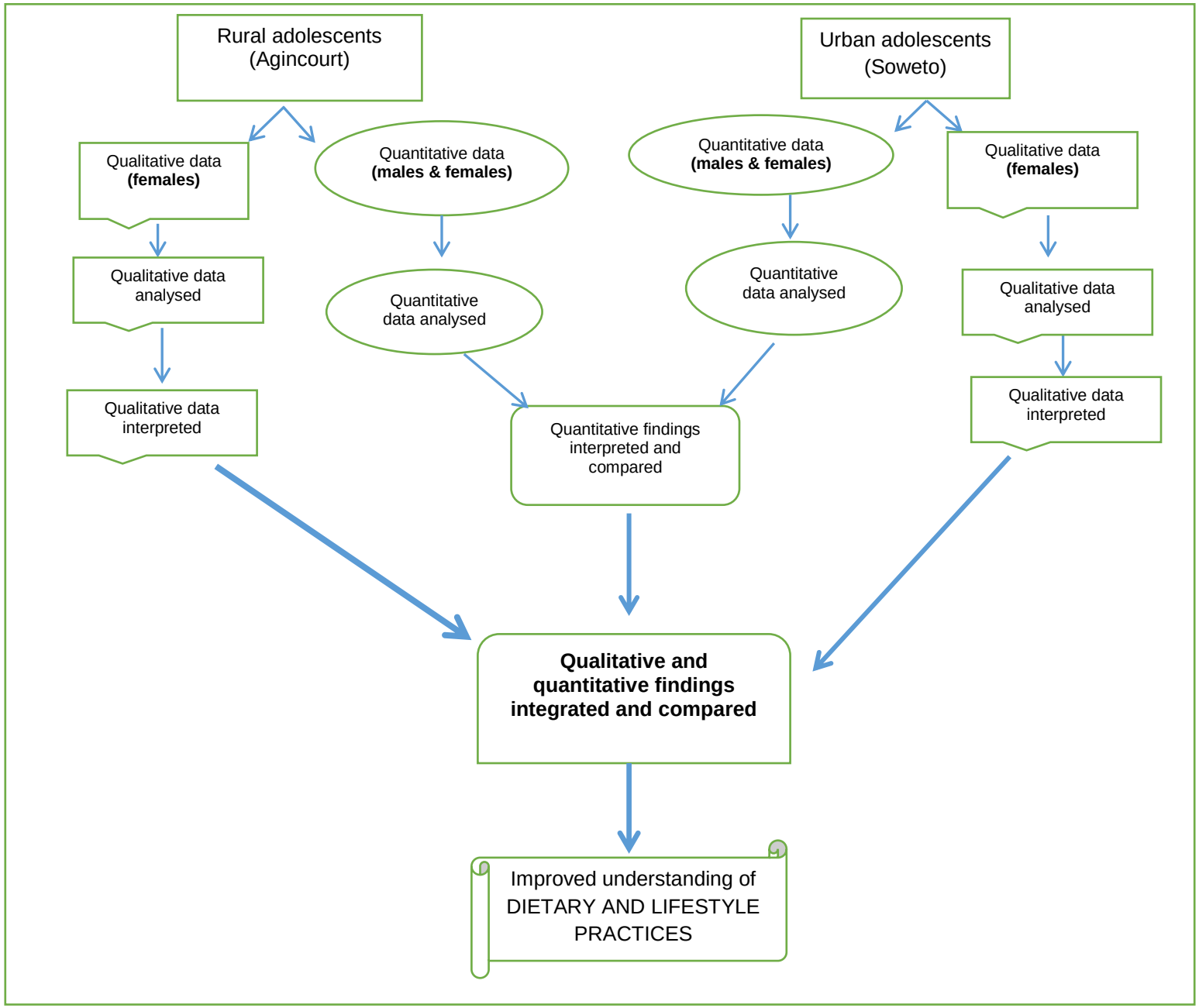

Figure 2.7.1: Mixed methods study design

2.7 Synopsis of methods used in each study component.

Below is a brief summary of methods employed in each study (Table 2.8.1). Descriptive details are covered in the empirical papers in their specific chapters and Appendix L.

Table 2.8.1: Summary of study methods employed in the study components.

Study	Study title	Synopsis of methods used	Instruments used
1 (Appendix L)	"We eat together; today she buys, tomorrow I will buy the food": adolescent best friends' food choices and dietary practices in Soweto, South Africa.	Qualitative study which aimed to explore if and how best friend pairs of adolescent girls at the verge of adulthood engage in shared eating and joint food choices in the context of living in Soweto, South Africa.	Interview schedule, anthropometric data (weight and height)
2	Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment.	Qualitative study which aimed to examine adolescent girls narratives around lifestyle practices to better understand socio-environmental influences (community, school and home). Same sample as in study 1.	Interview schedule, anthropometric data (weight and height)
3	Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa	Qualitative study aimed to explore perceptions and attitudes of adolescent girls in rural South Africa regarding healthy eating practices and physical activities. The aim was also to learn about rural and urban similarities and differences, using findings from study two.	Interview schedule
4	Dietary habits and eating practices and how they associate with obesity in urban and rural black South African adolescent boys and girls undergoing a health transition	The study aimed to compare the different dietary habits and eating practices between urban and rural adolescents in specific environments (community, home and school environment) and their associations with obesity.	Questionnaire to assess dietary habits, eating practices, and anthropometric measurements

2.8 Piloting of the study instruments

2.8.1 Qualitative Interview Guides

For the purposes of study 1 and 2, the interview guide was developed by the researcher with a research team, in a project funded by SANPAD. The interview schedule questions were piloted by the researcher, on a total of four pairs of friends who were not part of the study population, and adjustments were made to the interview schedule accordingly. Changes made to the schedule included rephrasing of questions for better understanding, changing questions to accommodate local languages and understanding. A question about birthdays was deleted as most girls in the population seemed not to have birthday parties or celebrations. A question on funerals of families or friends was deleted due to some of the girls having lost biological parents, and were therefore uneasy talking about attending funerals.

For the purposes of study 3, the interview schedule was piloted on two pairs of friends who were not part of the study population, after which changes were made to make the guide more understandable for study participants (Creswell and Miller, 2000).

2.8.2 Quantitative Questionnaires

For the purposes of study 3, several steps were undertaken (by a different researcher), to ensure the questionnaire validity (i.e. that the participants interpreted the questions as intended):

a) Translation and back translation into seSotho and isiZulu (common African languages spoken in Johannesburg).

b) Piloting of the questionnaire with experienced local fieldworkers to ensure the questions were phrased (culturally) appropriately for the community setting being worked in.

c) Piloting with age-appropriate participants (n=20) with cross-checking probes to ensure that they understood the meaning of the questions as intended.

2.9 Dependability and credibility of the qualitative interview schedules

Dependability and credibility of the qualitative interview scheduled was insured by following recommended methods (Long and Johnson, 2000, Whittemore et al., 2001, Onwuegbuzie and Johnson, 2006). In study 1 and 2, the dependability and credibility of the interview schedule was ensured by piloting the interview schedule on four pairs of female adolescents who did not form part of the study. The pilot interviews were conducted by different researchers, and based on feedback sessions, where the content of data collected was discussed, it was found that the stories of the participants were richer and deeper when interviewed in their local languages (mainly seTswana and IsiZulu), which the researcher was conversant in. The background of the researcher also assisted in checking the credibility of the stories shared by adolescents, due to the subjective and context specific nature of qualitative research.

Interviewing the adolescents in pairs also improved the dependability and depth of the information and stories shared, as pair members elaborated or clarified on some of questions asked. Credibility or true value (Lincoln and Guba, 1985, Onwuegbuzie and Johnson, 2006) of the data collected/stories told was ensured by the principal researcher's background, which was close to that of the participants. She was familiar with the environments, culture, languages, local food items, activities, and eating contexts that the participants referred to in the study sites. This also improved trust from the participants.

The researcher and a co-researcher, who took notes and served as an observer, were present during all interviews. Debriefing sessions were conducted by the researchers after each

interview in order to minimise bias and to help the researcher to reflect on her role in the research.

Credibility (Lincoln and Guba, 1985, Dahlgren et al., 2007) was ensured by inviting adolescents from different schools, with their best friend, in order to help corroborate their stories. During interviews for studies 1 and 2, two researchers participated in each interview, and peer debriefing sessions were conducted after each interview, to ensure internal validity (Lincoln and Guba, 1985, Dahlgren et al., 2007). In study 3, the researcher understood the local language but was not fully conversant, therefore local research assistants (Shangaan) were recruited and trained in order to ensure collected data was credible and collected in a consistent manner. Interviewing the adolescents in pairs and at the location of their choice also improved validity and credibility of data obtained as it supported trust and intimacy.

2.10 Reliability of the quantitative questionnaire

Reliability of the quantitative questionnaire was tested by a different researcher using the test-retest method (Gibson RS, 2005). Further details of the reliability testing procedure of the questionnaire are covered in her PhD thesis (Alison Feeley, PhD)

2.11 Ethical approval and consent

Confidentiality was maintained by the allocation of an identification number for each participant which was used on all questionnaires. Ethical approval for study one and two was awarded by the Human Research Ethics Medical Committee of the University of the Witwatersrand (M090427) (Appendix A), and agreement to undertake the project in Soweto schools was obtained from the Director of Education for Soweto. Participants consented to recording of the interviews for study 1, 2, and 3, before commencing with the studies (Appendix E).

Ethics approval for study three was awarded by the University of the Witwatersrand Human Research Ethics Committee (Medical), as an extension of study 1 and 2 (M 090427) (Appendix

B). All participants aged 18 years and older gave informed consent. At both centres, written consent was obtained from primary caregivers for those participants aged less than 18 years (Appendix D1 and Appendix D2) and assent was also obtained from these participants (Appendix E). For purposes of study four (Chapter 3), ethical approval for the Soweto centre was obtained by a different researcher from Witwatersrand University Committee for Research on Human Subjects (M080320) (Appendix G). Ethics clearance for the Agincourt centre was obtained by a different researcher (Titilola Pedro) from Witwatersrand University Committee for Research on Human Subjects (M090212) (Appendix H) and from the Ethical Committee of Mpumalanga Province (Appendix I).

PART 2: EMPIRICAL PAPERS

Chapter 3

Chapter 3 Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment

(Published in: South African Journal of Clinical Nutrition 2014: 27(3), 114-119)

3.1 Introduction

Adolescence offers a unique opportunity to influence the adoption of healthy eating, exercise and less sedentary behaviour, in terms of short- and long-term health benefits (Pearson et al., 2009c, Story et al., 2002). For example, physical activity in young people reduces cardiovascular disease (CVD) risk factors and improves bone mass acquisition and peak bone mass (Biddle et al., 2004). High-income country studies have shown that many adolescents engage in a high intake of fast foods, a low intake of fruit, vegetables and dairy foods, and erratic eating behaviour, such as meal skipping (Bull, 1992, Heald, 1992, Neumark-Sztainer et al., 1998). These practices may contribute to rising obesity levels. According to recent findings, obesity was identified in African female and male children as early as between two and five years of age by the South African National Health and Nutrition Examination Survey (SANHANES-1), where the combined prevalence of overweight and obesity was found to be 23.8% and 21.9%, respectively. African adolescents aged 10-14 years also had a high combined prevalence of overweight and obesity at 22.3% and 10.2% for females and males, respectively, in the same national study (Shisana et al., 2013). These findings are similar to those of the second national South African Youth Risk Behaviour Survey conducted on youth in grades 8-11, where pooled overweight and obesity prevalence almost doubled from 2002 to 2008 in black males (6.9% to 11.5%). The prevalence of pooled overweight and obesity in female participants in the same study increased significantly from 30% to 37.6% between the first and second South African Youth Risk Behaviour Surveys (Reddy et al., 2012b). The

combined prevalence of overweight and obesity was 40.9% and 9.5%, respectively, in the age group 15-24 years of age (Shisana et al., 2013).

Previously, in urban Soweto, the combined prevalence of overweight and obesity in girls and boys was 27.3% and 6.9%, respectively, at age 17 years, within the birth to 20 cohort (Feeley et al., 2012) Poor eating habits across the domains of the home, school and community in adolescents were reported in the same cohort. Within the home, adolescent girls and boys aged 13, 15, and 17 years showed a decrease in regular (at least three times a week) breakfast consumption practices (76.4%, 63.8% and 65.3%, respectively). At school, lunch box usage was uncommon, and declined from 17% at age 13 years to 8.6% by age 17 (Feeley et al., 2012). More than 80% of participants bought food from the tuck sho;p. The five most popular purchases for all ages were sweets, crisps, cold drinks, fried chips and white bread, accounting for 62% of purchases. Female participants consumed more confectionary options than males within the community environment. Sweets, crisps and soft drinks were the three most popular confectionary or beverage items, accounting for > 65% of items purchased at all time points (Feeley et al., 2012).

Interventions aimed at modifying adolescent eating and physical activity practices have met with mixed success (Heald, 1992) which, in part, may be because of inadequate understanding of the factors that govern eating and exercise beliefs and behaviour by adolescents.

Qualitative research methodology has been shown to be an effective research method to elucidate multiple factors that may explain dietary and physical activity, and beliefs and practices (Croll et al., 2001, Neumark-Sztainer et al., 1999, Noble et al., 2003, O'Dea, 2003b,

Puoane et al., 2006, Monge-Rojas et al., 2002). Identifying dietary and exercise beliefs and behaviour in South African urban adolescents, as well as factors that influence them is critical for future research and intervention development. This will inform strategy to curtail the burgeoning obesity epidemic in South Africa, especially in black females. Therefore, this study examined adolescent female narratives around lifestyle practices to better understand socio-environmental influences (community, school and home) in an urban obesogenic environment through the utilisation of an innovative qualitative methodological approach.

3.2 Methods

3.2.1 Recruitment and study design

The study took place in the township of Soweto, situated in the south-western part of the Johannesburg metropolis, which comprises several townships. With an estimated 1-1.5 million people, Soweto is one of the largest urban concentrations of black Africans on the continent (Stewart et al., 2006). Four high schools that were identified by local researchers as "long standing" in the community were chosen from different areas of Soweto. Grade 12 female students, i.e. in the last year of high school, were the target study population for the study. Recruitment was carried out by submitting an invitation and study information letter to the Gauteng Soweto Education district office. After permission was granted to visit the schools, the study was explained to the principals and teachers. Three schools agreed to participate in the study. One declined because of concerns relating to student examinations. Innovative qualitative, duo interviews were utilised for the study, whereby a participant and her best friend were interviewed, so as to facilitate greater information sharing. A best friend was defined as "someone of your own age, who you know very well, with whom you meet regularly (i.e. a couple of times a week) and with whom you engage in activities, 'hang out' and/or 'chill out'

with, and with whom you share emotional moments".

During a series of school visits, the research was introduced to the grade 12 teenagers, who were then asked to volunteer for participation, together with a best friend. Informed consent forms were provided to the volunteers. Thirty-two students returned the completed forms to their teachers. Parental consent was telephonically confirmed for all of the participants. All 32 pairs were then invited for an interview that took place at the Research Unit at Chris Hani Baragwanath Hospital. Three participant pairs were excluded from the study as they had decided not to take part. This resulted in 29 completed duo interviews, with 15, 9, and five friend pairs recruited from the three schools. This study was approved by the Human Research Ethics Committee (Medical) at Witwatersrand University (M090427) (Appendix A).

3.2.2 Conceptual framework and development of a semi-structured interview schedule

Conceptual frameworks are useful in understanding the dynamics of behaviour, the processes for changing it and the effects of external influences on it (Chopra et al., 2009, O'Dea, 2003b). In this study, the Theory of Triadic Influence was applied (Flay, 1993b, Flay, 1999b, Flay et al., 1995), which presumes that intentions of certain behaviour derive from three streams of influence; namely the cultural environment, the social environment, and biological and personality factors. Cultural factors represent the broad macro-environment, including factors such as religion and ethnicity. The social situation represents the immediate micro-environment, including influences such as household structure, parenting, peers, community, and factors that relate to the physical environmental. Biological and personality factors represent stable intrapersonal influences, originating from an inherited disposition (gender and age) and personality characteristics. The Theory of Triadic Influence has been successfully applied in nutrition research (de Bruijn et al., 2005, Wiefferink et al., 2006). The current study focused on

the social environment, in particular, to explore both distal (i.e. social normative beliefs) and proximal factors of influence that potentially affect lifestyle practices in the context of food choice, dietary patterns and physical activity. A semi-structured, open-ended interview schedule was formulated, using the expertise of a panel of qualitative and nutrition researchers who were familiar with the study setting.

3.2.3 Interview procedure

The interview schedule was piloted on four pairs of friends, who were not part of the study sample. Consequently, adjustments were made to the interview schedule. Changes included the rephrasing of questions for better understanding. Examples of the interview questions are given in Figure 3.2.1. A local researcher conducted all of the interviews in a combination of local languages, and was familiar with “township” culture and local food items. Cultural aspects were taken into account by the researcher, and giving the participants the choice of responding in the interview in English, Zulu, Sesotho or a combination of languages, thus enhancing participants’ comfort and willingness to engage freely. The trained interviewer began each interview by clarifying the goals of the study, building rapport and explaining confidentiality. An observer took notes, and measured weight and height of participants after each interview, to enable an understanding of the current nutritional status of the participants. Weight to the nearest gram, and height to the nearest millimeter were measured while the subjects wore light clothing and no shoes.

Food choices

Tell me about your day today, from when you got up what did you do?

Did you eat anything before going to school today? Why (not)?

What did you eat during break at school today? With whom?

Did you buy it at school or bring it from home? Why? Probe.

How do you decide what to eat? Probe.

Do share lunch with friends? How? Probe.

When you get home, do you guys eat? What do you eat?

What foods do you enjoy when you go out? How? Probe.

Let's talk about Soweto, what are the most popular activities in Soweto, things that make it unique? Any food items that you would call "Soweto food"?

Figure 3.2.1: Examples of interview questions

3.2.4 Analysis

The audio-recorded interviews were transcribed verbatim and translated into English, when necessary. The quality of the final transcripts and translation were checked by the researcher and a multilingual research assistant. The transcripts were analysed for emerging themes relating to dietary and exercise practices. Preliminary analysis occurred concurrently with the continued administration of interviews to identify emerging subthemes to be pursued in subsequent interviews (Guest et al., 2006). Five transcripts were read, coded and discussed in detail by two researchers. Themes were developed based on the Theory of Triadic Influence framework and interview content analysed (Bradley EH, 2007).

Using transcripts of five interviews, initial codes and themes were confirmed and agreed upon, including:

- *Food and activities:* Contexts included community, school and home setting.

- *Individual and environmental factors that influences food choices:* The relevance of eating breakfast and personal food choices, behaviour relating to dieting and physical activity.

The remaining transcripts were then read repeatedly and coded manually for emerging themes and validated until saturation was reached, i.e. when no new themes emerged (Ryan and Bernard, 2003, Strauss and Corbin, 1997). NVivo® version 8 was used to analyse the qualitative data and Stata® version 10, the quantitative data. The cut-off point for the Body mass index classification of participants > 19 years of age was used according to the WHO criteria for adults: underweight, < 18.5 kg/m^2; normal weight, 18.5-24.9 kg/m^2; overweight, 25-30 kg/m^2; obesity class I, 30-34.9 kg/m^2 and obesity class II and III, ≥ 35 kg/m^2. The classification of the BMI categories for participants ≤ 19 years of age was adjusted for age according to the WHO growth reference data (Onis et al., 2007).

3.3 Results

Of the 32 pairs of adolescents, three pairs were not available for follow-up. Twenty-nine completed the duo interviews, which lasted 90 minutes each on average. More than half (51.7%) of the 58 participants were either overweight or obese, and their age ranged from 15-21 years (mean 18, standard deviation 1.1). According to WHO growth reference charts,(Onis et al., 2007) in terms of height for age, the participants mean age and height were at the 15th percentile for 18-year-old women (Table 3.3.I).

Table 3.3.1: Anthropometric characteristics of the participants (n=58)

Measurement	Mean	SD	Minimum	Maximum
Age (years)	18	1.2	15.3	21.6
Height (cm)	157.4	5.6	139.9	169.5
Weight (kg)	64.6	14.3	43.7	109.1
Body mass index (kg/m^2)	26.1	5.8	17.3	44.1
Body mass index international grades*	**n**	**%**		
Underweight (< −1 SD)	2	3.4		
Normal weight (−1 SD to 1 SD)	26	44.8		
Overweight (1 SD to 2 SD)	17	29.3		
Obesity class I (2 SD to 3 SD)	10	17.2		
Obesity class II and III (≥ 3 SD)	3	5.2		

* For participants >19 years of age cut-off point for classification are used according to the WHO criteria for adults; underweight <18.5; normal weight 18.5-24.9; overweight 25-30; obesity class I 30-34.9; obesity class II+III ≥35. For participants ≤19 years of age classification of BMI category was adjusted for age according to the WHO Growth reference data (Onis et al., 2007)

SD: standard deviation

3.3.1 Food and activities

3.3.1.1 Community social setting

Adolescents in the study reported a strong sense of cultural identity in terms of being "Sowetan". Comments included: *"Soweto is a place where people love each other, and the youth have respect for the elderly",* and *"People in Soweto love each other. As a young person in Soweto, you are expected to greet your elders when you meet them in the street"*. This theme was consistent, despite the broad range of ethnic groups within the community.

Respondents reported that the most common community activities were *"chilling at street corners"* and going to fast food outlets with friends. They said that social occasions often involved sharing food, such as *magwinya* ("fat" cakes that are deep fried in cake flour dough), *kotas* [a quarter loaf of white bread filled with a portion of fried chips, a slice of processed

cheese and processed meat (Figure 3.3.1)], or *"street-roasted chicken"*. Street food was considered to be appealing because it is affordable, offered in large portion sizes and can be shared.



Figure 3.3.1: An example of a Sowetan kota(Feeley A et al., 2009)

Interestingly, attendance and involvement at church during the week and on Sundays was a common social community activity. This activity was shared with family and friends. Participants were unanimous in that there were not many recreational physical activities in which young women could engage within the community owing to *"concerns about safety"* and the *"limited availability of opportunities".*

3.3.1.2 School social setting

As in the community setting, sharing resources with friends at school was a common activity: *"We combine money and buy snacks most of the time. We buy them because they are cheap"* and *"We buy school pies if money is limited"*. Taking a lunch box to school, as opposed to buying food at the tuck shop, was less favoured. Participants bought lunch boxes to school on Mondays containing leftover food from Sunday, or on days when they could bring food to school that they enjoyed and which was available at home, such as burgers or cheese and meat

sandwiches. Most participants thought that a *"lunch box was for younger children" and "was embarrassing"* for a Grade 12 student. Food that was likely to be included in the lunch box was also seen as embarrassing because it reflected their *"poor"* status, e.g. traditional food, such as pap. Other reasons for not bringing a lunch box to school were that lunch money would then not be provided, and that the preparation of its contents was too time consuming. Participants who took lunch boxes to school said that they did so because they wanted to save money, the school food was not enjoyable, the queues for food at school were too long, or they wanted to be in control of what they ate in terms of energy intake. Participants mentioned that food choices at school were dependent on available lunch money. For example, although some participants said that they would like to eat fruit at lunch time, they couldn't afford it as "fruit was expensive at the school tuck shop" and its quality mostly poor.

The teenagers ate *kotas* at school because they were filling and affordable. They said that they would like to be able to choose from a greater variety of food at school, including pies, muffins or sandwiches. However, they admitted, that even if such options were available, they would still buy *kotas* as they enjoyed eating them and could share them with friends.

Participants' activities were primarily sedentary during break, e.g. *"chatting with friends", "going to the library", "completing unfinished school work"* and attending *"church services"* within the school. Although some participants said that they were active, e.g. running and playing in the school yard, they were in the minority.

3.3.1.3 Home setting

Participants agreed that their home environment influenced what they ate, e.g. in terms of what was available. They reported that what they consumed at home was not always healthy. Caregivers and elders (mothers, grandmothers and aunts, and in a few cases, grandfathers or fathers) determined what the household ate. A few participants cited cooking as a responsibility that they enjoyed. Some actively included vegetables when it was their turn to cook. Others said that there was an expectation that at least one vegetable should be included in the evening meal, even though vegetables were not always available in the household. Most households ate dinner together, especially while *"watching television".*

On weekends, participants said that household members often ate *kotas* as an alternative to home-cooked food as they were *"cheaper, convenient, easily accessible and filling". "Fish and chips", "burger with chips", "home-fried chips"* and *"samp with beans"* were other fast food options that were eaten by household members on Friday evenings and Saturday afternoons. Most participants enjoyed eating the main meal on Sunday because of the variety of food served on this day.

Going to the mall was the main household activity, particularly at the month end, when caregivers had money. Participants said that they didn't go out as a family to eat, but would go out individually with friends at the end of the month when there was money, or if they had saved their own.

3.3.2 Individual factors that influence food choices

3.3.2.1 The relevance of eating breakfast and personal food choices

Most participants said: “Breakfast is the most important meal of the day” and *“Breakfast gives you energy. It boosts the system”.* However, the majority said that they didn’t eat breakfast. Very few adolescents ate breakfast every morning. The majority of those without the time to eat breakfast would “buy something to eat before school started” or *“ask a friend to buy them something to eat”*. Those who could afford it bought *“‘fat’ cakes”* which were sold at most schools before classes commenced. A few of the participants ate sweets and potato crisps purchased from community vendors before attending school.

3.3.3 Behaviour relating to dieting and physical activity

Dieting was defined by participants as “food deprivation”, “eating a balanced diet” or *“eating less food”*. Most participants thought that *“only fat people should diet”*, or *“those who were unhappy with the way they looked”*, or *“those who wanted to get in shape”*. Some cited dieting practices included drinking lemon water, only eating snacks, missing dinner and not eating carbohydrates. Some of the women said that they had tried to diet, but stopped prematurely *“as it was very hard”.* In general, portion size reduction was a popular way of managing weight. Some consumed snacks, rather than meals, such as crisps, that were sold at school to lose weight. A major source of excess energy was reported to derive from foods deemed to be unhealthy, such as energy-dense snacks. Yet *“junk food”* was preferred owing to its affordability, availability and the fact that there was a large available variety of it.

All of the participants said that exercise was *“important for good health”*, but very few participated in any physical activities. A few said that exercise was only necessary for *“fat people to lose weight”*, while others believed that *“everyone should exercise to keep fit and*

prevent illness". Most had participated in exercise at some time. They said that they had stopped because of concerns about *"community safety", "getting tired quickly", "lack of support or someone to exercise with"*, *"sweating"*, *"concerns about what others would say if they saw them running"*, and because of time management conflicts with respect to studying. Those who were physically active participated in running, cycling (using a stationary exercise bike at home), walking, going to the gym, street dancing and street soccer. The few participants who said that they ate and cooked vegetables and salads, as well as small portions of food, also took part in regular exercise, such as jogging or playing soccer. Most of the teenagers who ate chips, sugared beverages and fast foods, such as *kotas,* did not cook at home or participate in exercise. They also took part in sedentary activities.

3.4 Discussion

The aim of this study was to recount the narratives of young urban adolescent women with regard to dietary and physical activity practices across various levels of influence, including the self, household, school and community. There was a high prevalence of overweight and obesity in this study, as observed in other urban studies (Joubert et al., 2007, Malhotra et al., 2008, Reddy et al., 2009).

3.4.1 Dietary practices

The findings from this study show that respondents were able to articulate an understanding of healthy dietary practices, and why less healthy food choices involved a health risk. However, there was a disparity between what they knew and what they practised. Only a few participants routinely made healthy food choices. This finding is similar to the results observed in high-income settings, such as the USA, in which it was demonstrated that knowledge alone did not enable adolescents to adopt healthy eating behaviour (Contento et al., 1992). The association

of nutrition knowledge with dietary behaviour was found to be weak (r = 0.10) following a meta-analysis of literature on adults, adolescents and children (Axelson et al., 1985).

In this study, female adolescents reported common dietary practices, including the consumption of fast foods, such as *kotas* and "fat" cakes, and a low intake of fruit and vegetables at home and at school, as well as meal skipping. The consumption of these foods seemed to be driven by economic reasons as these foods were affordable and accessible, unlike fruit and vegetables. At household level, a limited income and the increasing time and cost of food preparation for families could be important in the shifting of family dietary practices to less healthy choices.

The narratives of the adolescents suggest that currently schools do not provide healthy and affordable food options, either for breakfast or lunch. Our findings show that young women wanted to have more choices to buy healthy foods, were aware of the poor quality of food sold at their schools, but bought it anyway. This is in line with quantitative evidence with regard to grade 7-10 students in Cape Town, where the majority of the food consumed at school was also purchased at school, and to a large extent these were unhealthy choices (Puoane et al., 2006).

3.4.2 Physical activity

Listening to music, watching films, street dancing, going to the local mall, drinking alcohol and visiting friends were popular leisure time activities for the adolescents in this community. While street dancing was mentioned, but "formal" exercise was not. Limited community resources, such as youth recreational and sporting facilities, and community safety, were reported as contributing factors to limited participation in physical activities by these young women. Outside of performing household chores, participants were also not physically active at school or home. As with diet, we observed that our findings in relation to physical activity were similar to those in

high-income countries. For instance, Pearson et al (Pearson et al., 2009c) found that physical activity was low in adolescent females aged 12-16 years in the UK. The majority of participants in this study had knowledge of the benefits of physical activity, but few had experienced these benefits.

3.5 Conclusion

This study demonstrates that the behaviour pertaining to diet and physical activity exhibited by female adolescents in the Sowetan context is not dissimilar to that of adolescents in disadvantaged urban communities in high-income countries. The study participants were aware of the benefits of healthy eating and the need for physical activity, and had knowledge of obesity and non-communicable disease risks. Eating less healthily was favoured in community, family and school settings owing to the cost, convenience and availability of such food. Limited community resources and safety were primary reasons for limited participation in physical activities. The findings show the importance and need for immediate intervention efforts that are sensitive to socio-cultural contexts and realities within this community. Clearly, a multifaceted approach using interaction with various community stakeholders (churches, schools and vendors), government, families and the young women themselves, would be essential to target the rapidly rising rates of adolescent obesity and the subsequent risk of CVD in the Sowetan population. There is also a need to understand whether or not the same challenges exist for the male adolescents within this community, where the obesity rate is currently much lower than that in females, but nevertheless rising over time.

Chapter 4

Chapter 4 Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa

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4.1 Introduction

The eating habits of children and adolescents are of public health interest globally because of growing evidence relating poor childhood nutrition to obesity and increased risks of type II diabetes, metabolic syndrome, and cardiovascular diseases later in life (Duthie et al., 1999). The recent rapid increase in the overall prevalence of obesity in children and adolescents indicates that environmental factors, and particularly behaviours linked to diet and physical activity, are central to the causation of obesity (Eisenberg et al., 2005). South Africa, as a country in economic and health transition, is facing a triple burden of morbidity and mortality from infectious diseases including HIV/AIDS, NCDs, and violence (Contento et al., 2006). One result of this transition is the increase in obesity prevalence as a risk factor for NCDs (Case and Menendez, 2009). Other risk factors associated with obesity include high energy density diets, high consumption of sugar-sweetened beverages, large portion sizes, eating patterns (such as meal-skipping), high levels of sedentary behaviour and low levels of physical activity (Eisenberg et al., 2005). Recently, the WHO conducted a survey of physical activity levels in 51 mainly low- and middle-income countries. Among participants aged 18 to 29 years, the prevalence of inactivity was 13.2% in males and 19.1% in females (Flay, 1993a). In the 2013 South African National Health and Nutrition Examination Survey (SANHANES-1), 50.2% of participants aged 18–24 years of age were reported to be inactive (Shisana et al., 2013).

According to the Youth Risk Behaviour Survey conducted in South Africa in 2002 and 2008, among adolescents aged 13 to 19 years (n=9224), the combined overweight and obesity

prevalence almost doubled in black males (6.9% to 11.5%). Among female participants, the prevalence increased significantly from 30% to 37.6% over the same 6-year period (Reddy et al., 2012b). SANHANES-1 reported that in adolescents aged 15 to 17 years of age, the combined prevalence of overweight and obesity was 27.3% in females and 8.8% in males (Shisana et al., 2013). The risk of overweight and obese youth becoming overweight adults has been demonstrated in a review study (Singh et al., 2008), and the tracking of both physical activity and diet between childhood and adulthood has also been confirmed (Craigie et al., 2011).

Evidence from rural Agincourt (Mpumalanga province) in South Africa highlights the high prevalence of overweight and obesity among black African females. The prevalence steadily increased with age, reaching 25% by late adolescence. Central obesity risk (waist circumference cut-offs) also increased with puberty and peaked at 35% by early adulthood in females (Kimani-Murage et al., 2010).

There is an impetus to investigate in greater depth the gender differences and environmental factors within households, schools, and the community that contribute to adolescent obesity risk. Among urban females in Soweto, South Africa, we found that both at school and during visits to shopping malls, food was commonly shared and money pooled by friends to make joint food purchases (Voorend et al., 2013). The majority of participants did not prioritise eating breakfast at home, but purchased *vetkoek* (fried dumplings made from wheat flour) from vendors before school. Lunchboxes were not commonly brought from home; participants preferred to have spending money to purchase food from the school shop. *Kota* (a quarter loaf of white bread filled with fried potato chips and ample processed meat or cheese), *vetkoek*, and snacks (maize crisps) were popular lunch choices because of affordability, convenience, peer influence, and palatability. Respondents reported minimal physically active recreational activities. Barriers to activity were the lack of facilities and concerns about community safety .

Little research has explored the perceptions of facilitators of and barriers to healthy eating practices and physical activity within rural South African female adolescents.

The aim of this study was to explore perceptions and attitudes of adolescent girls in rural South Africa regarding healthy eating practices and physical activities, in order to learn about rural and urban similarities and differences, using previous findings from Soweto.

4.2 Methods

4.2.1 Study setting

This study was conducted in rural Agincourt, a sub district of Bushbuckridge, Mpumalanga province, northeast South Africa. The study site lies close to the border with Mozambique, bordering the Kruger National Park conservation area. It provides the foundation for the Rural Public Health and Health Transitions Research Unit of the Medical Research Council (MRC) and University of the Witwatersrand, South Africa (the MRC/Wits-Agincourt Unit). The Agincourt Health and Socio-Demographic Surveillance System (AHDSS) spans an area of 420 km^2 comprising a sub-district of 27 villages with traditional and elected leadership. The AHDSS was established in the early 1990s with an initial focus on district health systems development, sub-district health centre networks and referral systems, and training of clinically oriented primary health care nurses (Tollman and Zwi, 2000, Tollman et al., 1993). In this region, there are high levels of unemployment (between 40 and 50%) and low income levels. Housing types range from traditional mud structures to brick houses built on plots of farm land that are generally insufficient to support subsistence farming. Consequently, crops grown mostly supplement the family diet (Kimani-Murage et al., 2010).

4.2.2 Study design and data collection

We employed the “duo-interview” method to encourage in-depth discussion (Abraham and O'Dea, 2001, Dunton et al., 2007). This approach has previously been successfully applied in urban Soweto. Eleven duo semi-structured qualitative interviews were conducted with participants aged 16 to 19 years of age and their close friends residing within rural Agincourt. A close friend was defined as “Someone of your own age group who you know very well, with whom you meet regularly (i.e. a couple of times a week), are engaged in activities with, hang out and/or chill out with, and with whom you share emotional moments. This can be someone from the same neighbourhood, and not necessarily from the same school.”

The sampling and recruitment for this study was done through the AHDSS. Information about the study was discussed with the volunteers and caregivers during the recruitment process. All participants aged 18 years and older gave informed consent. Written consent was obtained from caregivers for those participants aged less than 18 years and assent was also obtained from these participants. Ethics approval for the survey was provided by the University of the Witwatersrand Human Research Ethics Committee (Medical) (M 090427) (see Appendix B).

Fieldwork was conducted by the study manager (TG) with a fieldworker and transcriber whose first language was Shangaan (the local vernacular) and who resided within Agincourt. The principal researchers [the researcher (MHS) and KE] trained the fieldworkers, including practice interviews that were conducted to ensure that the fieldworker was conversant with the interview schedule. The interview guide was piloted on two pairs of friends who were not part of the study population, after which changes were made to make the guide more understandable for study participants (Creswell and Miller, 2000). The principal researcher (MHS) offered technical assistance during data collection and she quality-controlled the interviews.

The interview guide was designed to explore the following: dietary and physical activity practices, attitudes towards healthy eating and physical activity including barriers and facilitators, understanding of health risks associated with obesity, eating and exercise practices at school and outside school, attitudes towards weight control, body image, cultural beliefs, and family factors. The interview schedule domains were informed by the Triadic Influence on Behaviour Model (Flay B, 1995, Flay, 1993b, Flay, 1999a), which presumes that the intentions behind certain behaviours derive from three streams of influence: the cultural environment, the social environment, and biological and personality factors. Cultural factors represent the broad macro-environment, including religion and ethnicity. The social environment represents the immediate microenvironment, including influences such as household structure, parenting, peers, community, and factors relating to the physical environmental. Biological and personality factors represent stable intrapersonal influences, originating in inherited dispositions (gender and age) and personality characteristics. The Triadic Influence on Behaviour Model has previously been successfully applied in nutrition research (de Bruijn GJ et al., 2005, Wiefferink CH, 2006). Each interview lasted for approximately 70 minutes and was digitally recorded.

4.2.3 Data handling and analysis

Debriefing sessions were held daily by researchers after the fieldwork to discuss issues and themes emerging from the interviews and to ensure consistency of question meaning. Preliminary analysis occurred concurrently with the continued administration of interviews to identify emergent sub-themes to be pursued in subsequent interviews. Data saturation was reached by the 11th interview. The 11 recorded interviews were transcribed and translated into English by the fieldworker. Four of the transcribed interviews were randomly selected for a quality check by an external local bilingual transcriber. The researchers who developed the interview schedule listened and the principal researcher read the transcripts horizontally

(individually) and vertically (across different transcripts) to identify recurrent themes in the data. A co-researcher (KE) read a sub-sample of the transcripts to cross-validate the coding. Thematic content analysis was used (Bradley et al., 2007) and themes were identified according to questions asked in the interview guide. The study findings are presented using similar domains as per the interview schedule structure.

4.3 Results

4.3.1 Perceptions related to healthy eating practices

Participants believed that traditional foods—specifically *miroho* (green leafy vegetables), locally grown legumes, vegetables and nuts—are good for health and that their consumption can prevent and cure illness. Participants' personal attitudes towards certain food items were influenced by traditional beliefs within their households and the community. Quotes below illustrate perceptions of healthy foods:

> *"Healthy foods are foods that make you live better. With unhealthy food, you will live, but it is not the same as healthy food: it makes you gain weight and become sick. Like carrots—when you have eaten them, they make your eyes whiter and clean. Beetroot and spinach are very important for the human body because they add blood, and spinach makes you healthy in your body." (pair 3)*

> *"Healthy foods are vegetables because they don't have fat and you get vitamins and everything in them, unlike meat. It's not in meat that we get vitamins and everything. Meat is making us sick but I've never heard someone say that she is sick because of eating vegetables—they are not causing illness. Food that we are allergic to, which means it's*

unhealthy because it is not good for you, and everything that makes you uncomfortable after eating, I can say is unhealthy" (pair 5)

"Healthy food according to my understanding is food that builds your body and protects you from illness, like vegetables. Unhealthy food is food that doesn't build our body, like sweets, chocolate, and food with a lot of oil." (pair 6)

"I think that breakfast is very good. You won't work without eating and you won't get power without eating, so you have to take breakfast first to be able to do all your activities." (pair 3)

More than half of the participants believed that breakfast was the most important meal of the day, based on what they had heard and had been taught in school and at local clinics. Most believed in the benefits of breakfast, although many did not eat breakfast at home owing to limited choices or lack of food.

Some mentioned the consequences of not eating breakfast, such as loss of concentration in class or headaches.

"I didn't eat today. I'm unable to eat in the morning. I eat at around 12 PM, and it is uncommon that I have breakfast. I think breakfast is healthy, because according to law we must not skip breakfast, but I'm used to it, I don't eat breakfast, I am fine, I don't feel hungry, and I don't have a headache. If I eat breakfast I won't have my lunch." (pair 5)

There were also signs of embarrassment. It seemed that some participants did not want to voice an opinion about breakfast, as they laughed when asked about their breakfast practices—they said they just get up in the morning, bathe, and go to school. For some participants, skipping breakfast was a coping mechanism to prevent feeling hungry, because they said that if they ate breakfast they would feel hungry sooner before lunch and would not be able to concentrate in class. Very few participants (two) who reported eating breakfast had more than one option available to them. Pap (a maize-based staple) and tea were the most common options among those who consumed breakfast.

4.3.2 Factors facilitating healthy eating practices

Most participants associated good health with local home-grown foods. Factors that increased consumption of fruits and vegetables were their taste and the feeling of health experienced after eating a particular fruit or vegetable. Family vegetable gardens - which were located within household yards, in vegetable fields outside household yards, at nearby schools or out in the open fields - enabled healthy eating. Common vegetables grown were beetroot, tomatoes, and green leafy vegetables such as spinach, lettuce, and *miroho*. According to participants, female caregivers within households collected edible wild green leaves that grow outside the rainy season to eat with pap. Based on interviews, locally grown vegetables were also sold by community members at affordable prices and neighbours often shared with each other. In the few households that did not have vegetable gardens, participants stated that they sourced vegetables from relatives or friends.

The influence of the female caregiver on the foods families consumed was cited as a major factor in facilitating healthy eating practices within households. Based on data from a majority of interviews, vegetable gardens were mainly cultivated by female caregivers who believed that

locally grown vegetables were good for health; they cooked vegetables for their families even if some household members did not like eating them.

The quotes below illustrate factors that facilitate healthy eating practices.

> *"I feel great and healthy when I have eaten lettuce; I just feel good and it makes me happy. I like to cook food for Sunday. I like cooking and making salads, beetroot, pumpkin, and cabbage. Salads are healthy. Healthy food makes a person's body always be good, but food that has lots of oil, they say, causes high blood pressure and illness for a person. To eat some is not a problem, but she must have a limit in order not always to eat it. I like mango because it is nice. When it is ripe and you eat it, it tastes good. And lettuce—I like it and everything that is grown in the garden; I just like it." (pair 4)*

> *"According to youth, they think healthy food is meat, but grannies and our parents think it is vegetables." (pair 1)*

> *"Old people are afraid to eat food with oil because they say it causes illness. They want you also to cook miroho." (pair 3)*

> *"I like oranges, and when you have eaten them they are good in the body and make you feel great. Then I fell in love with them." (pair 8)*

Health education messages in clinics, magazines, and church youth gatherings were recognised as encouraging healthy eating practices. Local schools with government-supported meal programmes provided cooked meals such as beans with soup, *samp* (dried corn kernels that have been stamped and chopped until broken but not as fine as mielie-meal or mielie rice) with beans, or *tihove*, a traditional dish consisting of boiled samp with locally grown crushed nuts. These also served as facilitators of healthy eating practices.

> *"Everywhere, like when we are in a place that is crowded like the clinic, they teach people that we must eat healthy food in order to help our bodies." (pair 5)*

> *"When we attend church conferences, they give us carrots, beetroot, cabbage, and a small portion of meat; they also add pumpkin and porridge or rice." (pair 3)*

> *"At school, we get free healthy food during break. Monday we get pap, Tuesday we get samp with, Wednesday rice with soup, Thursday samp with beans, and Friday we get pap with soup or beans." (pair 6)*

4.3.3 Factors acting as barriers to healthy eating practices

Factors cited as barriers to healthy eating practices were household poverty, the affordability and accessibility of healthier food, peer influence, and aspirations to purchase more socially desirable convenient fast foods. According to the participants, most households do their grocery shopping once a month when they receive money from family members who work in cities far from home. Limited money and transportation means households only purchase basic

necessities once a month, including mealie-meal (a maize-based staple), chicken feet, and frozen chicken. Most of the girls mentioned strict grocery lists to which households stick. Groceries purchased monthly often ran out sometime during the month, after which families could only afford to eat pap and *miroho* that they bought or picked from the fields, as they would have to wait for the end of the next month to purchase more groceries. Eating home-grown vegetables is believed to be a sign of poverty or lack of food, while meat is a sign of wealth or civilisation. Fruits were often cited as "luxuries" or "extras" and were bought only if there was money left after purchasing staple foods. It appeared that fruits were not easily accessible within the community.

> *"They think it is a sign of better status when eating meat every day." (pair 5)*

> *"My family doesn't like miroho and vegetables from the garden, we just like meat and anything from the fridge. When we eat vegetables, we only eat salads and it is not every day that we grow them. They are very scarce." (pair 1)*

Some participants said that they could not bring lunch boxes to school because of limited household resources. They mentioned food items they wished were available for lunch boxes, such as bread, polony (processed deli meat), "Russian" (processed sausages), eggs, "everything that tastes good", and juice. For those who took lunch boxes to school, the choice was constrained to what was available at home. Because of limited lunch money and resources at home, in most cases they were only able to take dry bread augmented with *atchar* (a pickle made with unripe mangoes and chillies, prepared in oil) or buy *vetkoek*, because it is affordable.

Some respondents brought lunch money that they stated was insufficient to purchase options that they perceived as relatively healthy, which resulted in them buying cheaper snacks from school vendors. Among items sold by vendors outside the school gate, the majority of participants mentioned bread, *vetkoek*, *kota* (a quarter loaf of white bread filled with fried potato chips and ample processed meat or cheese), deep fried potato chips, snacks such as crisps and sweets, sugar-sweetened beverages, atchar, and plates of food with pap and chicken or beef. Based on the interviews, few vendors outside schools sold fruit, which was generally more expensive than snacks—this absence is a barrier to healthy eating. Most participants shared money and food with friends just to make sure they have something to eat.

> *"I don't feel good about the free food we get at school, because they don't cook well. After eating it, I have stomach cramps, so we decided to stop eating the free food at school. If we don't have money for lunch, we just walk around the schoolyard until lunch is over; if we have some money we buy vetkoek and niknaks (from vendors). We like junk food because we don't have enough money to make our stomachs full. I don't like vegetables, I just eat, even if they are healthy, I don't care about that. When it comes to carrots, I don't get the taste of it." (pair 1)*

> *"Usually I take lunch money. When I use it, I buy some snacks and iced lollipops. If we don't get food at school, I buy kota, niknaks, and vetkoek (sold by school vendors)." (pair 5)*

> *"I like kota when it has everything on it: bread, Russian, cheese, chips, and atchar." (pair 10)*

Peer perceptions were also a barrier to healthy eating. Participants mentioned concerns about their peers' reactions if they ate *miroho*, since frequently eating meat or fast food items is seen as a sign of better economic status.

4.3.4 Perceptions related to physical activity

The majority of participants believed that physical exercise promotes good health, because exercise boosts the body's ability to fight against illnesses and helps to prevent illness. Even respondents who did not participate in physical activities stated that physical activity is good for health.

> *"It's good to exercise. If you exercise, you could lose weight, and it is necessary that every person exercise. At school I'm in athletics and netball. Just now we are writing exams, but [previously] I was always exercising. When I exercise, I'm not lazy and my body is always right; I don't get the flu easily." (pair 5)*

> *"I think to exercise is good, but I don't do it. I'm unable to run or jump, but when my friend says we must do it, I try to do it." (pair 10)*

> *"Young people should exercise so that the illnesses that are common nowadays cannot get us soon." (pair 3)*

4.3.5 Practices and factors facilitating physical activity

Most of the schools have a variety of physical activities during school breaks, after school, and during life orientation classes. Most students participate in games such as skipping rope; street dancing; sporting activities including netball, soccer, and volleyball; and a variety of traditional

dances. There appears to be positive peer influence promoting physical activity, with active encouragement by friends.

> *"We like dancing and singing. We play songs on our cell phones and then we dance. Sometimes we just play with kids on the street; we play netball and skip rope." (pair 3)*

> *"It is good because after playing ball, my friend wants to sit down, saying that she is tired. Then I force her, and I set up the clock so that now we will play for twenty minutes—after ten minutes she will play for the whole time we have set." (pair 10)*

Some students walk long distances to and from school, and thus get an opportunity to exercise. At home, most participants were involved in physical household chores such as cleaning, cooking, and working in the vegetable garden or the fields.

> *"We walk when we go to school. It takes me twenty minutes when I walk fast and forty minutes when I walk slow. I also run, in order to always feel good in the body. During break, we dance the kwaito dance, and we play netball. After school we have netball, ladies soccer, and volleyball. We play netball. When it comes to cultural dances, we have muchongolo, xibavhana, and xipenede [different types of local cultural dances]. We also clean our classrooms after school; then we come home. When we get home, we wash dishes and clean the house." (pair 6)*

4.3.6 Factors acting as barriers to physical activity

Some participants mentioned that in more senior grades, the school discouraged them from participating in extramural activities. They were encouraged to use that time for studying instead, as sports would disturb them. Most of these participants were involved in sports in junior grades.

> *"They don't allow us to play netball or any sports. When you are in grade 12, you don't participate in anything. Even singing they don't allow us. They don't allow it because it will disturb us. This year we are doing nothing at all—like when they[learners in lower grades] go to soccer, we used to go with them just to support them. After school we used to participate in Sarafina dance last year; this year we did nothing at all." (pair 3)*

Despite peer encouragement, a barrier to exercise was peer gossip. Many girls expressed concerns about how they looked when exercising and what their female and male peers would say about them.

> *"At school there is netball, soccer, ladies soccer, and volleyball. I don't participate in any activity. My problem is that people who are playing ball at school are talking a lot, and I don't like to talk." (pair 8)*

4.4 Discussion

Within a rural South African setting, adolescent girls could articulate an understanding of healthy eating. They were aware of healthy versus unhealthy foods, and the benefits of locally grown foods. Most study participants associated healthy foods with health benefits such as prevention of illness and feelings of wellness. Similar perceptions about healthy foods were shared by young females in an urban setting in Soweto, where we have previously investigated the meaning of healthy eating (Sedibe et al., 2014b). In both settings, participants described healthy

eating in terms of specific foods—in particular, fruits and vegetables, and the benefits of eating these foods, such as improved immune system function and protection from illness. In the current study, the participants described healthy foods as having less fat and including traditional and locally grown foods. The knowledge of health benefits attached to traditional foods imparted by female caregivers and their involvement in household agriculture and food preparation were important factors enabling adolescent girls to eat more healthily. A strong facilitator of healthy eating at the household level was the availability of family-grown vegetables within households or from neighbours, relatives, or local vendors. Interestingly, participants generally did not view the availability of miroho as facilitating healthy eating, but rather as a sign of poverty.

Poverty and food insecurity are factors that are barriers to healthier eating. For a majority of participants, unavailability of food for breakfast at home meant their not eating anything before going to school. For the few who did eat something, pap with tea was most common. Most young women felt that they did not have the resources to eat a healthy diet because of limited choices and restricted access to healthy foods. Given these findings, students may benefit from breakfast programmes such as the Maryland Meals program for Achievement, which provides free breakfast in classrooms. This is currently not common practice in South African government-supported high schools. This approach, where breakfast was supplied in the classroom as part of the school day, caused improvements in performance, attendance, attention, and behaviour (Murphy et al., 2000). It will play a major role in facilitating healthy eating practices in a community that is reported to have increased household food insecurity due a high prevalence of HIV/AIDS (Hunter et al., 2007).

However, it appears that peer pressure and cultural beliefs may hinder the consumption of traditional foods, as eating *miroho* is considered a sign of poverty. There is a strong aspiration to consume more meat and fast foods, because they are associated with better economic status and are therefore more desirable. With the benefits of poverty reduction that economic transition brings to South African urban and rural settings (Kessides and Alliance, 2006), it is concerning that healthy traditional and local eating practices could erode as communities adopt unhealthy eating behaviours.

The school meal programme provides cooked meals to school students who otherwise would not have had any food. However, adolescents mentioned that fruit was rarely available, and that the meals served might not be the "healthiest", with reports of stomach cramps. Increasing the availability of healthy foods through the school meal programme or reduced/subsidised food prices would facilitate healthy eating. This is supported by findings of a systematic review of United Kingdom-based studies examining barriers to and facilitators of healthy eating among young people aged 11 to 16 years. Adolescents overall believed that greater availability of healthy foods would facilitate healthy eating (Shepherd et al., 2006). However, in the current study, despite Agincourt participants acknowledging the school meal programme, they expressed a strong desire to have the financial resources to purchase convenience foods such as fried chips and sugar-sweetened beverages from school vendors. These findings are in line with the systematic review conducted by Shepherd et al. in 2006, where young people mostly preferred fast food for its taste and for the ability to choose what they ate (Shepherd et al., 2006).

As rural communities transition and become more urbanised, it is important that lessons from urban areas are acknowledged. In a similar study conducted in an urban setting, Soweto girls were skipping breakfast at home and consuming it at school, where school vendors sold unhealthy high-energy options such as *vetkoek* and snacks instead. Compared with their rural

counterparts, urban girls reported consuming more fast foods at home during weekends (such as *kota* and *vetkoek* for breakfast) owing to its greater accessibility, convenience, and cost. Some urban girls even replaced supper during the week with *kota* outside the home, which resulted in reduced sharing of family meals. In rural settings, because of the increasing cost of living, economic challenges, and increasing availability, access, and popularity of fast foods, it is possible that adolescents will consume more fast food. This could cause a decline in the consumption of locally grown and traditional vegetables among adolescents.

It is important to consider the impact of poverty and food insecurity the importance of informal food vendors in rural communities, the food composition of school meal programmes, and the aspirations of youth (including taste preferences and the emotional connotations of food) when envisaging interventions to promote healthier dietary behaviours. Clinics were also reported to provide health education messages that promote and encourage healthy eating practices.

While urban girls in the Soweto study also participated in house chores, the majority did not walk long distances to and from school, as did their counterparts in the current study, and some even used transportation (Sedibe et al., 2014b). In both settings, dancing (street and traditional) can be employed in interventions to increase physical activity. These findings are in line with a study conducted in rural Limpopo province, Dikgale village, where adult women were found to be highly active because they walked with increased intensity for long distances owing to transport limitations, and participated in household work, yard work, and farming activities (Cook et al., 2011). In a United States study of Florida adolescents aged 13 to 14 years, walking to school was associated with greater overall levels of vigorous physical activity throughout the day compared with travelling by car, bus, or train (Alexander et al., 2005).

Schools play a major role in facilitating and promoting physical activity among female students. However, schools need to encourage older adolescent learners at higher grades to participate in physical activity in order to encourage ongoing activity after they leave school. Based on recent findings in the same community, increased resources through innovative local organisations such as schools should assist in prioritising the provision of equipment and facilities for non-classroom activities (Micklesfield et al., 2014). In a South African township-based study among secondary school students in Durban, inadequate sports facilities were cited as the primary reason for nonparticipation in sports by black students (Mchunu and Le Roux, 2010).

4.6 Conclusions

The findings of this study will help to formulate strategies to address barriers and build on known facilitators of healthy practices among female adolescents in rural areas, thereby creating conditions that encourage healthy eating practices and physical activities.

As the nutrition transition advances in rural South African settings, it is necessary to protect and promote the availability of and access to locally grown foods and traditional dishes, in order to encourage healthy eating among female adolescents. Female caregivers and the elderly in the community can play an important role in teaching young females about the health benefits of traditional foods, because they are primarily involved in preparing family meals. Food availability in relation to food poverty needs to be addressed. This is a major barrier, because adolescents know about the benefits and importance of consuming breakfast. School meal programmes should be expanded and improved as a contribution to healthy eating among adolescents who do not have sufficient access to healthy options at home.

Physical activities that adolescents currently engage in, such as household chores, walking long distances, and traditional dancing, should be preserved and encouraged in a society with an

increasing prevalence of overweight and obesity. Extramural activities at school should be promoted, and sports facilities strengthened. Future studies should explore how other community-based structures such as churches and clinics can be employed to promote and protect healthy eating practices among adolescents. These interventions are vital to help reduce the prevalence of overweight and obesity among young girls and thus reduce the risk of future cardiovascular and metabolic disease.

Chapter 5

Chapter 5 Dietary habits and eating practices and how they associate with obesity in urban and rural black South African adolescents undergoing a health transition

(Submitted to BMC Public Health, under review)

5.1 INTRODUCTION

The prevalence of obesity in both high-income and low- and middle-income country populations is increasing (Abegunde et al., 2007, Vorster, 2002). Among adolescents, the occurrence of overweight and obese individuals has drastically increased over the past twenty years (De Onis and Blössner, 2000, Samuelson, 2000), a phenomenon that has been attributed to modifiable lifestyle factors linked to diet, physical activity and sedentary behaviour (Eisenberg et al., 2005).

Being overweight or obese during adolescence has been shown to increase one's risk of developing NCDs in adulthood (Singh et al., 2008). Research also suggests that dietary habits and practices developed in childhood are usually maintained into adulthood, and this predisposes individuals to obesity and increased metabolic disease risk (Gordon-Larsen et al., 2004, St-Onge et al., 2003). In urban South Africa, we have found poor eating habits among adolescents within the home, community and school environment, with poor dietary patterns which were already established at early adolescence (Feeley et al., 2012).

Differences and similarities in dietary habits and practices, and their association with obesity risk in urban and rural South African adolescents are not known. In addition, little is known about the differences in dietary habits and practices at different adolescent stages (early vs. mid adolescence). Therefore, our aim was to compare the different dietary habits and eating

practices between urban and rural adolescents in specific environments (community, home and school environment) and their associations with obesity.

5.2 METHODS

5.2.1 Setting and study population

Data for the current study was collected from two sites, Agincourt (rural) and Soweto (urban) between the years 2008-2009.

5.2.2 Urban site: Soweto – Birth to Twenty cohort (BT20)

The Birth to Twenty (Bt20) cohort monitors children's health and wellbeing (Yach D et al., 1991) and is comprised of only singleton children (n=3 273) born between April and June 1990, resident for at least 6 months in the Soweto-Johannesburg municipality after birth, and whose parents gave consent to be enrolled in the study. The cohort is demographically representative of long-term residents of Soweto-Johannesburg, and has been followed from birth to 23 years of age (Norris et al., 2007, Richter et al., 2007). Attrition over two decades has been comparatively low (30%), mostly occurring during the children's infancy and early childhood. Descriptive details of the study site have been published elsewhere (Norris et al., 2007, Richter et al., 2007). In the Birth to Twenty cohort, data collected at ages 13 and 15 years was used in the current study.

5.2.3 Rural site: Agincourt – Health and Demographic Surveillance System (AHDSS)

This study was conducted in rural Agincourt, a sub-district of Bushbuckridge, Mpumalanga province, northeast of South Africa. The study site lies close to the border with Mozambique, bordering the Kruger National Park conservation area. This site provides the foundation for the Rural Public Health and Health Transitions Research Unit of the Medical Research Council

(MRC) and University of the Witwatersrand, South Africa (the MRC/Wits-Agincourt Unit). Further details of the study site have been published elsewhere (Kahn et al., 2012, Kahn et al., 2007)

The sampling and recruitment for this study in rural Agincourt was done through the AHDSS. According to our statistical sample size calculation, 600 children from the AHDSS were selected to participate in the 2009 data collection, which was termed the Growth 2 Study. Cross sectional data was collected from participants who were 11-12 years of age (mean age 11.5) and those who were 14-15 years of age (mean age14.5). Previous studies have published details of recruitment methods and study design (Kahn et al., 2012, Kahn et al., 2007).

Participants were divided into two age groups: the “early adolescence” age group (Year 13), which represents the onset of adolescence; and the “mid-adolescence” age group (Year 15), in order to identify/detect any differences in dietary habits and eating practices at different age groups across the different domains of influence.

Adolescence may be divided into three developmental stages based on physical, psychological and social changes: early adolescence, 10/13-14/15 years; mid adolescence, 14/15-17; and late adolescence, between 17-21 (Delisle, 2005). All participants in the Agincourt group, who were between 11 and 12 years of age during the data collection period, were grouped into the “early adolescence” age group and compared with the 13 year old group from the Bt20 cohort. All participants in the Agincourt group, who were between 14 and 15 years of age at data collection period, were grouped into the “mid-adolescence” age group and compared with the 15 year (mid-adolescence) old group from the Bt20 cohort site.

Ethical approval for the Soweto site was obtained from Witwatersrand University Committee for Research on Human Subjects (M080320). Ethics clearance for the Agincourt site was obtained

from Witwatersrand University Committee for Research on Human Subjects (M090212) and from the Ethical Committee of Mpumalanga Province. Primary caregivers gave written informed consent for their child to participate in the research at each assessment visit and the child provided written assent. Confidentiality has been maintained by the allocation of an identification number for each participant which was used on all questionnaires.

5.2.4 Dietary habits and eating practices assessment

The questionnaire used in this study was developed with the guidance of a literature review. Questions around dietary habits and practices which have been shown to be associated with poor nutritional outcomes (Jenkins and Horner, 2005a, Greenwood and Stanford, 2008b, Gregory et al., 2000, Pomerleau et al., 2004b, Labadarios et al., 2005) within three key settings (home, school and community) were formulated, as these have been shown to be associated with poor nutritional outcomes (Greenwood and Stanford, 2008a, Jenkins and Horner, 2005b, Pomerleau et al., 2004a, Labadarios et al., 2005). The questionnaire was somewhat similar to a non-qualified food-frequency questionnaire, where the recording of the frequency of certain food items over the recall period was done. Eating practices that participants engaged in were identified, and once determined, which foods they ate (from a predetermined list based on focus group findings) and the frequency of the practice in the previous week was also investigated. This way the engagement in eating behaviour, and where relevant, the foods consumed and their frequency was investigated. In both site, the fieldworkers were trained on the administration of the questionnaire.

The questionnaire used was translated into local languages (including seSotho, isiZulu, and Shagaan/Tsonga), piloted, and modified in fieldwork debriefing sessions to ensure meaning equivalence of the questions. Piloting was carried out on a group of adolescents conveniently sampled to ensure understanding of questions and to test for appropriate translation to local vernacular. Reliability was assessed by using the test-retest design method, administering the

questionnaire to the pilot participants (n=20) twice, one week apart. To determine the retest reliability kappa-coefficients for nominal data were used, which showed very strong agreement between the first and second test responses, ranging from 0.89-1.00 for the different questions.

An interviewer administered the questionnaire during the participants' visit to the data collection sites in Soweto and Agincourt. The questionnaires covered dietary habits and eating practices, and eating occurring in three environments/settings: In the home, in the community, and in the school setting. In the home setting, participants were asked how frequently they ate their main meal with their family ("never", "some days", "almost every day"=most days/every day); categorised as follows: irregular = "never/some days" and regular = "most/everyday"; how frequently breakfast was consumed during the previous week, coded as irregular (≤2 days/week) or regular (3-5 days/week), and on the weekend, coded as irregular (0-1 weekend day) or regular (both weekend days); how frequently snacks where consumed while watching television (TV) in the previous week, coded as irregular =≤3 times/week, regular = >3 times/week; and the number of snacks consumed while watching TV in the previous week (0, 1, 2, 3, 4 or >5 snacks/week).

In the community setting, participants were asked how frequently they consumed fast foods (irregular=≤3 times/week, regular = >3 times/week) and the number of fast food items (0, 1, 2, 3, 4, >5) consumed in the previous week. In the school setting, participants were asked how frequently they made tuck shop (vendors and retailers on school premises) purchases (coded as irregular=≤2 times/week or regular=>3 times/week), and the number of items (0, 1, 2, 3, 4, >5) purchased at the tuck shop (TS) during the previous week; and how many days during the previous week a lunch box (LB) (irregular=≤2 /week, regular=3-5/week) was used (Feeley et al., 2013) .

5.3.5 Anthropometry

Anthropometry measurements were collected by trained fieldworkers. Weight (digital scale from Dismed, USA) to the nearest 100gram, and height (stadiometer from Holtaine, UK) to the nearest millimetre, were measured for all participants, with subjects wearing light clothing and no shoes. A software program (AnthroPlus 2007) developed by the WHO was used to calculate z-scores for BMI for age and constitute growth reference data for children aged 5 to 19 years (Blössner et al., 2009). A z-score of -2 is recommended as a cut-off for thinness. Cut-off scores for overweight and obesity are +1 and +2, respectively (equivalent to the 85th percentile and 97th percentile, respectively). The body mass index (BMI) (weight in kilograms divided by height in meters squared) (kg/m^2) was computed and BMI-for-age Z-scores were computed to determine overweight and obesity among adolescents using WHO 2007 BMI-for-age Z-score cut-off (Blössner et al., 2009) . This coincides, at 19 years of age, with adult cut-offs for BMI of 25 and 30 respectively For the purpose of this paper the adolescents were divided into underweight (Z≤-2SD), normal (Z>-2≤+1SD), overweight (Z>+1≤+2SD), and obese (Z>+2SD). In the bivariate regression models, the adolescents were divided into two categories: normal (Z>-1.99≤+1SD), overweight and obese (Z>+1SD).

5.2.6 Statistical analysis

All statistical analyses were performed using STATA statistical software package version 10.0 (StataCorp LP). Descriptive statistics were performed for each variable. For continuous variables, the Bartlett's test / Student t-test was used to test the differences between means across gender within the same age group, within the different study sites. For categorical variables frequencies are presented and the Pearson χ^2 test was run for differences in proportions by gender within specific age groups, in different sites. For comparing groups with less than five participants in each group, in addition to the Pearson χ^2 test, the Fisher's exact test was done. The results of the two did not differ (Pearson χ^2 test vs Fisher's exact test),

thus only results from the Pearson χ^2 test are presented. Logistic regression analyses were conducted to test the association between dietary habits and eating practices in different environments with risk of being overweight or obese for EA and MA. Odds ratios (95%CI) were computed for five models M1: (gender and site), M2: (included M1 plus home dietary habits and eating practices), M3: (included M2 plus and community dietary habits and eating practices), M4: (included M2 plus school dietary habits and eating practices) and M5 (included M3 plus school dietary habits and eating practices. R2 values are presented for each model. A p-value of <0.05 was considered statistically significant.

5.3 RESULTS

Descriptive characteristics of participants at early-adolescence (EA) and mid-adolescence (MA) are presented in Table 6.3.1 and 6.3.2 by gender and site [rural (Agincourt) and urban (Soweto)]. In both adolescent groups and at both sites mean BMI was significantly higher in girls. Early-adolescence (EA) urban boys and girls had a significantly higher mean BMI, height and weight compared to their rural counterparts (p=0.000), and there were significantly more urban boys and girls in the overweight and obese BMI-for-age Z-score cut-offs (P=0.000) category, and this difference was not observed in the MA group, where only the mean height and weight of MA urban boys was significantly higher than their rural counterparts (P=0.0002 and P=0.0011, respectively). Based on BMI-for-age Z-score cut-offs, after combining the numbers in the overweight and obese category, more females were in this category at both sites as compared to boys at both EA (rural: 17.34% vs 9.52%; urban: 36.15% vs 27.89%) and MA (rural 22.33% vs 5.50%; urban: 28.5% vs. 12.82%). The urban site had more overweight and obese adolescents as compared to the rural site. Underweight prevalence's did not differ much between females and males within both EA (8.16% vs.4.76% and 3.73% vs. 5.39%) and MA (3.88% vs.4.40% and 2.11% vs. 7.44%) in the rural and urban sites, respectively.

Table 5.3.1: Anthropometric characteristics of early-adolescent (Y13) boys vs girls in rural and urban participants (means and CIs where appropriate)

Site	Rural (Agincourt)		P value (boys vs girls within same centre)	Urban (Soweto)		P value (boys vs girls within same centre)	P value (boys vs boys across centres)	P value (girls vs girls across centres)
Age group	Y13			Y13				
Gender	Boys (n=105)	Girls (n=98)		Boys (n=760)	Girls (n=805)			
BMI (kg/m^2)(mean 95 CI)	16.82 (16.41-17.22)	18.22 (17.48-18.95)	0.001	18.64 (18.38-18.90)	20.64 (20.31-20.97)	0.00	0.00	0.00
Underweight (%)	4.76	8.16	0.139*	5.39	3.73	0.000*	0.00	0.00
Normal (%)	85.71	74.49		66.71	60.12			
Overweight (%)	3.81	11.22		6.05	15.03			
Obese (%)	5.71	6.12		21.84	21.12			
Height (cm) (mean 95 CI)	144.94 (143.40-146.51)	148.83 (147.24-150.41)	0.0007	154.59 (153.94-155.24)	155.6 (155.13-156.06)	0.125	0.00	0.00
Weight (kg) (mean 95 CI)	35.62 (34.23-37.01)	40.72 (38.60-42.84)	0.0001	44.87 (44.05-45.48)	50.16 (49.28-51.04)	0.00	0.00	0.00

WHO BMI-for-age Z-score classifications: Underweight= Z≤-2SD; Normal= Z>-2≤+1SD; Overweight= Z>+1≤+2SD Obese= Z>+2SD; BMI=body mass index (kg/m²)

kg= kilogram; cm= centimetres; BMI=body mass index (kg/m²)

p value based on Pearson chi squared test for categorical and t independent test for continuous variables

* p value based on Pearson chi squared test; ** p value based on both Pearson chi squared and Fisher exact test

Significant differences set at p<0.05

Table 5.3.2: Anthropometric characteristics of mid-adolescent (Y15) boys vs girls in rural and urban participants (means and CIs where appropriate)

Site	Rural (Agincourt)		P value (boys vs girls within same centre)	Urban (Soweto)		P value (boys vs girls within same centre)	P value (boys vs boys across centres)	P value (girls vs girls across centres)
Age group	Y15			Y15				
Gender	Boys (n=89)	Girls (n=100)		Boys (n=747)	Girls (n=786)			
BMI (kg/m^2)(mean 95 CI)	18.9 (18.39-19.41)	21.43 (20.63-22.23)	0.00	19.62 (19.39-19.85)	22.27 (21.95-22.59)	0.00	0.0408	0.0798
Underweight (%)	4.4	3.88	0.001**	7.44	2.11	0.00*	0.108	0.197
Normal (%)	90.11	73.79		79.74	69.39			
Overweight (%)	1.1	16.5		5.51	16.98			
Obese (%)	4.4	5.83		7.31	11.52			
Height (cm) (mean 95 CI)	162.55 (160.73-164.38)	159.87 (158.79-160.95)	0.0107	165.91 (165.35-166.48)	158.66 (158.23-159.09)	0.00	0.0002	0.0616
Weight (kg) (mean 95 CI)	50.38 (48.24-52.51)	54.82 (52.62-57.01)	0.0046	54.21 (53.46-54.97)	56.09 (55.24-56.93)	0.0012	0.0011	0.3183

WHO BMI-for-age Z-score classifications: Underweight= Z≤-2SD; Normal= Z>-2≤+1SD; Overweight= Z>+1≤+2SD Obese= Z>+2SD; BMI=body mass index (kg/m²)

kg= kilogram; cm= centimetres; BMI=body mass index (kg/m²)

p value based on Pearson chi squared test for categorical and t independent test for continuous variables

* p value based on Pearson chi squared test; ** p value based on both Pearson chi squared and Fisher exact test

Significant differences set at p<0.05

5.3.1 Dietary habits and eating practices

5.3.1.3 Home environment

Significantly more girls than boys ate their main meal with the family “almost every day” in the previous week, at both EA (51.02% vs 33.33%) and MA (48.51% vs 28.57%) in the rural site whereas this was not observed in the urban site, as presented in Table 5.3.3 and 5.3.4. Irregular breakfast consumption on weekdays was significantly higher in EA and MA girls (29.25% & 44.89%) vs males (21.19 & 27.47%), in the urban site. Urban girls consumed more snacks while watching TV than boys at both EA (5±5.6 vs 4±5.1; P≤0.015) and MA (9±7.3 vs 8± 5.9, P≤0.001), this was not observed in the rural site, as presented in Table 5.3.3 and 5.3.4. Significantly more urban than rural participants consumed snacks regularly while watching TV (49.46% vs 18.72%) only at EA. Urban participants consumed more snacks while watching TV than rural participants at both EA (4±5.4 vs 1±3.3; P≤0.0000) and MA (9±6.7 vs 5±3.0, P≤0.000 as presented in Table 5.3.5.

5.3.1.2 Community environment

At MA, girls from the urban site, consumed significantly more fast food items than boys (18±9.9 vs 17±8.9, P≤0.002), respectively as shown in Table 5.3.4. No differences between boys and girls were observed in terms of fast foods consumed at EA and MA in the rural setting.

5.3.1.3 School environment

Tuck shop: In the urban site, girls purchased significantly more tuck shop items than boys in the previous week at EA only (13± 7.9 vs 12±8.0, P≤0.002), as shown in Table 5.3.3. This was not observed in the rural setting at both EA and MA as shown in Table 5.3.3 and 5.3.4.

Lunch box: At EA, 100% of boys and girls had irregular lunch box usage in the previous week, among both urban and rural adolescents; whereas at MA, frequency of lunch box usage in the previous week was irregular among males as compared to females (MA, 92.25% vs 81.9% P≤0.00) in the urban site, no differences were observed in the rural setting as presented in Table 5.3.4.

Table 5.3.5 compares dietary and eating practices amongst African adolescents between sites (rural vs. urban) at EA and MA.

The following percentages were significantly higher in urban adolescents compared to their rural counterparts: Irregular frequency of breakfast consumption during weekday and weekend; the number of snacks consumed whilst watching TV; regular frequency and number of fast foods items consumed; and regular frequency and number of tuck shop purchases made during the previous week. Frequency of those eating their main meal with family some days was higher among rural vs urban EA (44.33 vs 14.07%, P≤0.00) and MA (38.54% vs 26.88%, P≤0.00) participants, respectively, whereas the irregular frequency of lunch box usage during the previous week was significantly higher in the urban site only at MA (P≤0.002), whereas irregular usage was 100% in both boys and girls among EA participants.

Table 5.3.3: Comparison of dietary practices and eating habits between genders within same site in the early-adolescence (Y13) group

Environment	Indicators	Frequencies	Urban (Soweto) (%)			Rural (Agincourt) (%)		
			Males n=760	Females n=805	P-value	Males n=105	Females n=98	P-value
Home	Frequency of eating main with family in the previous week.	Never	22.4	22.84	0.737	20.95	6.12	0.003
		Some days	13.43	14.68		45.71	42.86	
		Almost everyday	64.1	62.48		33.33	51.02	
	Frequency of eating breakfast on weekend days in the previous week.	Irregular (1 weekend day)	12.19	14.27	0.226	6.67	3.06	0.2
		Regular (both weekend days)	87.81	85.73		93.33	96.94	
	Frequency of eating breakfast on week days in the previous week.	Irregular(≤2 days/week)	21.19	29.25	0.000	11.43	6.12	0.1
		Regular (3-5 days/week)	78.81	70.75		88.57	93.88	
	Frequency of consuming snacks whilst watching TV in the previous week	Irregular(≤3times/week)	51.71	49.44	0.3	84.76	77.55	0.1
		Regular (>3times/week)	48.29	50.56		15.24	22.45	
	Number of snacks consumed whilst watching TV during the previous week (mean±SD)		4±5.1	5±5.6	0.0153	1±2.8	2±3.8	0.118
Community	Frequency of fast foods items consumption during the previous week	Irregular(≤3times/week)	1.97	1.47	0.7	5.71	10.2	0.2
		Regular (>3 times/week)	98.03	98.26		94.26	89.8	
	Number of fast food items consumed during the previous week (mean±SD)		17±8.6	17±8.5	0.12	8±4.8	9±5.7	0.24
School	Frequency of tuck shop purchases during the previous week	Irregular(≤3times/week)	14.08	8.94	0.001	15.24	19.39	0.4
		Regular (>3times/week)	85.92	91.06		84.76	80.61	
	Number of tuck shop items purchased in the previous week (mean±SD)		12± 8.0	13±7.9	0.002	6±4.3	7±4.9	0.3047

p value based on Pearson chi squared test for categorical and t independent test for continuous variables

Significant differences set at p<0.05

Table 5.3.4: Comparison of dietary practices and eating habits between genders within the same site in the Y15 group

Environment	Indicators	Frequencies	Urban (Soweto) (%)			Rural (Agincourt) (%)		
			Males n=747	Females n=786	P-value	Males n=89	Females n=100	P-Value
Home	Frequency of eating main with family in the previous week	Never	8.82	10.39	0.41	26.37	18.81	0.018
		Some days	26.2	27.53		45.05	32.67	
		Almost everyday	64.98	62.08		28.57	48.51	
	Frequency of eating breakfast on weekend days in the previous week.	Irregular (1 weekend day)	17.2	20.97	0.57	5.49	6.8	0.707
		Regular (both weekend days)	82.8	79.03		94.51	93.2	
	Frequency of eating breakfast on week days in the previous week.	Irregular(≤2 days/week)	27.47	44.89	0.00	10	13.59	0.442
		Regular (3-5 days/week)	72.53	55.11		90	86.41	
	Frequency of consuming snacks whilst watching TV in the previous week	Irregular(≤3times/week)	1.03	2.11	0.084	1.1	0.97	0.93
		Regular (>3times/week)	98.97	97.89		98.9	99.03	
	Number of snacks consumed whilst watching TV during the previous week (mean±SD)		8±5.9	9±7.3	0.001	5±3.3	5±2.9	0.9829
Community	Frequency of fast foods items consumption during the previous week	Irregular(≤3times/week)	3.21	2.35	0.302	9.89	9.7	0.96
		Regular (>3 times/week)	96.79	97.65		90.1	90.29	
	Number of fast food items consumed during the previous week (mean±SD)		17±8.9	18±9.9	0.0021	7±4.6	8±6.0	0.2031
School	Frequency of tuck shop purchases during the previous week	Irregular(≤3times/week)	12.69	11.28	0.385	23.08	14.56	0.128
		Regular (>3times/week)	87.31	88.72		76.92	85.44	
	Number of tuck shop items purchased in the previous week (mean±SD)		12±8.6	13±9.5	0.0686	9±6.6	9±6.5	0.518
	Frequency of lunch box usage during the previous week.	Irregular(≤3times/week)	92.25	81.9	0.00	83.15	75	0.171
		Regular (>3 times/week)	7.75	18.1		16.8	25	

p value based on Pearson chi squared test for categorical and t independent test for continuous variables

Significant differences set at p<0.05

Table 5.3.5: Comparisons of dietary practices and eating habits between sites for Y13 and Y15 age groups

Environment	Indicators	Frequencies	Y13 (% and mean 95%CI)			Y15 (% and mean 95%CI)		
			Urban (Soweto) n=1565	Rural (Agincourt) n=203	P-value	Urban (Soweto) n=1533	Rural (Agincourt) n=189	P-value
Home	Frequency of eating main with family in the previous week.	Never	22.66	13.79	0.00	9.62	22.4	0.00
		Some days	14.07	44.33		26.88	38.54	
		Almost everyday	63.27	41.87		63.5	39.06	
	Frequency of breakfast consumption on weekend days in the previous week.	Irregular (1 weekend day)	13.26	4.93	0.001	19.11	6.19	0.000
		Regular (both weekend days)	96.74	95.07		80.89	93.81	
	Frequency of breakfast consumption on week day in the previous week.	Irregular(≤2 days/week)	25.34	8.87	0.000	36.31	11.92	0.000
		Regular (3-5 days/week)	74.66	91.13		63.69	88.08	
	Frequency of consuming snacks whilst watching TV in the previous week	Irregular(≤3times/week)	50.54	81.28	0.000	1.58	1.03	0.558
		Regular (>3times/week)	49.46	18.72		98.42	98.97	
	Number of snacks consumed whilst watching during the previous week (mean±SD)		4±5.4	1±3.3	0.0000	9±6.7	5±3.0	0.0000
Community	Frequency of fast foods items consumption during the previous week	Irregular(≤3times/week)	1.85	7.88	0.000	2.77	9.79	0.000
		Regular (>3 times/week)	98.15	92.12		97.23	90.21	
	Number of fast foods items consumed during the previous week (mean±SD)		17±8.6	8±5.2	0.000	17±9.4	8±5.4	0.000
School	Frequency of tuck shop purchases during the previous week	Irregular(≤3times/week)	11.44	17.24	0.017	13.55	18.56	0.058
		Regular (>3times/week)	88.86	82.76		86.45	81.44	
	Number of tuck shop items purchased in the previous week (mean±SD)		12±7.9	7±4.6	0.0000	12±9.0	9±6.5	0.0000
	Frequency of lunch box usage during the previous week.	Irregular(≤3times/week)	82.1	61.19	0.000	86.98	78.84	0.002
		Regular (>3 times/week)	17.9	38.81		13.02	21.16	

p value based on Pearson chi squared test for categorical and t independent test for continuous variables
Significant differences set at p<0.05

5.3.2 Association of dietary habits and eating practices with overweight and obesity risk

Tables 5.3.6 and 5.3.7 present odds ratios for being overweight and obese with gender, site and dietary habits and eating practices in different settings (home, community and environment) at EA and MA respectively.

When gender and site were adjusted for (M1), at both EA and MA respectively, being male (OR=0.389, 95% CI= 0.292-0.520; P≤0.000; OR=0.276, 95% CI= 0.207-0.369; P≤0.000), and residing in the rural site (OR=0.562, 95% CI= 0.350-0.900; P≤0.017; OR=0.610, 95% CI= 0.383-0.972; P≤0.037) were associated with reduced risk of being overweight and obese. In M2, when home dietary habits and eating practices were adjusted for, being male (OR=0.402, 95% CI= 0.301-0.538; P≤0.000; OR=0.285, 95% CI= 0.212-0.383; P≤0.000) was associated with reduced risk of being overweight and obese at EA and MA, respectively; the risk was also reduced in EA participants who ate the main meal with the family almost every day (OR=0.611, 95% CI= 0.421-0.888; P≤0.01). Irregular frequency of breakfast consumption on weekdays (OR=1.399, 95% CI= 1.021-1.917; P≤0.037) was associated with increased risk among EA, whereas among MA participants, the irregular frequency of breakfast consumption on weekends (OR=1.476, 95% CI= 1.065-2.047, P≤0.019) was associated with reduced risk of being overweight and obese.

In M3, when home and community dietary habits and eating practices were adjusted for, being male (OR=0.399, 95% CI= 0.298-0.535; P≤0.000; OR=0.283, 95% CI= 0.211-0.381; P≤0.000) was associated with reduced risk of being overweight and obese at EA and MA, respectively. Irregular frequency of breakfast consumption on weekdays (OR=1.385, 95% CI= 1.010-1.900; P≤0.043) and eating the main meal with family almost every day (OR=1.627, 95% CI= 1.119-2.366; P≤0.011) were associated with increased risk of being overweight and obese among EA;

whereas among MA participants, irregular frequency of breakfast consumption on weekends (OR=1.467, 95% CI= 1.058-2.035, P≤0.022) was associated with increased risk of being overweight and obese.

In M4, when home and school dietary habits and eating practices were adjusted for, being male (OR=0.402, 95% CI= 0.300-0.538; P≤0.00; OR=0.296, 95% CI= 0.219-0.399; P≤0.00) was associated with reduced risk of being overweight and obese at EA and MA, respectively, whereas residing in the rural site (OR=0.580, 95% CI= 0.349-0.964; P≤0.04) was only associated with reduced risk of being overweight and obese among EA participants. Eating the main meal with family some days (OR=1.794, 95% CI= 1.126-2.860; P≤0.014); eating the main meal with family almost every day (OR=1.624, 95% CI= 1.117-2.361; P≤0.011); and irregular frequency of breakfast consumption on weekdays (OR=1.390, 95% CI= 1.014-1.906; P≤0.041); were associated with increased risk of being overweight and obese among EA participants; whereas among MA participants, irregular frequency of breakfast consumption on weekends (OR=1.538, 95% CI= 1.105-2.141, P≤0.011) was associated with increased risk of being overweight and obese among MA participants.

In M5, when home, community, and school dietary habits and eating practices were adjusted for, being male (OR=0.401, 95% CI= 0.299-0.537; P≤0.000; OR=0.294, 95% CI= 0.218-0.397; P≤0.000) was associated with reduced risk of being overweight and obese at EA and MA, respectively. Residing in the rural site (OR=0.547, 95% CI= 0.324-0.924; P≤0.024) was associated with reduced risk of being overweight and obese only among EA participants. Eating the main meal with family some days (OR=1.777, 95% CI= 1.114-2.835; P≤0.016); eating the main meal with family almost every day (OR=1.610, 95% CI= 1.106-2.343; P≤0.013); and irregular frequency of breakfast consumption on weekdays (OR=1.382, 95% CI= 1.007-1.896; P≤0.045); were associated with increased risk of being overweight and obese among EA;

whereas among MA participants, irregular frequency of breakfast consumption on weekends (OR=1.530, 95% CI= 1.099-2.129, P≤0.012) was associated with increased risk of being overweight and obese.

In all models, being male was associated with reduced risk of being overweight or obese, among EA and MA participants. The irregular consumption of breakfast on week days during the previous week, was associated with significant increased risk of being overweight or obese in the 5 models, only among EA participants; whereas the irregular consumption of breakfast on weekend days during the previous week, was associated with increased risk of being overweight or obese in all 5 models, only among MA participants.

Table 5.3.6: Multiple logistic regression analysis for risk of being overweight or obese (BMI for age z scores cut offs), gender, site and dietary practices in different settings by adolescence stage

BMI z scores Y13			M1		M2		M3		M4		M5	
			Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value
Sex			0.389(0.292-0.520)	0.000	0.402(0.301-0.538)	0.000	0.399(0.298-0.535)	0.000	0.402(0.300-0.538)	0.00	0.401(0.299-0.537)	0.000
Female			1		1		1		1		1	
Site			0.562(0.350-0.900)	0.017	0.604(0.367-0.995)	0.604	0.558(0.332-0.939)	0.028	0.580(0.349-0.964)	0.04	0.547(0.324-0.924)	0.024
Urban			1		1		1		1		1	
Dietary practices/habits												
	Frequency of eating main with family in the previous week.	Never			1		1		1		1	
		Some days			0.555(0.349-0.885)	0.013	1.1779(1.115-2.836)	0.016	1.794(1.126-2.860)	0.014	1.777(1.114-2.835)	0.016
		Almost everyday			0.611(0.421-0.888)	0.01	1.627(1.119-2.366)	0.011	1.624(1.117-2.361)	0.011	1.610(1.106-2.343)	0.013
	Frequency of eating breakfast on weekend in the previous week.	Regular			1		1		1		1	
		Irregular			1.210(0.813-1.803)	0.347	1.213(0.814-1.807)	0.342	1.210(0.812-1.803)	0.35	1.216(0.815-1.813)	0.338
Home	Frequency of eating breakfast on week days in the previous week.	Regular			1		1		1		1	
		Irregular			1.399(1.021-1.917)	0.037	1.385(1.010-1.900)	0.043	1.390(1.014-1.906)	0.041	1.382(1.007-1.896)	0.045
	Frequency of consuming snacks whilst watching TV in the previous	Regular			1		1		1		1	
		Irregular			1.289(0.975-1.704)	0.074	0.741(0.494-1.110)	0.146	0.761(0.506-1.145)	0.19	0.761(0.506-1.145)	0.19

	week.								
	Number of snacks consumed whilst watching TV during the previous week.			0.998(0.961-1.036)	0.901	0.999(0.961-1.038)	0.965	1.001(0.963-1.041)	0.955
	Frequency of fast foods items consumption during the previous week.			1				1	
Community		Irregular		1.327(0.502-3.508)	0.568			1.327(0.501-3.518)	0.569
	Number of fast food items consumed during the previous week.			0.993(0.976-1.011)	0.438			0.994(0.976-1.012)	0.52
	Frequency of tuck shop purchases during the previous week.	Regular				1		1	
		Irregular				0.739(0.423-1.288)	0.286	0.742(0.425-1.294)	0.293
School	Number of tuck shop items purchased in the previous week.					0.989(0.967-1.011)	0.327	0.991(0.969-1.014)	0.451
R2 values of each model			0.057	0.074	0.076	0.076		0.077	

We performed multiple logistic regression analysis for being overweight and obese (cut offs set by using BMI for age Z-scores) with gender, centre and dietary practices and eating habits in different settings (home, community and environment) at Y13.

Significant differences set at $p<0.05$

Model 1 adjusted for gender and centre

Model 2 adjusted for Model 1 and

dietary habits and eating practices
within the home

Model 3 adjusted for Model 2 and dietary habits and eating practices within the community

Model 4 adjusted for Model 2 and dietary habits and eating practices within the school

Model 5 adjusted for Model 3 and dietary habits and eating practices within the school

Table 5.3.7: Multiple logistic regression analysis for risk of being overweight or obese (BMI for age z scores cut offs), gender, site and dietary practices in different settings by adolescence stage

BMI z scores Y15			M1		M2		M3		M4		M5	
			Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value	Exp (B) (95% CI)	p-value
Sex			0.276(0.207-0.369)	0.000	0.285(0.212-0.383)	0	0.283(0.211-0.381)	0.000	0.296(0.219-0.399)	0.00	0.294(0.218-0.397)	0.000
Female			1		1		1		1		1	
Site			0.610(0.383-0.972)	0.037	0.688(0.424-1.118)	0.131	0.650(0.394-1.073)	0.092	0.703(0.431-1.147)	0.16	0.666(0.403-1.102)	0.113
Urban			1		1		1		1		1	
Dietary practices/habits												
	Frequency of eating main with family in the previous week.	Never			1		1		1		1	
		Some days			0.876(0.554-1.387)	0.573	0.873(0.551-1.382)	0.562	0.882(0.551-1.411)	0.599	0.875(0.546-1.401)	0.579
		Almost everyday			1.091(0.719-1.656)	0.681	1.081(0.712-1.641)	0.715	1.097(0.715-1.682)	0.672	1.082(0.705-1.660)	0.72
	Frequency of eating breakfast on weekend in the previous week.	Regular			1		1		1		1	
		Irregular			1.476(1.065-2.047)	0.019	1.467(1.058-2.035)	0.022	1.538(1.105-2.141)	0.011	1.530(1.099-2.129)	0.012
Home	Frequency of eating breakfast on week days in the previous week.	Regular			1		1		1		1	
		Irregular			1.148(0.867-1.521)	0.336	1.140(0.860-1.511)	0.361	1.121(0.841-1.495)	0.436	1.115(0.836-1.487)	0.457
	Frequency of consuming snacks whilst watching TV in the previous week	Regular			1		1		1		1	
		Irregular			0.763(0.214-2.721)	0.677	0.773(0.217-2.757)	0.692	0.792(0.221-2.841)	0.721	0.802(0.223-2.877)	0.734

	Number of snacks consumed whilst watching TV during the previous week			1.00(0.980-1.020)	0.972	1.005(0.983-1.028)	0.655	0.996(0.974-1.018)	0.705	1.000(0.977-1.024)	0.997
	Frequency of fast foods items consumption during the previous week.	Regular				1				1	
		Irregular				0.838(0.369-1.902)	0.672			0.779(0.327-1.855)	0.572
Community	Number of fast food items consumed during the previous week					0.991(0.975-1.008)	0.303			0.990(0.972-1.008)	0.28
	Frequency of tuck shop purchases during the previous week.	Regular						1		1	
		Irregular						0.738(0.444-1.227)	0.242	0.762(1.457-1.272)	0.299
School	Number of tuck shop items purchased in the previous week.							1.002(0.984-1.021)	0.791	1.006(0.987-1.026)	0.544
	Frequency of bringing lunch box to school in the previous week.	Regular						1		1	
		Irregular						0.815(0.562-1.183)	0.283	0.821(0.566-1.192)	0.301
R2 values of each model			0.089		0.098		0.099		0.098		0.1

We performed multiple logistic regression analysis for being overweight and obese (cut offs set by using BMI for age Z-scores) with gender, centre and dietary practices and eating habits in different settings (home, community and environment) at Y15.

Significant differences set at $p<0.05$

Model 1 adjusted for gender and centre

Model 2 adjusted for Model 1 and dietary habits and eating practices within the home

Model 3 adjusted for Model 2 and dietary habits and eating practices within the community

Model 4 adjusted for Model 2 and dietary habits and eating practices within the school

Model 5 adjusted for Model 3 and dietary habits and eating practices within the school

5.4 DISCUSSION

This study evaluated the similarities and differences in dietary habits and eating practices between urban and rural adolescents in specific environments (community, home and school environment) and their associations with obesity in early and mid-adolescence. At early and mid-adolescence, more girls were in the overweight and obese category than boys in both sites, and the proportion of overweight and obese adolescents was higher in the urban site.

5.4.1 Dietary habits and eating practices at home

Main meal with family: Site and gender differences were observed across the two adolescence stages, where significantly more urban girls than boys, ate their main meal with the family "almost every day" in the previous week. This finding is in accordance with observations made among Malaysian and USA female adolescents (Chin and Mohd Nasir, 2009, Fulkerson et al., 2006). This could be due to reported high involvement of female adolescents in family meal preparation in both sites. A USA based study reported that greater involvement in food preparation was associated with increased frequency of meals taken with family (Patnode et al., 2010). Adolescents involved in food tasks were also more likely to consume excess energy or exercise less often than their peers (Patnode et al., 2010), which could also explain the increased prevalence of overweight and obesity among female adolescents in the current study communities (Kimani-Murage et al., 2010). The vast difference between the urban and rural adolescents in eating the main meal with the family can also be explained by the local rural (Sedibe et al., 2014a) practice which also occurs in USA communities, where adults within the same family, do not always eat at the same time or in the same room with the children (Boutelle et al., 2003, Patnode et al., 2010).

Breakfast: In both sites and genders more than 60% of participants in early and mid-adolescence consumed breakfast regularly during the week. These findings are in line with

European and local findings where more than 65% of adolescents reported having breakfast regularly (Erenoglu et al., 2006, Temple et al., 2006, Shisana et al., 2013), and such participants had the lowest proportion of obesity (Ayranci et al., 2010). Site differences observed of irregular breakfast practices where 25% urban vs 8.87% rural early-adolescent participants, respectively, are comparable and at times higher than recent national findings of 14.4% and 9.8%, respectively (Shisana et al., 2013). This same difference was also found among mid-adolescents where 36.31% urban vs 11.92% rural consumed breakfast irregularly, which compares with findings among 12-17 year old Cape town based black South African adolescents, where 22% did not have breakfast before school (Patnode et al., 2010), and in USA based studies where at least 19% of adolescents skipped breakfast (Videon and Manning, 2003, Nicklas et al., 2000). It is important to also highlight that the current study participants were not asked where they ate breakfast, and whether they ate food from home or outside the home for breakfast. Based on recent research conducted among females in the current urban setting, majority bought unhealthy food items such as the “vetkoek” (fried dumplings made from wheat flour) just before school from vendors , which could account for the higher percentages of participants who skipped breakfast (Sedibe et al., 2014b). The majority of urban participants cited time limitations as a reason for not consuming breakfast before going to school, even though they knew its importance. They, however, reported eating fast foods and snacks sold by school vendors as breakfast options (Sedibe et al., 2014b). In the current rural setting, majority of females cited unavailability of food at home as a reason for not eating breakfast (Sedibe et al., 2014a). In other South African studies the majority of participants reported not being hungry in the early morning, not having enough food in the house or people within the household not having breakfast, as the most common reasons for skipping breakfast (Shisana et al., 2013).

In studies where regular breakfast consumption and its benefits were reported among adolescents, the consumption of a healthful breakfast that doesn’t provide excess energy was

important. Breakfast consumers were more likely to have better overall diet quality (O'Dea, 2003a), and skipping breakfast was found as a common behaviour in overweight and obese adolescents (O'Dea, 2003a). Breakfast consumption has been positively related to children and adolescents cognitive function, school performance, and school attendance (Pollitt et al., 1981, Pollitt, 1995, Murphy et al., 1998, Michaud et al., 1991, Conners and Blouin, 1983). Also children and adolescents breakfast consumption is related indirectly to some total serum cholesterol and obesity (Resnicow, 1991) as cardiovascular risk factors that persist into adulthood (Children, 1991).

Students in both settings, may benefit from breakfast programs such as the USA based School Breakfast program (SBP) which was introduced in the Bogalusa schools (Smith, 1992, Devaney and Fraker, 1989, Burghardt et al., 1995) and the Maryland Meals program for Achievement (MMFA)(Murphy et al., 2000), that would offer healthier breakfast options for urban, and also improve food availability for rural adolescents. This approach would also reduce the purchasing of unhealthy breakfast options from vendors, especially as has been identified among urban participants from the same setting (Sedibe et al., 2014b).

Snacks: Gender differences were observed in the urban site where girls consumed more snacks while watching TV than boys at both early- and mid- adolescence. In terms of site, significantly more urban than rural participants consumed snacks regularly while watching TV only during early adolescence EA. Urban participants also consumed more snacks while watching TV than rural participants at both early- and mid-adolescences. Current findings are in line with previous studies, where television watching among girls was significantly associated with more snacks consumption, which was also a strong predictor of increase in BMI (Francis et al., 2003). Previous longitudinal studies among children (van Ansem et al., 2015) and adolescents in early- and mid-adolescence (Pearson et al., 2011) have shown a significant association between the availability of snacks and the consumption thereof within the home environment. In the current

study, it is very likely that snacks are more available within the urban vs rural adolescents' household owing to SES factors.

5.4.2 Dietary habits and eating practices in the community

Fast foods: Across both sites and genders, >90% of participants consumed fast foods regularly (>3 times) in the week prior to data collection. A gender and site difference was only observed among mid-adolescent participants, where urban girls consumed significantly more fast food items than boys, but no significant difference was observed among rural participants within the groups in the two adolescent stages.

These findings were higher than recent national surveys in South Africa (Steyn et al., 2011, Shisana et al., 2013) . Based on recent findings, the most frequently consumed fast food items in Soweto and Agincourt were the local energy dense *kota* (quarter-loaf of white bread filled with fried potato chips, processed cheese and any other processed meats and sauces), chips, and *vetkoek* (fried dumpling made from wheat), due to their affordability and accessibility (Sedibe et al., 2014b, Sedibe et al., 2014a). Among urban females, these options were also cited as breakfast and meal replacements consumed at household level (Sedibe et al., 2014b).

5.4.3 Dietary habits and eating practices at school

Tuck shop: Over 80% of participants in the urban and rural sites, made purchases from the school tuck shop with significantly more mid-adolescent girls than boys making tuck shop purchases, a difference not observed among early adolescents. In a cross sectional survey of USA adolescents from 20 schools (grades 9-12), 72% of participants did not use lunch boxes in the previous week, and 31% reported to purchasing snacks from the school vending machine (Neumark-Sztainer et al., 2005).

These findings match those from adolescents in Cape Town, where significantly more girls (74.6%) than boys (62.9%) bought food from school, and the majority (85.7%) of the purchases

were unhealthy (Temple et al., 2006). However, the high rate of tuck shop purchases in the current study exceeds findings from other local studies (Temple et al., 2006, Shisana et al., 2013). Recent findings in the current communities, show that most food items purchased at tuck shops are unhealthy, but females still prefer to buy food rather than bring food to school, with purchases being influenced by cost and availability (Sedibe et al., 2014b, Sedibe et al., 2014a). This suggests that if the quality of food at school tuck shops and vendors could be improved, the general diet of adolescents would be enhanced.

Lunch boxes: More than 70% of mid-adolescent participants brought/used lunchboxes irregularly, whereas irregular lunch box usage was 100% among early adolescents in the two sites. These figures are comparable to, and even higher than found in recent national data where 62.4% of children aged 10-14 years either sometimes did or did not take lunch boxes to school (Shisana et al., 2013). In the SANHANES-1 study, the proportion of African participants aged 10-12 years of age who “did not/sometimes took” lunch box to school was at 66.9% vs 62.5% at national level (Shisana et al., 2013). More girls than boys among mid-adolescent urban participants in the current study used lunch boxes regularly in the previous week. Significantly more urban than rural participants were irregular lunch box users among mid-adolescents. This is different from current national findings whereby generally more rural than urban participants did not take a lunch box to school or did so only sometimes (Shisana et al., 2013). These findings are also in line with the SANHANES-1 study where there were no significant differences in lunchbox practice by sex found in children aged 10-14 years (Shisana et al., 2013). Current study findings are higher than the SANHANES-1 results where more formal urban (47.6%) vs rural informal (25.3%) and urban informal (40.0%) dwellers aged 10-14 years of age, did not take a lunch box to school (Shisana et al., 2013).

5.4.4 Association of dietary habits and eating practices with the risk of being overweight and obese

Based on logistic regression findings, significant associations between some dietary habits and eating practices and the risk of overweight and obesity were observed, even when gender and site were adjusted for. There was no significant association between dietary habits and eating practices within the community and school environment, and the likelihood of being overweight and obese. It seems that dietary habits and eating practices within the home environment have a stronger association with the likelihood of being overweight and obese.

5.4.4.1Dietary habits and eating practices associated with decreased risk of overweight and obesity

Male participants in early and mid-adolescence were less likely to be overweight and obese compared to their female counterparts. In the current study, being in a rural setting and being male was associated with a lowered the likelihood of being overweight and obese in early- and mid-adolescence. This means that being male and rural could have some protective properties against overweight and obesity. Based on previous findings in the rural setting under investigation, majority of adolescents walk long distances to and from school as opposed to their urban counterparts, and most females engage in household chores, which urban females also engage in (Sedibe et al., 2014b), even though these chores might be more for rural adolescents, resulting in increased physical activity (Sedibe et al., 2014a). These findings are however different from USA based studies where children living in rural settings were more likely to be overweight than their urban counterparts (McMurray et al., 1999, Gauthier et al., 2000, Felton et al., 2005, Davy et al., 2004), but in a nationally representative study of children

ages 5-17 years, the risk of being overweight and obesity among rural female participants was mostly linked to physical inactivity, television watching, and computer use (Lutfiyya et al., 2007).

5.4.4.2Practices associated with increased risk of overweight and obesity

Irregular breakfast consumption during the week and weekends, eating the main meal with family “some days” and “almost every day”, accounted for most of the increased risk of being overweight and obese.

The current findings are in agreement with findings among adolescents in Dubai, UAE, Brazil, and the Gulf region, where missing breakfast was significantly associated with increased overweight and obesity among girls (Terres et al., 2006, Bin Zaal et al., 2009, Musaiger, 1991), and USA and Europe based longitudinal studies where breakfast skipping among adolescents was associated with increased risk of being overweight (Berkey et al., 2003, Szajewska and Ruszczyński, 2010). Among females, this could also be a reflection of a dieting technique most prevalent among girls as observed among female students aged 18 to 24 years in USA and local studies in which the female students skipped breakfast as means of weight control (Sedibe et al., 2014b, Malinauskas et al., 2006). This is a practice that starts in early adolescence and remains prevalent throughout adulthood (Huon and Lim, 2000), and it has also been found in other local studies (Sedibe et al., 2014b) and investigations in UICs (Malinauskas et al., 2006). Another study conducted among 13-17 year old urban Portuguese adolescents showed that increased breakfast frequency had beneficial effects on a reducing overweight and obesity (Mota et al., 2008).

The findings in the current study suggest that eating main meals with family regularly could have protective properties against being overweight and obese. These findings were also observed among racially diverse, urban adolescents (Minneapolis) enrolled in the Team COOL (Controlling overweight and obesity for life), with a mean age of 17.2 years, where participants

who reported never eating family dinner were significantly more likely to be overweight (Fulkerson et al., 2006). Eating meals with family or alone was found to have no significant association to obesity in boys and girls aged 12-17 years of age, in a Dubai based study (Bin Zaal et al., 2009).

Dietary habits and eating practices within the community and school were not found to be significantly associated with the likelihood of being overweight and obese among early and mid-adolescent. This finding is similar to a study conducted among children 11-18 years, where there was no significant association between fast food consumption and BMI in females, however, the same study showed that males who consumed fast foods regularly (≥3 times per week) had significantly lower BMI compared with males who frequented fast food restaurants irregularly (≤2 times per week) (French et al., 2001). Other cross-sectional and cohort studies showed significant association between fast food consumption, increased caloric intake (Bowman et al., 2004, Bin Zaal et al., 2009), and higher BMI z-score (Schmidt et al., 2005). Among girls aged 8-12 years of age, those who consumed fast foods ≥2 times a week at baseline, experienced the highest increase in mean BMI z-score compared to those who ate fast foods ≤1 times a week (Thompson et al., 2003). In another study where the effects of genetics vs environment were disaggregated, twins living apart exhibited greater discordance in BMI change, physical activity and fast food consumption from adolescence into adulthood, highlighting the influence of physical and household environments on BMI (Nelson et al., 2006). As these adolescents mature into adulthood, studies conducted among adults document a direct link between fast food consumption and increase in BMI (Pereira et al., 2005, Duffey et al., 2007, Bes-Rastrollo et al., 2006).

It is interesting that irregularly breakfast consumption on weekends and week days was generally higher among girls and yet the girls made significantly more tuck shop purchases than

boys in the early adolescence group and the frequency of tuck shop purchases was more regular among early- and mid- adolescent girls, who tend to gain weight. It seems that girls who miss breakfast might consume more food at other times such as from the tuck shop, thereby gaining weight. Unhealthy snacking is an important feature of adolescent food consumption, and since many snacks have a high caloric content, the direct relationship between snacking and the risk of overweight and obesity observed in this study could indicate increased energy intake (Jahns et al., 2001).

5.5 CONCLUSION

The current study findings identified similarities and differences in dietary habits and eating practices between girls and boys in early and mid-adolescence from rural and urban sites, and in specific environments (community, home and school environment). Being male and residing within a rural setting in early and mid-adolescence was associated with reduced risk of overweight and obesity. The irregular consumption of breakfast on weekdays was associated with the increased risk of overweight and obesity among mid-adolescents, whereas irregular consumption of breakfast on weekend days was only associated with increased risk of obesity among mid-adolescent individuals. Dietary practices within the home environment need to be prioritised in interventions aimed at reducing the risk of overweight and obesity, especially among urban adolescents.

5.6 LIMITATIONS

The sample size from the rural site was smaller than that for the urban site.

PART 3: DISCUSSION AND CONCLUSION

Chapter 6 Discussion

6.1 Introduction

This chapter summarises the research findings, and discusses the emergent themes identified by this research. The theoretical relevance of the thesis will be outlined and a revised conceptual framework proposed. The relevance of the research findings specific to the South African context will be discussed. Finally, the research limitations will be highlighted, future research opportunities identified, and an overall conclusion drawn from the research.

6.2 Consolidated findings

This research aimed to examine four research questions with regard to dietary and lifestyle practices of adolescents in rural vs urban South African adolescents. Each objective was achieved through empirical studies that were carried out as outlined in chapters 3, 4, 5 and Appendix L. Table 6.2.1 shows a summary of findings obtained for each research question.

Table 6.2.1: Consolidated findings of this thesis

No.	Objective	Chapter	Main findings
1	To explore if and how female adolescents engage in shared eating and joint food choices with best friends within the context of living in urban Soweto, South Africa	3	• Overweight rates were high, but there was no association between friend pairs who participated in the study. • Friends did not share dieting behaviours, majority shared foods at school and during visits to shopping malls. • Foods were commonly shared and money pooled together by friends to make joint purchases, and foods purchased at school were mostly unhealthy. • Factors that affected the choice of foods purchased at school were availability, price and quality. • Preference shaped joint choices within the shopping mall environment
2	To investigate the narratives pertaining to dietary and physical activity practices among female adolescents in Soweto.	4	• Locally prepared convenience foods were reported to replace home-prepared The majority of participants did not prioritise eating breakfast at home, but purchased deep-fried dough balls ("fat" cakes) from vendors before school. • Lunch boxes were also not commonly used as participants preferred to use spending money to purchase food from the school tuck shop. • Kotas, "fat" cakes and snacks were popular lunch choices because of their affordability, convenience, peer influence and popularity. • Respondents engaged in minimal active recreational activities. • A lack of facilities and concerns about safety were barriers to activity.

3	To explore perceptions and attitudes of adolescent girls in rural South Africa regarding healthy eating practices and physical activities.	5	• The majority of participants considered locally grown and traditional foods, especially fruits and vegetables, to be healthy. Their consumption was limited by availability, and these foods were often sourced from family or neighbour's gardens. • Female caregivers and school meal programmes promoted healthy eating practices. • Most participants believed in the importance of breakfast, even though for the majority, limited food within the household was a barrier to eating breakfast before going to school. • The majority cited limited accessibility to healthy foods as a major barrier to healthy eating, and noted the increasing intake of "convenient and less healthy foods". • Girls were aware of the benefits of physical activity and engaged in various physical activities within the home, community, and schools, including household chores, walking long distances to school, traditional dancing, and extramural activities such as netball and soccer.
4	To compare dietary habits and eating practices between rural and urban adolescents and their associations with obesity risk	6	• Differences in dietary habits and eating practices by gender and between urban and rural adolescents within the home, community, and school were identified. • Using logistic regression analysis, after adjusting for gender, site, and dietary habits and eating practices within the home, community and school environment, eating the main meal with family some days (OR=1.777, 95% CI= 1.114-2.835; P≤0.016), eating the main meal with family almost every day (OR=1.610, 95% CI= 1.106-2.343; P≤0.013), and irregular frequency of consuming breakfast on weekdays (OR=1.382, 95% CI= 1.007-

			1.896; P≤0.045) were all associated with increased risk of being overweight or obese. • For mid-adolescent participants, irregular frequency of consuming breakfast on weekends within the home environment (OR=1.530, 95% CI= 1.099-2.129, P≤0.012), was associated with increased risk of being overweight and obese. • For both early- and mid-adolescents, being male and residing in a rural setting were associated with reduced risk of being overweight and obese.

6.3 Emerging themes

6.3.1 Applying mixed methods

6.3.1.1 Successes

The current study findings give useful information to those seeking to understand and potentially intervene in adolescents and their eating and lifestyle behaviours. This study combined qualitative and quantitative methods, to better understand dietary and lifestyle behaviour among adolescents in their different social environments, in rural vs urban South African settings. Through qualitative findings, the female adolescents' social environments was investigated and understood in-depth, in order to inform potential intervention strategies. The qualitative duo interview approach was powerful in helping participants corroborate stories and share in-depth even about activities within their different environments. The qualitative findings were valuable as they complemented and provided understanding to the quantitative findings particularly among female participants.

6.3.1.2 Challenges

The use of mixed methods was not without challenges, even though each method was used separately. Collection and analysis of qualitative data took time, as it had to be done for both sites, and the analysis of quantitative data took place much later. The mixed method approach required the researcher to become skilled and competent in both analytical processes, which extended the time period of the PhD. However, with complex public health research questions, mixed methods could be valuable in helping gain better insight and interpretation of findings or recommendations.

6.3.2 Cultural, peer influences, and site influences on dietary habits and eating practices

Findings of the current study have identified friends as important sources of influence on urban females adolescents, which is in line with previous studies (Contento et al., 2006, Contento et al., 1988).Friends/peers have been previously identified as important sources of influence Previous studies have confirmed the association of dietary habits within the nuclear family than between friends (Feunekes et al., 1998). Similar yet slightly different from current findings in the urban setting, adolescents (Feunekes et al., 1998) ate most meals and snacks with their nuclear family. These adolescents regularly ate their lunch and snacks with friends but the snacks were brought from home, whereas in the current study, urban females made joint food choices and pooled money buy mostly unhealthy food items. This was also influenced mainly by availability and preferences. We can assume that food sharing might be a common practice among peers/friend, the difference could be in the type and quality of food shared. Food available in the social environments of home, community, and school need to be addressed in order to equip female peers to choose and share healthier food items.

Mixed findings have come through about the role of health knowledge on dietary behaviour, where some studies have shown that health and nutrition knowledge are not primary influences on food choices among majority of adolescents (Horacek and Betts, 1998), and knowledge alone does not translate into dietary behaviour (Axelson et al., 1985), while others found a strong association between nutrition knowledge and fruit, vegetable, and fat intake (Wardle et al., 2000). According to current findings health and nutrition knowledge among urban females did not translate into healthy dietary practices, whereas among rural females, the strong involvement and supervision of the female caregiver in the food growing, choices and dietary practices within the home could have positively influenced the consumption of healthy food within household. This was also observed in previous studies where the positive impact of parental involvement in family food choice was found to impact positively on the consumption of fruits and vegetables (Peltzer and Pengpid, 2012). In review studies, parental modelling and monitoring was found to positively influence young adolescents' dietary behaviour (Blanchette and Brug, 2005, Pearson et al., 2009a, Pearson et al., 2009b, Van der Horst et al., 2007). As much as urban girls mostly said the food their families consumed was not always healthy, it was driven by its availability, whereas among rural participants, family-grown vegetables were more accessible, and the meals provided within the school environment enabled them to eat healthier. Poverty and food insecurity could generally be higher in the rural setting, the female adolescents ate healthier options compared to their rural counterparts, even though according to the rural girls, the consumption of local fast foods was on the increase, but limited access was a hindrance, which is an environmental factor. Most shops in the rural setting are distant (far), and the consumption of indigenous green leafy vegetable, miroho, was a sign of poverty to some. Common foods and beliefs about certain foods, food taboos, food beliefs and cultural beliefs were more common in the rural environment and these influenced what participants ate. In a study where the effects of genetics vs environment were disaggregated, twins living apart exhibited greater discordance in BMI change, physical activity and fast food consumption from

adolescence into adulthood, highlighting the influence of physical and household environments on BMI (Nelson et al., 2006). This confirms the strong impact the environment has on dietary choices and practices.

It is not clear from the data analysed in the current study, but previous studies highlight that adolescence may also introduce gender differences in eating behaviour possibly due to both physiological changes and social pressures experienced during this period (Casey et al., 2010, Delisle et al., 2005b). Studies from other countries suggest that various groups interpret the recommendations in different ways, and that opinions about food, health and nutrition therefore may vary according to age, socio-economic status and gender (Blaxter & Paterson, 1983; Calnan, 1987; Calnan, 1990; Lupton, 1996). These studies have revealed that such opinions reflect food habits and the food culture in general, but that other motives such as body image, endurance and performance pressure also may influence peoples' attitude towards food and health. Culture pathways can influence perceptions of body size, which if internalised and applied, may incline adolescents to a view of their bodies that may result in unhealthy dietary behaviour (Hsu, 1987, Feldman et al., 1988). Among African American women (Cachelin et al., 2002, Sánchez-Johnsen et al., 2004), this trend is mostly attributed to the overall culture of tolerance for bigger body size, and often in LMICs, obesity is seen as a sign of wealth, beauty and fertility (Al-Shammari et al., 1994, Wang et al., 1999).

In the current study findings, among rural female adolescents, few participants mentioned that a larger body size was also a sign of good health due to the high prevalence of HIV. This was also confirmed by previous South African findings where in rural communities a larger body size was associated with affluence, health, attractiveness and happiness, and also as an indication that someone is not HIV-positive (Mvo, 1999, Puoane et al., 2005), whereas in another study, urban college females were dissatisfied with bigger body size compared with their rural counterparts

(Senekal et al., 2001). Recent data from Bt20 during adolescence also showed that most black urban teenagers were embracing Western norms of thinness even though some evidence of traditional influences on perceptions of female silhouettes was found, which also influenced their eating attitudes and behaviour (Gitau et al., 2014)

Current findings identified distinct differences in dietary habits and eating practices across settings and by gender (chapter 5), within the home, community and school setting. Interventions targeted at lowering overweight and obesity risk among adolescents, need to focus improving social environmental factors that impact particularly on dietary, eating and physical activity practices of female urban adolescents.

6.3.3 The obesogenic environment

The environment: Recent studies have focused on the role of the built environment when looking at the obesity epidemic (Egger and Swinburn, 1997, Papas et al., 2007, Roux, 2003). The built environment may play a crucial role in creating a climate that promotes obesity through increased energy consumption (high accessibility of inexpensive high energy dense foods) and reduced energy expenditure (crime and safety may prevent outdoor physical activity) (Hill et al., 2003, Egger and Swinburn, 1997, Papas et al., 2007, Roux, 2003). The built environment can be thought of as those aspects of the adolescent's surrounding that are human –made or modified, and not naturally occurring, "external to the individual" (Prevention, 2015), which includes urban developments, agriculture, housing, etc, as these aspects influence health as factors in the broad physical and social environment (Prevention, 2015). The development of successful community specific obesity prevention interventions requires a better understanding of the impact of this built environment.

Research also shows the positive association between neighbourhood food environment and dietary intake among adolescents, where close proximity to convenience stores within the adolescents' home environment was associated with low diet quality score, and close proximity to convenience stores and fast-food outlets and high density of fast-food outlets in the neighbourhood were also associated with poor nutritional intake (He et al., 2012). It is important to investigate ways in which the urban environment can be modified to improve access and availability of healthy food options for the family, community and school settings.

Current findings also showed the kota was also commonly shared among friends where money and food were combined and shared within the community and school environments. This was also fuelled by the low cost, availability and portion sizes of these foods which enabled adolescents to share them with their friends. This could be identified as an interpersonal factor, which has also been identified as playing a great role in dietary behaviour (de Vet et al., 2013).

Availability and accessibility of fast foods: Current study findings stressed the increasing availability, accessibility and low cost of local fast foods (the kota and fat cakes) to households, the community and within the school environment, especially within the urban Sowetan environment. These factors were contributing to the increased consumption of these high fat and energy dense food items. In a review of reviews study, no evidence of association was found between easy access to unhealthy food products to higher consumption thereof (de Vet et al., 2011), whereas other study showed significant association (de Vet et al., 2013, Laska et al., 2010).

Based on current qualitative findings, as much as healthy eating was well understood and desired by the urban females, the abundance of these local food vendors and fast food outlets

within the community and the school environment were not conducive to encouraging healthy eating as a practice. Among USA urban adolescents, environmental factors such as the convenience of food, hunger, appeal of food, time availability to the adolescents and their parents, and convenience of the food, were identified as primary influential factors whereas food availability, and situation specific factors (e.g. place, time) were of secondary importance in food choices; cost, habit, and body image concerns were also raised (Neumark-Sztainer D et al., 1999). In another US based study, adolescents perceived shorter walking time was significantly associated with the purchase of more sugar-sweetened beverages (SSB). The purchase of SSB was also significantly associated with the number of food outlets within a 10 min walk (Laska et al., 2010).

The food choices of majority of adolescents are not primarily influenced by health and nutrition. Research has shown that due to the rapid physical growth spurt during adolescence, where there is increase demand for energy and nutrients, therefore hunger as a physiological drive, might be mainly influencing the food intake of adolescents (Neumark-Sztainer D et al., 1999), resulting in them wanting something fast and something that will fill them up. In a qualitative study among USA adolescents, hunger was reported as the second most important reason for vending snack choice(French et al., 1999). Convenience and immediate gratification that is brought by the local fast food, outweighs the long term benefits of good health. In both settings in the current study, female adolescents understood and explained the un-healthiness of fast foods/junk food, but is seemed consumption was boosted by convenience, affordability and the eating or sharing it with friends. Some of the findings were similar to Canadian female adolescents, who associated the consumption of fast foods with pleasure, being with friends, weight gain, independence, affordability and convenience (Chapman and Maclean, 1993). Within the South African context, the local kota, fat-cakes, and snacks being consumed in the

rural and urban settings would be the equivalent of the vending snacks since these are not available in majority of local government schools.

Recent research has highlighted the dietary fat intake as being directly implicated as a causal agent in the development of obesity, as it may displace more micronutrient-dense, fibrous, carbohydrate containing foods in the diet. From personal experience, the researcher believes the kota is a township culture, a trade mark, which former township residents still buy when they visit friends and family in the township; even some women social groups, share this food item when they have their monthly meetings within the townships (anecdotal). The kota is a township culture, that might not be easy to break, it has evolved with time, from Indian Durban communities, where it was called Bunny chow (a hollowed-out half-loaf of bread filled with meat or vegetable curry, as a takeaway) (Jaffrey, 2003) by an restaurateurs known as Bunias (Desai and Vahed, 2011), it comes in quarter, half and full loaves of bread. It was used as a means to serve take-aways to excluded people, through back windows, as they were not allowed in certain shops and cafes. In local townships like Soweto, the bunny chow is called the kota "quarter", where growing up in the township, we used to buy the kota composed of either brown or white bread filled with vegetable soup and atchaar, when white bread kota was more expensive that with brown bread. The contents of the kota have become more energy dense and unhealthy with time. This shows that the kota has also undergone transition.

Lack of physical activity: Limited participation in physical activity engagement has also been shown in previous review studies to be positively linked to availability of exercise facilities at school and neighbourhood, traffic safety neighbourhood appearance (Davison and Lawson, 2006, Davison et al., 2008, Limstrand, 2008, Sallis et al., 2000). This is similar and sheds light into the limited facilities and safety concerns that urban females in the current study highlighted.

6.4 Theoretical relevance

The Triadic model of influence was selected because of its benefit in helping to guide the PhD process. This model assisted us to quantitatively and qualitatively investigate this phenomenon. Given our study findings, we were able to expand the conceptual framework with relevance to the South African context (figure 7.4.1); in terms of intra-personal influences, there were gender and adolescence stage differences that also played a role in dietary and eating habits within the rural and urban settings. Being female increased the risk of being overweight and obese. Specific dietary practices and eating habits within the social influence of the household environment were associated with increasing the risk of being overweight and obese only among mid-adolescents, which linked to the intra-personal influence of adolescence stage. In terms of the social situation influence, female caregivers had a strong influence on dietary practices and eating habits of female adolescents within the home environment. Female peers were also identified as strongly influencing food choice of their friends in the urban setting.

Within the school environment, cost, availability and choice of food influence what adolescents ate. In the rural setting, female adolescents had aspirations to purchase more fast foods, and the school environment influenced their physical activity engagement. Within the urban community environment, safety and availability of facilities influenced the engagement of female adolescents in physical activities. In terms of cultural influence, rural participants were found to have a lower risk of being overweight and obese, and the rural females were engaged in more physical activities than their urban counterparts.

These findings do not just provide a description of the obesogenic environment or the quantification of dietary practices. They also helps provide insight into how the cultural, social and intra-personal environments interact in contributing to the increasing obesity risk among adolescents. This helps identify potential areas of interventions in the different settings and environments of influence, in order to reduce the increasing prevalence of overweight and

obesity in the rural and urban settings. The dietary habits and eating practices within the home environment have been identified as significantly associated with increasing the risk or being overweight and obese among adolescents. Interventions need to focus on this social influence in improving access to healthy food options.

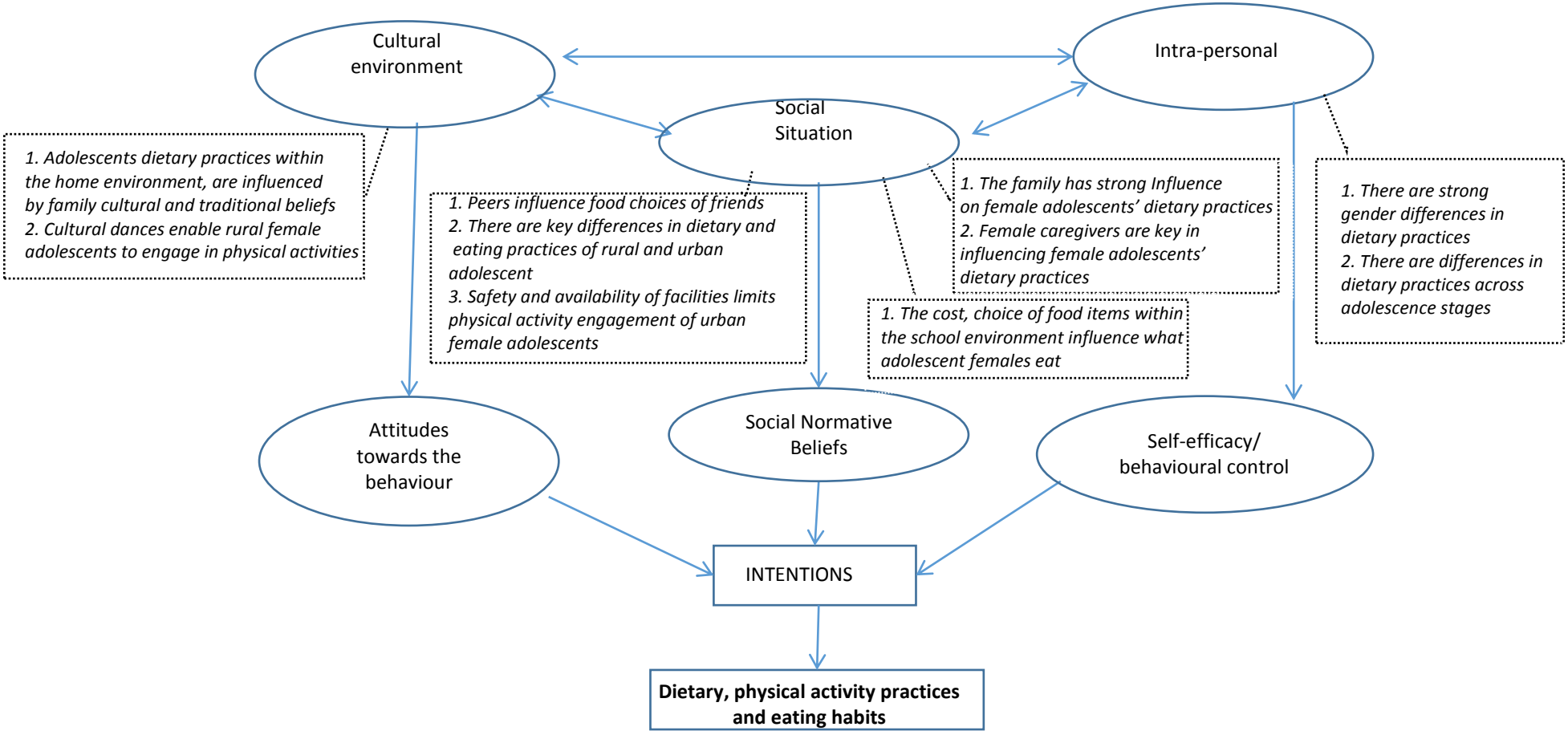

Figure 6.4.1: Adapted conceptual framework

6.5 Reflexivity

The researcher had an understanding of the language and culture, especially in the urban setting, where she interviewed adolescent girls. She could relate and understand the stories, without being judgemental. The research participants were more open and free to speak in their local languages, since the researcher had an understanding of these languages, and she could probe using them. This helped enrich the depth of the stories and also helped easy flow of conversation between the pairs interviewed.

At some point during data collection in the urban setting, the researcher realised that she was emotional affected by some of the stories that came out of the interviews. They uncovered realities behind the eating practices and activities that happened in the urban environment. Originally she felt that this study would help her understand what and why people in the urban setting ate the food they did, but this took her back to some of the realities, as a girl who grew up in urban Tembisa. The stories shared were very close to her, and brought up some experiences and realities in urban South Africa, even though some of the stories were not necessarily shared by study participants. The researcher dealt with some of her emotions, during the debriefing sessions with her co-researcher who served as an observer during each of the urban interviews. This also assisted in reducing bias in the interpretation of data.

The researcher was not as affected during the interviews with rural girls, as she didn't really grow up in the rural setting, even though she was aware of some of the dynamics, such as limited access to food, and the shyness that she expected from rural adolescent girls. As she expected, rural girl participants were shyer than their urban counterparts, yet their stories were similarly enriched by the duo-interview approach. The interviews in the rural setting were also conducted with the help of local people who understood the local language better.

Going forward, as a researcher I would like to conduct more qualitative studies in order to understand lifestyle practices of male adolescents in light of social pressures that they face, such as drug abuse. I would also like to apply the qualitative approach in understanding nutrition related topics within different population groups in South Africa. In spite of the challenges of qualitative research, I believe that interventions can only be meaningful and relevant, if informed by evidence based understanding of stories behind what people do and eat, within their different areas of social influence.

6.6 Limitations

The empirical papers have identified limitations within their specific chapters (3, 4, 5, and Appendix L. In particular:

- The qualitative findings are context and time bound, they are a subjective reality of the participants and cannot be generalised.
- Within the cross-sectional quantitative study, there is potential for recall bias as the data collected was self-reported, depending on participants' honesty and accuracy. The the sample size from the rural site was smaller than that for the urban site.

6.7 Future Studies

The current study findings have identified the following areas that need further research:

1. Longitudinal studies need to follow-up children through adolescence into adulthood to monitor changes and trends in dietary practices and eating habits within the different environments and their association with obesity risk in rural and urban settings.

2. Current findings could be used to inform intervention aimed at supporting healthy eating, habits and physical activity behaviour among adolescents within their different social environments, which are relevant to specific settings.
3. More qualitative studies are needed in order to improve the understanding of the social, cultural and intra-personal influences that are more predictive of adolescents' lifestyle practices. The relative strengths of these influences also need to be explained in order help develop effective nutrition interventions.
4. Future interventions need to prioritise the influence of the home environment on eating practices and dietary habits and how to measure environmental exposures and household influences, in order to help reduce the risk of being overweight and obese.
5. What people eat is intricately weaved with issues of identity, self-concept, friendship, security, independence, and authority. There is a need for more research into understanding the meanings of the different foods such as the kota and fat cakes within the current rural and urban settings, which adolescents consume, and the links between the meanings and social contexts in which they are consumed. This could redirect the focus onto the importance of changing social norms related to healthful eating.
6. Future research needs to investigate ways in which communities can be involved in increasing the availability of healthy food option, even improving the quality of local fast foods, and increasing the safety and the availability of physical activity facilities within communities, in order to address the increasing prevalence of obesity

6.8 Conclusion

In conclusion, both the family and community environments are critical to optimise adolescents' dietary and physical activity practices in order to reduce the increasing prevalence of overweight and obesity. Healthy food options need to be subsidized in order to improve accessibility to households, communities, and the school environments. The composition of local fast food options, need to be regulated and local vendors and food outlets need to be empowered to make healthier food options available to households, communities and schools. Within the school environment, especially high schools, adolescents need to be educated about healthy eating and lifestyle practices and healthier food options need to be made more accessible to adolescents. Parents and community leaders could be targeted as change agents to support adolescent health through interventions. The urban community environment needs to be improved in order to help increase physical activity engagement among adolescents.

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APPENDICES

Appendix A: Ethics clearance certificate – Soweto (qualitative)

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Mrs Modiehi Sedibe

CLEARANCE CERTIFICATE	**M090427**
PROJECT	Social Normative Beliefs and Practices around Food Consumption and Dietary Patterns of Black South African Female Adolescents and Their Peers
INVESTIGATORS	Mrs Modiehi Sedibe.
DEPARTMENT	Department of Paediatrics
DATE CONSIDERED	09.04.29
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09.04.29 **CHAIRPERSON** .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr S Norris

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

.....

Appendix B: Ethics clearance certificate – Mpumalanga (qualitative)

University
of the Witwatersrand,
Johannesburg

Human Research Ethics Committee (Medical)
(formerly Committee for Research on Human Subjects (Medical)

Secretariat: Research Office, Room SH10005, 10th floor, Senate House • Telephone: +27 11 717-1234 • Fax: +27 11 339-5708
Private Bag 3, Wits 2050, South Africa

21 July 2009

Ms Modiehi Sedibe
Department of Paediatircs
Birth to Twenty Programme
CH Baragwanath Hospital
University

Dear Ms Sedibe

RE: Protocol M090427:' Social Normative Beliefs and Practice around Food Consumption and Dietary Patterns of lacks South African Female Adolescents and their Peers'

This letter serves to confirm that the chairman of the Human Research Ethics Committee (Medical) has reviewed and approved the extension of the abovementioned study to include Agincourt

Thank you for keeping us updated and informed.

Yours sincerely,

Anisa Keshav
Secretary
Human Research Ethics Committee (Medical)

Appendix C: Information sheet – Qualitative studies

Wits Medical School

7 York Road, Room 4L16

Parktown 2193

Tel: 011 717-2701 or 2730

PARTICIPANT INFORMATION SHEET

SOCIAL NORMATIVE BELIEFS AND PRACTICES AROUND FOOD CONSUMPTION AND DIETARY PATTERNS OF BLACK SOUTH AFRICAN FEMALE ADOLESCENTS AND THEIR PEERS.

Hello, our names are Mrs Modiehi Sedibe, a Researcher at the Department of Paediatrics at Witwatersrand University, Ms Carlijn Voorend, a Research-assistant/student at the Birth to Twenty and the VU University, in the Netherlands and Ms Tabither Gitau a research-assistant/Pre-doctoral student at Witwatersrand University. Together with other colleagues of the University of the Witwatersrand we will be conducting a research study to examine the social eating and dietary habits of teenagers in Agincourt. We would like to invite you to participate in this research study.

What is involved in the study?

Together with your best friend you will be invited to come to Bushbuckridge in Agincourt where we are based. We will provide you with refreshments, transport money to get home and a small gift to thank you for your participation. At our offices, you and your best friend will be interviewed by one of our researchers who will ask a series of questions about your friendship, activities you engage in together, dietary habits and eating practices. We are interested in your personal experiences and opinions. The interview will last approximately 60-90 minutes and will be conducted in the language you are most comfortable with.

Risks:

There are no risks anticipated in the study. If you do experience any discomfort, emotional counseling services will be provided.

Benefits:

The benefits of participating in the study are that, you and your best friend will contribute to the body of knowledge concerning social normative beliefs and dietary patterns among teenagers, here in South Africa and in other countries.

Participation is voluntary:

You can refuse to participate or discontinue participation at any time without penalty or loss of benefits. You can choose not answer any question(s) which make you feel uncomfortable.

Confidentiality:

Personal information will be handled with strict confidentiality. Personal information may only disclosed if required by law and organizations that may inspect and/or copy your research records for quality assurance and data analysis, which includes groups such as the Research Ethics Committee. If results are published, they will not lead to individual identification. These events are not expected and are highly unlikely.

Further information:

If you require any further information or have any questions/complaints on the study please contact Ms Carlijn Voorend or Mrs Modiehi Sedibe or Ms Tabither Gitau on 011 717-2730 or Birth to Twenty on 0800 1318 18 (toll free) or Dr Shane Norris on 011 933 1122. You may also contact Rene' Wills at (011) 274-9278 for questions around study ethics of the University of Witwatersrand Human Ethics Committee.

Your consideration to participate in the study is greatly appreciated. If you are happy to take part in the study please read and sign the attached consent form and contact us to confirm your participation.

Thank you for your time and attention and hope to see you soon!

Mrs Modiehi Sedibe , Ms Carlijn Voorend and Ms. Tabither Gitau

Appendix D1: Caregiver consent form (Friend A) – Qualitative studies

PARTICIPANT CONTACT SHEET **FRIEND A**

SOCIAL NORMATIVE BELIEFS AND PRACTICES AROUND FOOD CONSUMPTION AND DIETARY PATTERNS OF BLACK SOUTH AFRICAN FEMALE ADOLESCENTS AND THEIR PEERS - study.

If you and your best (female) friend are willing to participate in this study, it is necessary that your caregivers/parents give consent. The caregivers/parents should read the information sheet and sign the informed consent form on the back of this sheet.

Please fill in the following:

ADOLESCENT'S (YOUR) NAME: _____ (Friend A)

YOUR CONTACT NUMBER: _____ (Friend A)

NAME OF YOUR SCHOOL: _____ (Friend A)

YOUR FRIEND'S NAME: _____ (Friend B)

FRIEND'S CONTACT NUMBER: _____ (Friend B)

NAME OF FRIEND'S SCHOOL: _____ (Friend B)

We would also like to know what your day of preference is to come to the interview site at Baragwaneth Hospital. Please tick in the days when you are usually available after school and/or during school holidays. We will try to secure an appointment with you on your most preferred day, where possible.

DAYS OF PREFERENCE

Monday	Tuesday	Friday

If you have filled in all the information, make sure your friend has done the same for the form on which is stated FRIEND B. Please hand in both your form and your friends form together by giving it to your teacher, Mr/Ms …… You may keep the participant information sheet for your information.

Thank you very much for your interest, we appreciate that you are willing to participate in this study. We are aiming to conduct interviews with 30 pairs of friends, if more pairs show interest, we will make a random selection. We will contact you after the selection, to secure an appointment.

Wits Medical School
7 York Road, Room 4L16
Parktown 2193
Tel: 011 717-2701 or 2730

INFORMED CONSENT

I, …… agree to my child's participation in the SOCIAL NORMATIVE BELIEFS AND PRACTICES AROUND FOOD CONSUMPTION AND DIETARY PATTERNS OF BLACK SOUTH AFRICAN FEMALE ADOLESCENTS AND THEIR PEERS, study.

The goals and the methods of the study are clear to me. I understand that the study will involve an interview which will be recorded. All the details and purpose of this study has been explained to me and my child. I understand that I have the right to refuse the participation of my child in the study.

I agree to my child's participate in the study on condition that:

1. She can withdraw from the study at anytime voluntarily and that no adverse consequences will follow on withdrawal from the study.
2. She has the right not to answer any or all questions posed in the interviews.
3. The Committee for Research on Human Subjects at the University of the Witwatersrand has approved the study protocol and procedures.
4. All results and recorded data will be treated with the strictest confidentiality.
5. Only group's results, and not my child's individual results, will be published in scientific journals and in the media.
6. The Birth to Twenty Scientific Team is committed to treating participants with respect and privacy throughout the procedure.

ADOLESCENT'S NAME

_____ _____
Printed Name Contact number

PARENT/ GUARDIAN/ CAREGIVER

_____ _____
Printed Name Contact number(s)

_____ _____
Signature/Mark or Thumbprint Date

Appendix D2: Caregiver consent form (Friend B) – Qualitative studies

PARTICIPANT CONTACT SHEET

FRIEND B

SOCIAL NORMATIVE BELIEFS AND PRACTICES AROUND FOOD CONSUMPTION AND DIETARY PATTERNS OF BLACK SOUTH AFRICAN FEMALE ADOLESCENTS AND THEIR PEERS - study.

If you and your best (female) friend are willing to participate in this study, it is necessary that your caregivers/parents give consent. The caregivers/parents should read the information sheet and sign the informed consent form on the back of this sheet.

Please fill in the following:

ADOLESCENT'S (YOUR) NAME: _____ (Friend B)

YOUR CONTACT NUMBER: _____ (Friend B)

NAME OF YOUR SCHOOL: _____ (Friend B)

YOUR FRIEND'S NAME: _____ (Friend A)

FRIEND'S CONTACT NUMBER: _____ (Friend A)

NAME OF FRIEND'S SCHOOL: _____ (Friend A)

We would also like to know what your day of preference is to come to the interview site at Baragwaneth Hospital. Please tick in the days when you are usually available after school and/or during school holidays. We will try to secure an appointment with you on your most preferred day, where possible.

DAYS OF PREFERENCE

Monday	Tuesday	Friday

If you have filled in all the information, make sure your friend has done the same for the form on which is stated FRIEND A. Please hand in both your form and your friends form together by giving it to your teacher, Mr/Ms …… You may keep the participant information sheet for your information.

Thank you very much for your interest, we appreciate that you are willing to participate in this study. We are aiming to conduct interviews with 30 pairs of friends, if more pairs show interest, we will make a random selection. We will contact you after the selection, to secure an appointment.

Wits Medical School
7 York Road, Room 4L16
Parktown 2193
Tel: 011 717-2701 or 2730

INFORMED CONSENT

I, …… agree to my child's participation in the SOCIAL NORMATIVE BELIEFS AND PRACTICES AROUND FOOD CONSUMPTION AND DIETARY PATTERNS OF BLACK SOUTH AFRICAN FEMALE ADOLESCENTS AND THEIR PEERS, study.

The goals and the methods of the study are clear to me. I understand that the study will involve an interview which will be recorded. All the details and purpose of this study has been explained to me and my child. I understand that I have the right to refuse the participation of my child in the study.

I agree to my child's participate in the study on condition that:

1. She can withdraw from the study at anytime voluntarily and that no adverse consequences will follow on withdrawal from the study.
2. She has the right not to answer any or all questions posed in the interviews.
3. The Committee for Research on Human Subjects at the University of the Witwatersrand has approved the study protocol and procedures.
4. All results and recorded data will be treated with the strictest confidentiality.
5. Only group's results, and not my child's individual results, will be published in scientific journals and in the media.
6. The Birth to Twenty Scientific Team is committed to treating participants with respect and privacy throughout the procedure.

ADOLESCENT'S NAME

_____ _____

Printed Name Contact number

PARENT/ GUARDIAN/ CAREGIVER

_____ _____

Printed Name Contact number(s)

_____ _____

Signature/Mark or Thumbprint Date

Appendix E: Participant consent – Qualitative studies

Wits Medical School

7 York Road, Room 4L16

Parktown 2193

Tel: **011 717-2701 or 2730**

INFORMED CONSENT

I, …… agree to my participation in the SOCIAL NORMATIVE BELIEFS AND PRACTICES AROUND FOOD CONSUMPTION AND DIETARY PATTERNS OF BLACK SOUTH AFRICAN FEMALE ADOLESCENTS AND THEIR PEERS, study.

The goals and the methods of the study are clear to me. I understand that the study will involve an interview which will be recorded. All the details and purpose of this study has been explained to me. I understand that I have the right to refuse my participation of my child in the study.

I agree to participate in the study on condition that:

1. I can withdraw from the study at anytime voluntarily and that no adverse consequences will follow on withdrawal from the study.
2. I have the right not to answer any or all questions posed in the interviews.
3. The Committee for Research on Human Subjects at the University of the Witwatersrand has approved the study protocol and procedures.
4. All results and recorded data will be treated with the strictest confidentiality.
5. Only group's results, and not my individual results, will be published in scientific journals and in the media.
6. The Birth to Twenty Scientific Team is committed to treating participants with respect and privacy throughout the procedure.

I,…… herewith confirm that the above participant has been full informed about the nature, conduct and risks of the study.

RESEARCH ASSISTANT:

Printed Name	Signature/Mark or Thumbprint	Date and Time

PARTICIPANT

Printed name	Signature/Mark or Thumbprint	Date and Time

WITNESS: (If applicable)

Printed Name	Signature/Mark or Thumbprint	Date and Time

Appendix F: Interview guide – Qualitative studies

Interview Schedule

Introduction

Hi, my name is ……(interviewer) at …….(interview site), with a participant in a study focusing on Narratives around dietary and exercise practices of rural young adult females in Soweto or Mpumalanga. Today's date is ……. and the time is …….. .

School

- Please tell me how school was today?
- How do you get to school?
- How long does it take you to get to school?
- What did you have for lunch today? (*probe for drinks, do you drink before, with, or after eating)*
- How did you decide to eat that?

Probe for detail on influence on food choice, availability or money etc

- Who do you eat lunch with? (*do you share food with friend, how does it all happen, probe for detail)*

(*Probe about lunchbox, or food bought at school or food provided at school)*

- What else do you do during breaks?
- What extramural activities are available at school?

(*Probe for involvement at school, and reasons for participation or non-participation)*

- So after school, what do you do? (*Probe for any activities after school. And if they go home after school)*
- If they eat bread what type of bread do they eat?
- If they eat snacks, meat and vegetables ask how often the eat them.
- If they drink cold drinks (probe for frequency and type of drink they take)

Home

- What do you when you get home? (*probe for activities)*
- Do you cook? (*If she cooks, probe for cooking schedule within family, and favourite thing to cook)*
- Are there any specific foods that your family enjoys, any eating?
- Can you think of any foods that your family does not eat? *(Probe for detail, reasons, food taboos, reasons for the taboos, probe for religious, beliefs or cultural reasons, attitudes towards different foods)*
- Does your family grow any vegetables or fruits? *(probe for detail on food supply and grocery shopping, who does grocery shopping, who decides of the list, who does the shopping, probe for seasonality in food choices)*
- Do you eat together as a family (tell me how your family eats, *probe for setting, do they watch TV or sit around the table)*
- Family activities (*probe for detail and specifics, eating with other families or members outside their family household)*

- What do you eat/do on Christmas/weddings?.....(I find this irrelevant from the few interviews we have conducted they rarely attend weddings and during Christmas they just cook and invite neighbours)
- Does your family have a field?
- Do you help in ploughing?
- Do you have domestic animals at home?

Probe whether they look after the animals and whether they contribute to their diet.

Self

- What is your favourite thing to eat?

(Probe for detail, seasonality, fruits and vegetables, and reasons)

- Do you have any foods that you don't like or are allergic to?

(Probe for details of allergic reactions or reasons for dislikes)

- Do you have any favourite thing to drink? *(probe for detail of what it is and when she drinks)*
- When do you drink, before or after meals (*probe for details)*
- What do you think about breakfast? (*probe for opinion about importance of breakfast, if she eats breakfast, and reasons for answer)*
- What is your favourite traditional/local food? *(probe for examples and reasons)*
- What is your opinion about dieting? (*probe for understanding of the term, who should diet, why anyone should diet)*
- Have you tried to diet before, how did you go about it?
- Is there a reason why you did it?
- What would be an ideal body for you? (*Probe for clothes size, or body shape)*
- What do you avoid eating in order not to gain weight?
- Who would you say has the ideal body shape among celebrities or role models. *(probe for detail, silence)*
- What do you think about exercise, who should do it?
- Have you tried to do it? (*If no, probe for limitations, if yes, ask for detail and why she did it.)*
- What do you know about high blood pressure? (*Probe for definition, understanding, things to or not to eat with high blood pressure, causes of high blood pressure)*

- What is your understanding of heart diseases *(probe for understanding, causes, limitations (do's and don'ts))*
- What is your understanding of healthy vs un-healthy foods *(probe for meaning and examples)*
- What is your opinion about junk food (*probe for understanding and examples)*

- Who or what would you say is the most reliable source of health information for you? (*probe for detail of role model or source of info e.g tv, radio, magazines, internet)*
- What is your favourite magazine to read? (they rarely read magazines)
- What is your favourite program you watch on tv? *(probe for source of information/ influence, soul city and love life)*
- Any other food related thing you want to share with me?
- What is your opinion about yourself (*probe for self view or perception)*
- If you could change anything about yourself, what would it be?

Peers

- What things do you do with friends? *(probe for activities or eating, hanging out etc)*
- Do you attend any occasions with friends? What is your favourite food or drinks in these occasions?
- Do you think you change what you eat or drink depending on different friends (*probe for peer influence)*

Community

- Any food items that you would call "village /local food" (*probe about the specific village)*
- Which foods in your village would you say is "healthy" and which is "non-healthy"?
- Which foods are tasty and which are not tasty?

- Any food taboos within your village *(probe for detail of source/origin or the food belief)*
- Any food beliefs in the village (*probe for foods that is said to cause sicknesses, foods that heal, foods for/not for males vs females.*

Appendix G: Ethics Clearance Certificate – Soweto (quantitative)

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Feeley

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M080320**
PROJECT	The impact of dietary habits and practices during adolescence on the risk of obesity: The birth to Twenty Cohort
INVESTIGATORS	Miss ABB Feeley
DEPARTMENT	Faculty of Health Sciences
DATE CONSIDERED	08.03.25
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 08.05.07 **CHAIRPERSON** .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr S Norris

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix H: Ethics clearance certificate – Mpumalanga (quantitative study)

M0
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Mrs TM Pedro

CLEARANCE CERTIFICATE	**M090212**
PROJECT	The Association of Nutrition on Body Composition and Metabolic Disease Risk in Rural South African Children and Adolescents
INVESTIGATORS	Mrs TM Pedro.
DEPARTMENT	Department of Paediatrics/Birth to Twenty
DATE CONSIDERED	09.02.27
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09.05.15 **CHAIRPERSON** .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr S Norris

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix I: Ethics clearance certificate - Mpumalanga

0

MPUMALANGA PROVINCIAL GOVERNMENT

Building No 3
No. 7 Government Boulevard
Riverside Park Extension 2
Nelspruit
1200
South Africa

Private Bag X 11213
Nelspruit
1200
Tel: (013) 766 3129
Fax: 086 511 3208
E-mail: AlternM@social.mpu.gov.za

Department of Health

Litiko Letemphilo ne LaMisebenti ye Tenhlalo yaBantfu | UmNyango Wezamaphilo no Wezomphakathi | Departement van Gesondheid en Maalskaplike Dienste

FACSIMILE TRANSM...

TO : MRS PEDRO TITILOLA	FAX : 013 795 5071 TEL:011 488 3604
PAGES: 02 INCLUDING COVER	
FROM : MS KATE MATHE/MR MOLEFE MACHABA	
TEL. NO: (013) 766 3102/3009	FAX NO: 0865170729
DATE: 21July 2009	
SUBJECT: RESEARCH APPROVAL LETTER	

Kindly receive copies of the approval letter

KIND REGARDS

Ms KATE MATHE
EPIDEMIOLOGY & RESEARCH

Appendix J: Participant Information sheet and consent form (Quantitative study)

Children/Adolescent Information Sheet

Hello, my name is ……. (researcher) and I am a Doctoral student from the Agincourt Health and Demographic Surveillance System (AHDSS) of the MRC/Wits,

Rural Public Health and Health Transitions Research Unit, and the Birth To Twenty Unit, Department of Paediatrics, also at Wits University.

I, together with my colleagues will be conducting research on the relationship of nutrition on body composition and lifestyle diseases risk in rural South African children and adolescents. We would appreciate your participation in this research study.

What is involved in the study?

You are invited to have measurements taken at a nearby school. Height, weight, skin folds, waist and blood pressure will be measured. We will also ask you to fill in a couple of questionnaires - a trained assistant will help you with this. The questionnaires are on pubertal assessment (how you are maturing physically), what you eat and how you eat, physical exercise, and what you think is the best body shape. We will also ask to take a blood sample so we can test you for different lifestyle diseases like hypertension for example. In addition, you will be given a questionnaire to assess your risk and sexual behaviour.

Risks:

There are no anticipated risks in the study. If you do experience any discomfort, there are trained fieldworkers and nurses to help you and counselling services will be provided.

Benefits:

The growth and blood tests would be of direct individual benefit if there were problems, the individual concern will be referred. In addition, this will raise awareness of obesity and its risks in the study sample and contributing to knowledge in South Africa and in other countries.

Participation is voluntary:

You can refuse to participate or discontinue participation at any time. You can choose not answer any question or questions which make you feel uncomfortable.

Confidentiality:

Your personal information will be kept fully confidential.

Further information:

If you require any further information or have any questions/complaints on the study please contact Titilola Pedro on 076709 7745, Dr. Kathleen Kahn on 011 717-2617and Dr Shane Norris on 011 933 1122. You may also contact or questions around study ethics of the University of Witwatersrand Human Ethics Committee.

Your consideration to participate in the study is greatly appreciated. If you are happy to take part in the study please read and sign the attached consent form.

Thank you and hope to see you soon!

..... ……

Researcher (Mrs) Date

I agree to myself being a participant in the Birth to Twenty study.

The goals and methods of Birth to Twenty are clear to me.

I understand that the study will involve interviews, measures of growth, a DXA scan, Oral Glucose Tolerance tests, eating habits and school reports. All the details and purposes of these tests have been explained to me. I understand that I have the right to refuse to participate in the study.

I, the undersigned, hereby declare that I understand:

1. That the University of the Witwatersrand, Johannesburg (hereafter referred to as “the University” has insured itself against the acts and omissions of persons acting on its behalf insofar as it is liable in law therefore and that its registered students and staff are insured during the course and scope of their registered courses and/or within the scope of the University business, where the fault can be attributed to the University or its affiliates.

2. That in cases where no fault can be attributed to the University, I hereby indemnify, absolve and hold harmless the University, its officials, employees, students and invitees in respect of any damage to the property, death or bodily injury to/of myself and/or third parties, whether on/off the University precincts, or whilst engaged in any activity related to the University.

3. And undertake, for any period during which I am on the university precincts or during my participation in the Birth to Twenty Study, to be bound by the rules and regulations of the University for the time being in force and by any requirements or conditions imposed by the University on me.

I agree to participation in the study on the condition that:

1. I can withdraw from the study at any time voluntarily and that no adverse consequences will follow on withdrawal from the study.

2. I have the right not to answer any or all questions posed in the interviews and not to participate in any or all of the procedures / assessments.

3. The Committee for Research on Human Subjects at the University of the Witwatersrand has approved the study protocol and procedures.

4. All results will be treated with the strictest confidentiality.

5. Only group results, and not my/my child’s individual results, will be published in scientific journals and in the media.

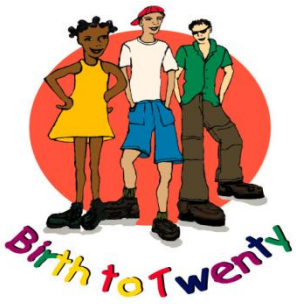
6. The Bt20 scientific team are committed to treating participants with respect and privacy through interviews conducted in private and follow-up counselling available on request.

7. I will receive a referral note to a health service if any result is out of the normal range or a problem is detected in the course of the study.

Adolescent: _____ Research Assistant : _____

Date: ____/_____/_____

Appendix K: Questionnaire (Agincourt and Birth-to-twenty)



University of the Witwatersrand

Department of Paediatrics and Child Health

BIRTH TO TWENTY BARA SITE: 17TH YEAR

ADOLESCENT HEALTH SERVICES QUESTIONNAIRE

AND/OR

University of the Witwatersrand
Rural Public Health and Health Transition Research Unit

Agincourt Growth Study
HEALTH SERVICES QUESTIONNAIRE

DATE : Day ☐☐ **Month** ☐☐ **Year** ☐☐☐☐

AGS NUMBER : ☐☐☐☐☐☐☐

The FIRST section of the questionnaire we are going to talk about…

EATING HABITS AND PRACTICES

SECTION A: Breakfast habits

Think about a **usual school week and weekend** and try to answer the following questions about your eating habits as truthfully as possible. There are no right or/ wrong answers so please feel free to give your answer.

1. On how many weekdays do you usually eat breakfast? **Mark one only**

Never	1	
1-2 days	2	
3-4 days	3	
Every weekday (5)	4	☐

2. How often do you usually eat breakfast on a weekend? **Mark one only**

Never	1	
Saturdays only	2	
Sundays only	3	
Saturdays and Sundays	4	☐

3.1 What best describes the way you usually eat during the week? **Mark one only**

3 or more meals a day	1	
2 meals a day	2	
1 meal a day	3	☐

3.2 What best describes the way you usually eat over a weekend? **Mark one only**

3 or more meals a day	1	
2 meals a day	2	
1 meal a day	3	☐

4. How many times do you eat snacks in a day? **Mark one only**

Just once a day	1	
Twice a day	2	
3 or more times a day	3	
Never	4	☐

SECTION B: Fast foods

1. How often during the **past week** (past 7 days) did you eat any of the following takeaways? **Tick each item**

	0 x last week	1x last week	2x last week	3x last week	4x last week	5+ last week
Hamburger						
Chicken Burger						
Chicken pieces						
Fried fish						
Fried chips						
Pizza						
Vetkoek						
Pies or sausage roll						
Samoosas						
Pita bread						
Hotdog						
Boerewors roll						
Doughnuts						
Sweets						
Cake						
Chocolates						
Chips e.g. nik naks						
Ice cream						
Soft drinks e.g. Coke						
Squash e.g. *Drink-o-pop/Oros*						
Diet drinks						
Other:						

2. How often do you usually eat at a friend's house? (In a week) Tick where applicable.

0 x per week	1x per week	2x per week	3x per week	4x per week	5+x per week

SECTION C: School lunch box
(if applicable)

Think about a typical school week and answer the following questions about your lunch box that you take to school.

1. How often do you generally take a lunch box to school? **Mark one only**

0 x per week	1x per week	2x per week	3x per week	4x per week	5 per week

2. Do you share or exchange what you have in your lunch box with friends?

Yes	No
1	2

3. Which foods do you often have in your lunch box? **Tick each item**

	0 x per week	Less than 2x per week	More than 2x per week
White bread or rolls			
Brown bread or rolls			
Fruit			
Chips (hot)			
Chips (e.g. nik naks)			
Pap			
Meat or chicken			
Pie / sausage roll			
Cold drink			
Diet cold drinks			
Fruit juice			
Milk or sour milk			
Yoghurt			
Cheese			
Sweets or chocolates			
Biscuits or cookies			
Peanuts			
Other:			

4. Who prepares your school lunch box (yourself, mother, father etc)

_____

5. Do you get money to spend on food / snacks at school? **Mark one only**

Yes	No	Sometimes
1	2	3

6. How much money do you usually get to spend at school per week on food? **Mark one only**

Transport	No money	1	**Lunch**	No money	1
	R10 or less	2		R10 or less	2
	R20 or less	3		R20 or less	3
	More than R20	4		More than R20	4

7. Which of the following foods did you buy at school (tuck shop)? **Tick each item**

	Did not buy	Bought 1 time	Bought 2 times	Bought 3 times	Bought 4 times	Bought 5 times or more
White bread or rolls						
Brown bread or rolls						
Fresh fruit						
Chips (e.g. nik naks)						
Pap and Meat or chicken						
Chips (hot)						
Pie / sausage roll / samoosa						
Vetkoek						
Cold drink						
Diet cold drinks						
Fruit juice						
Milk or sour milk						
Yoghurt						
Cheese						
Sweets or chocolates						
Cakes/ donuts/ éclairs						
Hot dogs						
Hamburger (beef or chicken)						
Popcorn						
Peanuts/nuts						
Other:						

1. How often do you snack when you are watching TV? **Mark one only**

Every day	1
More than three days a week	2
Less than 3 days a week	3
Never	4

2. Which snacks did you eat while watching TV last week (past seven days)? And how often? **Tick each item**

	Didn't eat	1 time	2 times	3 times	4 times	5 or more times
Fruit						
Popcorn						
Chocolates						
Bread (any type)						
Crisps e.g. nik-naks						
Biscuits						
Cakes/ donuts/ éclairs						
Drinks e.g. Coke						
Fries						
Other:						

4. Do TV adverts on foods influence you to buy those food items? **Mark one only**

Never	1
Hardly ever	2
Often	3
Very often	4

5. Which food and drinks that you see advertised on TV do you buy?

1.)
2.)
3.)

6. Where do you usually eat your main meal of the day? **Mark one only**

Kitchen at a table/counter (eating by yourself)	1
Dining room at a table (eating with other family members)	2
In front of the TV off your lap	3
Other	4

7. How many times do you eat dinner/supper with your family/parents/caregivers?

Never	1
Some Days	2
Most Days	3
Every Day	4

8. How much does your mother/caregiver/father control what you eat?

1.	Not at all	2.	Sometimes	3.	Mostly	4.	Completely

Original papers

Appendix L: Paper 1

‘We eat together; today she buys, tomorrow I will buy the food’: adolescent best friends’ food choices and dietary practices in Soweto, South Africa

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‘We eat together; today she buys, tomorrow I will buy the food’: adolescent best friends’ food choices and dietary practices in Soweto, South Africa

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Abstract

Objective: To explore if and how female adolescents engage in shared eating and joint food choices with best friends within the context of living in urban Soweto, South Africa.

Design: A qualitative, exploratory, multiple case study was conducted using semi-structured duo interviews of best friend pairs to ascertain their eating patterns, friendship and social interactions around dietary habits.

Setting: Participants were recruited from three high schools in the urban township of Soweto, South Africa.

Subjects: Fifty-eight female adolescents (twenty-nine friend pairs) still in high school (mean age of 18 years) were enrolled.

Results: Although overweight rates were high, no association between friends was found; neither did friends share dieting behaviours. Both at school and during visits to the shopping mall, foods were commonly shared and money pooled together by friends to make joint purchases. Some friends carefully planned expenditures together. Foods often bought at school were mostly unhealthy. Availability, price and quality were reported to affect choice of foods purchased at school. Preference shaped joint choices within the shopping mall environment.

Conclusions: Food sharing practices should be investigated in other settings so as to identify specific behaviours and contexts for targeted and tailored obesity prevention interventions. School-based interventions focusing on price and portion size should be considered. In the Sowetan context, larger portions of healthy food may improve dietary intake of fruit and vegetables where friends are likely to share portions.

Keywords
Adolescent behaviour
Peer group
Obesity
Eating
Qualitative research

In Africa, as elsewhere, obesity rates are rising[1]. In South Africa, the overall prevalence of being overweight or obese is particularly high (57 %) among women[2]. Results from Cape Town show an even higher prevalence in historically disadvantaged townships, where 80 % of the females were found to be overweight or obese even though child undernutrition was also a major concern in the same community[3,4]. A disadvantaged urban South African township is Soweto, which comprises several townships positioned in the south-western part of the Johannesburg metropolis. It has one of South Africa's highest population densities[7], with an estimated 1–1·5 million people[8], and a prevalence of overweight in 17-year-old females of 27 %, which is higher than the national average[2,9]. Furthermore, high consumption of fast foods has been documented: on average females and males consume eight fast food items per week in Soweto[9]. The age of late adolescence and early adulthood is of particular relevance for females given the start of obesity at a young age[2,10] and the high risk of overweight/obesity in adult females.

Research into adolescent food choice has focused on individual factors, including taste, familiarity/habit, health, dieting and satiety[11,12]. Multiple studies also indicate the influence of peers on food intake and food-related behaviours[13–17]. The mere presence of a friend while eating was shown to increase food intake in adolescents[15] and friends were found to be important

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predictors of the subjective norm related to eating patterns[18]. Understanding the role friends play in the mutual shaping of the formation of identity and food consumption patterns may be helpful to identify strategies to effectively influence healthy adolescent food behaviour[19]. While peers exert an important influence on adolescent behaviour[11,16,20], most prior research has focused on the influences in relation to intakes. No prior research has explored the process of food choices made by friend pairs in the urban African context.

Sharing with friends reinforces social bonds while potentially resulting in new consumption patterns for one or both of the friends. While most studies use the individual as the unit of analysis, research is needed to explore food choices and eating behaviours that are shared because food choices, especially in the adolescent age group, are often not made individually. Understanding the food-related behaviours of adolescents requires a model that includes cultural, social and biological/personal influence as described in the theory of triadic influence[21–23]. The theory has been successfully used in previous nutrition research[24,25] including adolescent behaviour[22,23]. In the context of an obesogenic environment, such as in Soweto, the theory of triadic influence provides a framework for exploring the influence of the broader cultural environment as well as the social context of the school and home in relation to the food choices friends make together, while also taking into account the friends' own individual characteristics. The present study aimed to explore if and how best friend pairs of female adolescents at the verge of adulthood engage in shared eating and joint food choices in the context of living in Soweto, South Africa.

Methods

The present research uses a qualitative exploratory multiple case study approach[26] and a duo-interviewing technique[27]. The study was carried out by a team of researchers with diverse academic and socio-cultural backgrounds.*

Population and sampling

The target study population was grade 12 students (i.e. last year of high school). Four high schools identified by local researchers as 'long standing' in the community were chosen from different areas of Soweto. Of the four schools approached, one declined participation out of concerns related to student exams. The researchers visited each of the three participating schools to invite grade 12 girls to participate in the study and to be interviewed together with their best friend. A best friend was defined as 'someone of your own age, you know very well, with whom you meet regularly (i.e. couple of times a week), you are engaged in activities, hang out and/or chill out with and you share emotional moments. This can be someone from the same neighbourhood and may not be from the same school'. The researchers provided informed consent forms for students to take home to their caregivers. Among all schools, thirty-two students returned the consent forms for themselves and for their best friend to their teacher. The written informed consent of all caregivers was confirmed by telephone (C.G.N.V.). All thirty-two pairs were then invited for an interview that took place at the Research Unit at Chris Hani Baragwanath Hospital. Two participant pairs were lost to follow-up, and one pair of students changed their mind and decided they did not want to participate. In total, fifteen, nine and five friend pairs were included for participation from the three schools.

Interview method

Duo interviewing may improve the quality of information gathered and encourages in-depth discussion[27]. Participants may build upon each other's responses[28] and point out divergent statements. Furthermore, the duo interview allows for an analysis that focuses on the answers of the pair (the duo), rather than individual answers, reflecting the normative behaviour of the two friends. In particular, through the process of giving an answer, agreeing or disagreeing with each other, the duo interview illustrates the decision process the friends make, as a unit. Other studies have successfully applied the duo-interviewing method in nutrition research[25,28] although to our knowledge no studies have previously used this method to explore shared eating.

Interview design

An interview topic guide was developed with a set of questions informed by aspects of the theory of triadic influence[21,25] that were thought to be relevant to social bonding and food behaviours. The topic guide and formulated questions were piloted in four interviews. Questions were reformulated and new emerging concepts were probed through additional questions. For example, a number of participants mentioned pooling money together to purchase foods and this was identified as a new theme. Box 1 shows the revised main starting interview questions. In the pilot phase, multiple interviewers from different socio-cultural backgrounds were used. The interviewers were then evaluated based on quality and depth of information and level of participant comfort achieved. Based on these criteria, a local interviewer (M.H.S.) was appointed as the most successful interviewer. M.H.S. was able to conduct all interviews in a combination of local languages and was familiar with township culture and food items.

*C.G.N.V., MSc Health Sciences, Dutch national (native Dutch speaking); S.A.N., PhD Epidemiology, South African national (native English speaking); M.H.S., MSc Nutrition BSc Dietetics, South African national (native Northern Sesotho speaking); P.L.G., PhD Demography, UK national (native English speaking); M.J.W., PhD qualitative research methods, Dutch national (native Dutch speaking); C.M.D., MA Anthropology, PhD Nutrition, US national (native English speaking).

Box 1 Examples of interview questions

Friendship
- So let's talk about your friendship, how did you meet?
- What things do you do together?
- Do you spend time together during school breaks?
- Did you introduce any new foods to each other since you've known each other?

Food choices
- Tell me about your day today, from when you got up what did you do?
- Did you eat anything before going to school today? Why (not)?
- What did you eat during break at school today? With who?
- Did you buy it at school or bring it from home? Why? Probe.
- How do you decide what to eat? Probe.
- Do share lunch with friends? How? Probe.
- When you get home, do you guys eat? What do you eat?
- What foods do you enjoy when you go out? How? Probe.
- Let's talk about Soweto, what are the most popular activities in Soweto, things that make it unique? Any food items that you would call 'Soweto food'?

Interview procedure

The twenty-nine duo interviews were conducted from June to July 2009, each lasting approximately 90 min. The trained interviewer (M.H.S.) began the interview by clarifying the goal of the study, explaining confidentiality processes and building a rapport with participants. The pairs were encouraged to talk freely and to discuss shared behaviours as well as individual differences. The interviewer probed for further understanding of the social interaction and negotiations related to food choices. Interviews were carried out in English, Zulu, Sesotho or combined languages, to enhance the participants' comfort and the quality of information shared. An observer (C.G.N.V.) took notes and measured weight and height after the interviews to enable an understanding of the current nutritional status of the participants. The study was approved by the Human Research Ethics Medical Committee of the University of the Witwatersrand and agreement to undertake the project in Soweto schools was obtained from the Director of Education for Soweto.

Analysis

All interviews were audio-recorded, transcribed verbatim and translated into English where necessary. The final transcribed interviews were checked for quality by M.H.S. and C.G.N.V., with translation checked by M.H.S. and a multilingual research assistant. Out of the twenty-nine interviews, eight transcripts were of insufficient quality for transcription and translation. Audio recordings of these interviews were used in the final stage to confirm and check for contrary or new information. Content analysis of twenty-one transcripts was undertaken in an integrated approach[29] with the aim to explore and understand normative food choices. Using transcripts of five interviews, M.H.S. and C.G.N.V. confirmed and agreed initial codes on themes characterizing the friendship bond (e.g. origin, meaning, activities involved in together), the context of eating (e.g. home, school, mall) and individual and environmental factors influencing food choice (e.g. dieting, bringing a lunchbox, financial constraints). Afterwards, both researchers independently analysed the data, exploring if and how the pairs were involved in each other's food choices; examining similarities and differences within and between the duos. Relevant parts of transcriptions were coded and extracted using Microsoft Excel. Consistency of coding between C.G.N.V. and M.H.S. was checked by two other researchers (C.M.D., P.L.G.). The strength of the interpretations was critically discussed by the research team. Quantitative data (i.e. weight, height, age and school attended) were collected according to appropriate methods and analysed for all twenty-nine pairs of best friends.

Results

Findings in the following sections are presented to tell a logical story – providing context of the friendships, explaining how friends are engaged in shared eating and which food choices are made in the two main social/cultural contexts where friends were involved in shared eating. Friends' interaction, influences from the environment and caregivers, as well as personal characteristics that influence food choices that friends make together, are described. The last section focuses on individual overweight, and if and how dieting plays a role in the friendship.

Context friendship and food

Most of the friendships started at school or, as in the case of one pair, because they lived close to one another. Apart from three other pairs that were relatives, the friendships had existed for 1·5 to 12 years (average 4·6 years).

Predominantly (i.e. twenty-four of the twenty-nine duos) the best friends were attending the same school as one another. Two participants brought their best friend who was attending university and three others brought a friend from a different high school. Students in some pairs were both part of the same bigger group of friends; in other cases they individually had their own separate group of friends.

Best friends often interacted in multiple contexts, such as spending time outside school at home or at the mall:

> We like the same things so we do a lot of things together. (Pair 25)

A few pairs also went to parties or church together and some reported sleeping over at weekends at each others' homes. In some instances, the friend pair partly or temporarily lived in the same house; for example, one of the cousin pairs but also a non-relative friend pair. A few examples were seen of friends who did not spend all breaks together at school and who only had occasional contact outside school. Sometimes, one or both individuals reported having one or only a few friends:

> We don't attend the same class. On breaks we see each other, not always because I either go to the library or stay in class being busy reading. And sometimes at home because, I stay in Klipspruit and she stays in Diepkloof, so we have to travel so most of the time. … but I am always busy, I don't get much time, but the time we get we make use of it big time. (Pair 19)

In addition to doing things together, best friends were also a source of social support:

> We understand each other, I can tell her about what is going on in my life, I am open to her, I tell her my problems and she gives me a solution. (Pair 1)

> If I have a problem within myself I go to her and if she has a problem she comes to me. (Pair 15)

Listening and being understanding, keeping secrets, encouraging and advising were characteristics that participants reported to value in their friends. Friends also accepted and valued their differences:

> She is not a friend who just agrees to everything. (Pair 20)

> We kind of show each other light. We don't judge each other. (Pair 15)

Some friends included their shared love of food when they were asked about their friendship:

> We eat the same food, same clothes we share the same style. (Pair 15)

Shared food consumption was reported by most friends, and occurred mainly in the school environment and during visits to the shopping mall. Other contexts, such as eating at a friend's home, when going on trips with friends, or while visiting other family members or hanging out with larger groups of friends in the neighbourhood, were less frequently mentioned.



Fig. 1 Example of a Sowetan 'kota', also known as a 'quarter' or 'bunnychow' (retrieved from Feeley *et al.*[9])

The school environment: food choices

Food for lunch and other breaks was often bought, and only a small proportion of the participants took a lunchbox to school regularly. Most respondents reported getting money from caregivers to spend on lunch, with amounts varying from R5 up to R30 per day (equivalent to approximately $US 0·64–3·84). Some chose not to bring a lunchbox because they preferred getting the money:

> I don't like to bring lunch; if I take lunch they are going to give me R5·00 [laughs] my money would go down if I bring lunch. They would never allow me to take lunch and still give me R20, never. (Pair 20)

While many respondents described bringing a lunchbox from home as undesirable or embarrassing, some respondents did not have a choice:

> My mom says I must carry the lunchbox … she does not understand, she just wants us to carry the lunchbox; I don't get any money. (Pair 4)

Multiple adolescents explained bringing a lunchbox as being related to financial constraints of their caregivers:

> Well in the middle of the month, maybe when my mother doesn't have money then I would come with lunch. (Pair 24)

Tuck shops at or near schools were a popular source for food. The most popular item to buy at schools during this break was the relatively cheap, so-called 'kota'; a quarter of a loaf of white bread with chips, meat, cheese, egg and/or sauce, as shown in Fig. 1.* Fruit juices and

*At the time of the interview, a kota varied in price from R5 to R15, or $US 0·64 to $US 1·92.

fatcakes (doughnut textured food item) were also regularly consumed. For smaller breaks small food items were popular to buy:

> During first school break we buy kotas and cold drink, the next one crisps, the other one during study time we buy sweets and chocolate. (Pair 11)

The choice for particular food items was affected by different factors in the school environment such as the availability of food items, since at some schools food choices were limited:

> But the one at school I eat it because it's there. (Pair 11)

Waiting time was for some no restriction, whereas others would rather choose something different to eat:

> Though I like the kota, it takes a long time to prepare and my friends wait on the line for a long time, there's no line for cakes. (Pair 20)

Although the consumption of the kota was mentioned at all schools, buying and consuming healthy foods was reported by only some friend pairs, mostly from one particular school:

> We buy oranges, apples … then I love avocados, we have plenty of options at school. (Pair 7)

At this school a hot lunch including rice, chicken and salad was also sometimes eaten as it was available for about the same price as a kota:

> When we crave for take away plate we buy take away, and when we crave for kota we will buy kota, and when we feel like eating snacks we will buy fruits. (Pair 12)

The price of foods was mentioned to affect food choices, for example, one pair from another school did not buy fruits for this reason:

> I bring mine from home, at school fruits are expensive. (Pair 11)

In addition, bad quality and taste of certain foods at school was reported multiple times as a reason to not buy these foods:

> They [other friends] buy food from school, those taste horrible. (Pair 20)

> I don't eat because I don't trust it, it's because I once ate mince then I had a runny stomach then I find out where I bought it, if the food was too much they would keep it on the fridge and warm them the next day like that until its tastes less. (Pair 11)

> I don't like food from the tuck shop … sometimes they get burnt. (Pair 1)

Sharing food and money at school

The majority of best friend pairs who attend the same school ate together during breaks and almost all of these pairs reported to share food regularly. Sometimes this happened within a bigger group of friends. When friends did not share with each other, mostly they shared with another (group of) friend(s). For example, a pair of cousins explained that they did not eat together because of their age difference. Few exceptions concerned cases where one of the friends spent a lot of time doing things alone while the friend ate with others:

> Friend A: It's either I am in the library or in the class busy reading. Friend B: I buy food with my classmates and then we go and sit down and eat. (Pair 19)

The way food was shared differed between the pairs. Some took turns in buying food:

> We eat together, we change turns; today she buys, and tomorrow I will buy the food. (Pair 11)

In other cases both friends reported bringing their own food to be shared:

> I do buy a kota, we share the lunchbox and we share the kota. (Pair 11)

Sometimes food was shared to socially support friends who did not buy any:

> If there is someone who did not buy or did not carry some food and then we share with them. (Pair 19)

> We all share for that person or sometime you'll find that we give her money, maybe she'll like to buy snacks then we'll all contribute for her. (Pair 32)

Money was pooled together to make joint purchases by the majority of friends who shared their food, either between the two of them or in a larger group of friends:

> We change turns; today she buys and tomorrow I will buy food. (Pair 11)

The amounts of money contributed by the friends were not necessarily equal:

> Everyone says how much they have then we'd put it together. So everything we do we'd buy it together, so there isn't this thing that one has so much money, we buy together. (Pair 24)

Sometimes, joint purchases were made for practical reasons:

> We have to combine it to one so that you don't have to stand in a long queue. (Pair 27)

As depicted earlier, money for food regularly came from home and some participants specifically planned to

maximize the amount by not taking a lunchbox; while, for the same reasons, others decided to take a lunchbox to school:

> I take food to school, I do get money, but I save my money. (Pair 25)

Furthermore, some friends planned together, for instance by choosing to use money that is given for food to buy other things:

> We are saving for after exams, there are t-shirts we want to buy. … we ate today, we took out R5 every Friday; this Friday I won't eat, because I must save that R5. (Pair 29)

Sharing food and money at the shopping mall

Time together with the best friend was often spent visiting a shopping mall. Like in the schools, friends also reported sharing their money to buy food here:

> Everyone says how much they have then we'd put it together. So everything we do we'd buy it together. (Pair 24)

In general, mainly unhealthy foods were consumed at fast-food chains, which were very popular, and snacks were bought at small retailers or grocery stores. Food choices were generally made together, which was in some cases a compromise of alternating between the preferences of both friends:

> We go there twice a month; the first week we'll buy KFC, then at month end we'll buy Wimpy, we compromise. (Pair 29)*

In other cases the choice was determined by whoever was paying:

> Sometimes its Wimpy, we can't choose it's not our money. (Pair 11)

However, sometimes preferences differed and accordingly friends did not eat together:

> Friend A: We argue about eating time because I'm on a diet and she wants to eat. Friend B: … when I want to eat it I go alone, I leave her behind. She doesn't eat it. She wants us to go to Pick 'n Pay, and buy Lays, and buy some drinks and chocolate only. (Pair 25)†

Overweight and dieting

More than half of the fifty-eight participants were overweight (Table 1), although less than a third (28 %) of the friend pairs were both overweight and no pairs were both obese. As most participants did not diet, dieting was generally not an issue in the friendship. However, in one case where both friends were overweight, one participant strongly disapproved of her friend dieting:

> About her diet, well she knows I don't support it. She's on and off, like when she hears someone saying she's gained weight, she gets worried then she'll want to hold herself. (Pair 25)

Others also expressed opinions against dieting:

> Have you ever dieted? I don't think I will be able to. (Pair 31)

> No, like I love the way I look. (Pair 32)

Nevertheless, a few adolescents reported having dieted with their best friend or other friends:

> At home if we find that we are fat, we try to slim. We have this thing in class that you would find us talking about going on a diet, we even went to the gym. (Pair 24)

Dieting was largely attributed to perceived body weight, although not necessarily related to obesity or overweight classification. Reasons for dieting were most often to look slim for a particular event, most often the matric dance:

> Like right now I want to diet for the matric dance. The other reason was there was a time where we would go to trips and all of us would want to diet so that we could wear bikinis. (Pair 8)

However, almost all participants currently reported not dieting and that they did not diet for a long period:

> But ha [giggles] I wouldn't survive like three days I'm done. (Pair 08)

> [laughing] I don't know, but I can never stop eating junk. Maybe I would decrease a little but I would never stop eating it. (Pair 24)

Table 1 Anthropometric characteristics of the study participants: adolescent females (*n* 58), Soweto, South Africa

Measurement	Mean	SD	Min	Max
Age (years)	18·0	1·2	15·3	21·6
Height (cm)	157·4	5·6	139·9	169·5
Weight (kg)	64·6	14·3	43·7	109·1
BMI (kg/m^2)	26·1	5·8	17·3	44·1
	n	%		
BMI international grades*				
Underweight (< 1 SD)	2	3·4		
Normal weight (1 SD–1 SD)	26	44·8		
Overweight (1 SD–2 SD)	17	29·3		
Obesity class I (2 SD–3 SD)	10	17·2		
Obesity class II+III (>3 SD)	3	5·2		

*For participants >19 years of age, cut-off points for classification were according to the WHO criteria for adults: underweight, BMI<18·5 kg/m^2; normal weight, BMI = 18·5–24·9 kg/m^2; overweight, BMI = 25·0–29·9 kg/m^2; obesity class I, BMI = 30·0–34·9 kg/m^2; obesity class II+III, BMI > 35·0 kg/m^2. For participants <19 years of age, classification of BMI category was adjusted for age according to the WHO growth reference data[36].

*KFC and Wimpy are fast-food chains.

†Lays is a brand of crisps, Pick 'n Pay is a local chain of grocery stores.

Discussion

Our findings illustrate the importance of qualitative research to better understand underlying social influences on behaviour. The study highlights how adolescent female best friends in an obesogenic environment of Soweto are engaged in shared food consumption and choices. Qualitative exploration revealed that it is common for best friends to share food and also share any healthy or unhealthy eating behaviour. This phenomenon was seen in multiple contexts, with most food sharing taking place around the purchase of fast foods at school and visits to the shopping mall. The pooling of money to purchase fast foods was an integral part of social support among friends and in some cases included economic planning. Eating together and sharing play an important role in the friendship, food sharing is part of the bidirectional influence friends have on each other[30].

Our findings are consistent with results from Cape Town showing that most of the food purchased at school was classified as unhealthy (i.e. high in fat, added sugar and sodium, low in fibre and a low nutrient density)[31]. In our study, availability, quality and price of foods at school are important factors in food choice. The importance of money and availability of low-cost healthy options in choice of foods found in the present study is consistent with the literature[18]. In the shopping mall adolescents are less limited by availability and quality factors as compared with school. However, fast foods were still often bought and preferred. These results are consistent with other results from South Africa showing the popularity of fast food[9]. Our findings reinforce other research showing that healthier food choices are often less widely available[12,32]. Also, caregivers played an important role in determining food choices at school through providing the money for adolescents to purchase lunch at school.

There was a high prevalence of overweight and obesity rates in our study population and this prevalence exceeded proportions found in other similar aged South African female groups[2,9]. Dieting did not play a major role in the friendships, suggesting that the predominantly overweight girls are not contemplating action to reduce their weight. This possibly relates to the positive association of bigger body sizes with respect to happiness and beauty by South African females[33]. Hence, interventions to improve weight in this population should take this into consideration in their design.

Prior research on food consumption and friend influence has assumed the primary unit of data collection and analysis to be at the individual level. However, our findings in the South African context, similar to those of Mzicha *et al.*[33], suggest the need to involve not only the targeted individual but also those close to the individual in health promotion activities. We strongly emphasize the importance of including the perspective of friends in future health interventions targeting obesity in South Africa. Shifts towards the Western diet and obesity starting at an earlier age[10] confirm the need to intervene to reduce risk of obesity before adulthood. Globally, policy recommendations have also included calls for a reduction in portion size to address the obesity epidemic[34]. In cultures where friends commonly buy and share food together, more research is needed to adapt pricing and portion size strategies. The results related to sharing have important implications regarding price and portion size. Inconsistent with the findings of the study by French[35], we observed that price does influence the food choices made at school. It was only in the school described as having 'plenty of options' where respondents reported buying fruits and the healthier school lunch. This was the only school where respondents reported pooling money to buy these meals. Food sharing may have positive influences by encouraging healthy food choices where large portions of healthy meals are sold at a low cost and shared among friends.

Future research should explore whether food sharing and pooling money also occur in other settings. In our study population, reasons given for these phenomena related to both social connection between friends as well as their economic situation. A comparison of findings in other contexts may complement the picture for the Sowetan setting by providing information as to the relative importance of both these factors in other contexts. The use of the duo-interviewing technique is recommended for future similar studies since this method allowed the researchers to observe the actual interaction among friends together while probing for in-depth understanding of choices. Because the two participants were already friends, it was relatively easy to build up a rapport and the participants were enthusiastic and reported enjoying participating in the research. As in other studies, it was less intimidating for the participants to speak since they were together with a friend[28]. Furthermore, high follow-up rates may be attributed to the fact that when pairs applied for participation they committed themselves not only to the researchers but also to each other. Unfortunately, it was not possible to document the response rate. All female students from grade 12 attending the target schools were eligible to participate in the study but it is unknown how many were present on the day students were informed. Furthermore, we only have information from those who came forward to participate. Therefore, it is not clear how those participants differ from other students. Additionally, it is important to note that in some cases the interview was dominated by one of the friends. In these cases, the interviewer specifically invited the less dominant participant to give her opinion. However, it is impossible to fully avoid this bias. It should also be noted that in the process of transcription it was sometimes difficult to distinguish the two friends in the transcript. As with any qualitative study the results are subject to the interpretation of the research team. Yet, individual bias was minimized through

the rigorous approach to coding and the checking of those codes by four members of the research team.

Conclusions

The qualitative duo-interview approach used has helped to identify critical information. Unique findings of the present study highlight that in Soweto a significant proportion of food is commonly decided upon and shared among friends. Also, joint decisions made were often unhealthy ones, influenced by availability in the school context and shaped by preference in the mall context. To tackle obesity, future research needs to explore the relationships between food sharing, portion size, pricing and the food choices friends make together in varying contexts. Future interventions need to recognize that a critical component may be to involve friends in the intervention design. Potential practical application of the current findings is the provision of desirable and price-competitive larger portions of healthy food. This may improve dietary intake of fruit and vegetables where a single portion is often shared among two or more friends.

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Appendix M: Paper 2

Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment

Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment

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Abstract

Objectives: The objectives of this study were to investigate the narratives pertaining to dietary and physical activity practices by female adolescents in Soweto.

Design: This was exploratory qualitative research, using duo interviews (pairs of best friends) (n = 29) from adolescent females.

Setting: The setting was three urban high schools in the township of Soweto, South Africa.

Subjects: Subjects were twenty-nine pairs of Grade 12 female adolescents predominantly, with a mean age of 18 years (15.3-21.6, standard deviation 1.1).

Outcome measures: The outcome measure was body mass index, interpreted in relation to eating practices and exercise participation.

Results: Locally prepared convenience foods were reported to replace home-prepared breakfast. The majority of participants did not prioritise eating breakfast at home, but purchased deep-fried dough balls ("fat" cakes) from vendors before school. Lunch boxes were also not commonly used as participants preferred to use spending money to purchase food from the school tuck shop. *Kotas*, "fat" cakes and snacks were popular lunch choices because of their affordability, convenience, peer influence and popularity. Respondents engaged in minimal active recreational activities. A lack of facilities and concerns about safety were barriers to activity.

Conclusion: This study highlights the importance of investigating the immediate social context as a potential intervention point to improve the lifestyle of adolescents, to enable them to make the affordable and convenient choice, the healthier choice.

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Introduction

Adolescence offers a unique opportunity to influence the adoption of healthy eating, exercise and less sedentary behaviour, in terms of short- and long-term health benefits.[1,2] For example, physical activity in young people reduces cardiovascular disease (CVD) risk factors and improves bone mass acquisition and peak bone mass.[3] High-income country studies have shown that many adolescents engage in a high intake of fast foods, a low intake of fruit, vegetables and dairy foods, and erratic eating behaviour, such as meal skipping.[4-6] These practices may contribute to rising obesity levels. According to recent findings, obesity was identified in African female and male children as early as between two and five years of age by the South African National Health and Nutrition Examination Survey (SANHANES-1), where the combined prevalence of overweight and obesity was found to be 23.8% and 21.9%, respectively. African adolescents aged 10-14 years also had a high combined prevalence of overweight and obesity at 22.3% and 10.2% for females and males, respectively, in the same national study.[7] These findings are similar to those of the second national South African Youth Risk Behaviour Survey conducted on youth in grades 8-11, where pooled overweight and obesity prevalence almost doubled from 2002 to 2008 in black males (6.9% to 11.5%). The prevalence of pooled overweight and obesity in female participants in the same study increased significantly from 30% to 37.6% between the first and second South African Youth Risk Behaviour Surveys.[8] The combined prevalence of overweight and obesity was 40.9% and 9.5%, among females and males, respectively, in the age group 15-24 years of age (SANHANES 2012).[7]

Previously, in urban Soweto, the combined prevalence of overweight and obesity in girls and boys was 27.3% and 6.9%, respectively, at age 17 years, within the birth to 20 cohort.[9] Poor eating habits across the domains of the home, school and community in adolescents were reported in the same cohort. Within the home, adolescent girls and boys aged 13, 15, and 17 years showed a decrease in regular (at

least three times a week) breakfast consumption practices (76.4%, 63.8% and 65.3%, respectively). At school, lunch box usage was uncommon, and declined from 17% at age 13 years to 8.6% by age 17.[10] More than 80% of participants bought food from the tuck shop. The five most popular purchases for all ages were sweets, crisps, cold drinks, fried chips and white bread, accounting for 62% of purchases. Female participants consumed more confectionary options than males within the community environment. Sweets, crisps and soft drinks were the three most popular confectionary or beverage items, accounting for > 65% of items purchased at all time points.[10]

Interventions aimed at modifying adolescent eating and physical activity practices have met with mixed success,[5] which, in part, may be because of inadequate understanding of the factors that govern eating and exercise beliefs and behaviour by adolescents.

Qualitative research methodology has been shown to be an effective research method to elucidate multiple factors that may explain dietary and physical activity, and beliefs and practices.[11-16] Identifying dietary and exercise beliefs and behaviour in South African urban adolescents, as well as factors that influence them, is critical for future research and intervention development as part of the strategy to curtail the burgeoning obesity epidemic in South Africa, especially in black females. Therefore, this study examined adolescent female narratives around lifestyle practices to better understand socio-environmental influences (community, school and home) in an urban obesogenic environment through the utilisation of an innovative qualitative methodological approach.

Method

Recruitment and study design

The study took place in the township of Soweto, situated in the south-western part of the Johannesburg metropolis, which comprises several townships. With an estimated 1-1.5 million people, Soweto is one of the largest urban concentrations of black Africans on the continent.[17] Four high schools that were identified by local researchers as "long standing" in the community were chosen from different areas of Soweto. Grade 12 female students, i.e. in the last year of high school, were the target study population for the study. Recruitment was carried out by submitting an invitation and study information letter to the Gauteng Soweto Education district office. After permission was granted to visit the schools, the study was explained to the principals and teachers. Three schools agreed to participate in the study. One declined because of concerns relating to student examinations. Innovative qualitative, duo interviews were utilised for the study, whereby a participant and her best friend were interviewed, so as to facilitate greater information sharing. A best friend was defined as "someone of your own age, who you know very well, with whom you meet regularly (i.e. a couple of times a week) and with whom you engage in activities, 'hang out' and/or 'chill out' with, and with whom you share emotional moments".

During a series of school visits, the research was introduced to the grade 12 teenagers, who were then asked to volunteer for participation, together with a best friend. Informed consent forms were provided to the volunteers. Thirty-two students returned the completed forms to their teachers. Parental consent was telephonically confirmed for all of the participants. All 32 pairs were then invited for an interview that took place at the Research Unit at Chris Hani Baragwanath Hospital. Three participant pairs were excluded from the study as they had decided not to take part. This resulted in 29 completed duo interviews, with 15, 9, and five friend pairs recruited from the three schools. This study was approved by the Human Research Ethics Committee (Medical) at Witwatersrand University (M090427).

Conceptual framework and development of a semi-structured interview schedule

Conceptual frameworks are useful in understanding the dynamics of behaviour, the processes for changing it and the effects of external influences on it.[15,18] In this study, the Theory of Triadic Influence was applied,[19-21] which presumes that intentions of certain behaviour derive from three streams of influence; namely the cultural environment, the social environment, and biological and personality factors. Cultural factors represent the broad macro-environment, including factors such as religion and ethnicity. The social situation represents the immediate micro-environment, including influences such as household structure, parenting, peers, community, and factors that relate to the physical environmental. Biological and personality factors represent stable intrapersonal influences, originating from an inherited disposition (gender and age) and personality characteristics. The Theory of Triadic Influence has been successfully applied in nutrition research.[22,23] The current study focused on the social environment, in particular, to explore both distal (i.e. social normative beliefs) and proximal factors of influence that potentially affect lifestyle practices in the context of food choice, dietary patterns and physical activity. A semi-structured, open-ended interview schedule was formulated, using the expertise of a panel of qualitative and nutrition researchers who were familiar with the study setting.

Interview procedure

The interview schedule was piloted on four pairs of friends, who were not part of the study sample. Consequently, adjustments were made to the interview schedule. Changes included the rephrasing of questions for better understanding. A local researcher conducted all of the interviews in a combination of local languages, and was familiar with "township" culture and local food items. Cultural aspects were taken into account by using a local interviewer, and giving the participants the choice of responding in the interview in English, Zulu, Sesotho or a combination of languages, thus enhancing participants' comfort and willingness to engage freely. The trained interviewer began the interview by clarifying the goals of the study, building rapport and explaining confidentiality. An observer took notes, and measured weight and height after the interviews to enable an understanding of the current nutritional status of the participants. Weight to the nearest gram, and height to the nearest millimetre were measured while the subjects wore light clothing and no shoes.

Analysis

The audio-recorded interviews were transcribed verbatim and translated into English, when necessary. The quality of the final transcripts and translation were checked by the researcher and a multilingual research assistant. The transcripts were analysed for emerging themes relating to dietary and exercise practices. Preliminary analysis occurred concurrently with the continued administration of interviews to identify emerging subthemes to be pursued in subsequent interviews.[24] Five transcripts were read, coded and discussed in detail by two researchers. Themes were developed based on the Theory of Triadic Influence framework and interview content analysed.[25]

Using transcripts of five interviews, initial codes and themes were confirmed and agreed upon, including:

- *Food and activities:* The context included the community, school and home settings.
- *Individual and environmental factors that influence food choices:* These factors included the relevance of eating breakfast and personal food choices, as well as behaviour relating to dieting and physical activity.

The remaining transcripts were then read repeatedly and coded manually for emerging themes and validated until saturation was reached, i.e. when no new themes emerged.[26,27] NVivo® version 8 was used to analyse the qualitative data and Stata® version 10, the quantitative data. The cut-off point for the body mass index classification of participants > 19 years of age was used according to the World Health Organization (WHO) criteria for adults: underweight, < 18.5 kg/m², normal weight, 18.5-24.9 kg/m²; overweight, 25-30 kg/m², obesity class I, 30-34.9 kg/m² and obesity class II and III, ≥ 35 kg/m². The classification of the BMI categories for participants ≤ 19 years of age was adjusted for age according to the WHO growth reference data.[28]

Results

Of the 32 pairs of adolescents, three pairs were not available for follow-up. Twenty-nine completed the duo interviews, which lasted 90 minutes each on average. More than half (51.7%) of the 58 participants were either overweight or obese, and their age ranged from 15-21 years (mean 18, standard deviation 1.1). According to WHO growth reference charts,[28] in terms of height for age, the participants mean age and height were at the 15th percentile for 18-year-old women (Table I).

Table I: Anthropometric characteristics of the participants (n = 58)

Measurement	Mean	SD	Minimum	Maximum
Age (years)	18	1.2	15.3	21.6
Height (cm)	157.4	5.6	139.9	169.5
Weight (kg)	64.6	14.3	43.7	109.1
Body mass index (kg/m²)	26.1	5.8	17.3	44.1
Body mass index international grades^	n	%		
Underweight (< –1 SD)	2	3.4		
Normal weight (–1 SD to 1 SD)	26	44.8		
Overweight (1 SD to 2 SD)	17	29.3		
Obesity class I (2 SD to 3 SD)	10	17.2		
Obesity class II and III (≥ 3 SD)	3	5.2		

SD: standard deviation
^ For participants >19 years of age cut-off point for classification are used according to the WHO criteria for adults; underweight < 18.5; normal weight 18.5-24.9; overweight 25-30; obesity class I 30-34.9; obesity class II+III ≥ 35. For participants ≤19 years of age classification of BMI category was adjusted for age according to the WHO Growth reference data[28]

Food and activities

Community and social setting

Adolescents in the study reported a strong sense of cultural identity in terms of being "Sowetan". Comments included: "Soweto is a place where people love each other, and the youth have respect for the elderly", and "People in Soweto love each other. As a young person in Soweto, you are expected to greet your elders when you meet them in the street". This theme was consistent, despite the broad range of ethnic groups within the community.



Figure 1: An example of a Sowetan *kota*[9]

Respondents reported that the most common community activities were "chilling at street corners" and going to fast food outlets with friends. They said that social occasions often involved sharing food, such as *magwinya* ("fat" cakes that are deep fried in cake flour dough), *kotas* [a quarter loaf of white bread filled with a portion of fried chips, a slice of processed cheese and processed meat (Figure 1)], or "street-roasted chicken". Street food was considered to be appealing because it is affordable, offered in large portion sizes and can be shared.

Interestingly, attendance and involvement at church during the week and on Sundays was a common social community activity. This activity was shared with family and friends. Participants were unanimous in that there were not many recreational physical activities in which young women could engage within the community owing to "concerns about safety" and the "limited availability of opportunities".

School social setting

As in the community setting, sharing resources with friends at school was a common activity: "We combine money and buy snacks most of the time. We buy them because they are cheap" and

"We buy school pies if money is limited". Taking a lunch box to school, as opposed to buying food at the tuck shop, was less favoured. Participants bought lunch boxes to school on Mondays containing leftover food from Sunday, or on days when they could bring food to school that they enjoyed and which was available at home, such as burgers or cheese and meat sandwiches. Most participants thought that a "lunch box was for younger children" and "was embarrassing" for a Grade 12 student. Food that was likely to be included in the lunch box was also seen as embarrassing because it reflected their "poor" status, e.g. traditional food, such as pap. Other reasons for not bringing a lunch box to school were that lunch money would then not be provided, and that the preparation of its contents was too time consuming. Participants who took lunch boxes to school said that they did so because they wanted to save money, the school food was not enjoyable, the queues for food at school were too long, or they wanted to be in control of what they ate in terms of energy intake. Participants mentioned that food choices at school were dependent on available lunch money. For example, although some participants said that they would like to eat fruit at lunch time, they couldn't afford it as "fruit was expensive at the school tuck shop" and its quality mostly poor.

The teenagers ate *kotas* at school because they were filling and affordable. They said that they would like to be able to choose from a greater variety of food at school, including pies, muffins or sandwiches. However, they admitted, that even if such options were available, they would still buy *kotas* as they enjoyed eating them and could share them with friends.

Participants' activities were primarily sedentary during break, e.g. "chatting with friends", "going to the library", "completing unfinished school work" and attending "church services" within the school. Although some participants said that they were active, e.g. running and playing in the school yard, they were in the minority.

Home setting

Participants agreed that their home environment influenced what they ate, e.g. in terms of what was available. They reported that what they consumed at home was not always healthy. Caregivers and elders (mothers, grandmothers and aunts, and in a few cases, grandfathers or fathers) determined what the household ate. A few participants cited cooking as a responsibility that they enjoyed. Some actively included vegetables when it was their turn to cook. Others said that there was an expectation that at least one vegetable should be included in the evening meal, even though vegetables were not always available in the household. Most households ate dinner together, especially while "watching television".

On weekends, participants said that household members often ate *kotas* as an alternative to home-cooked food as they were "cheaper, convenient, easily accessible and filling". "Fish and chips", "burger with chips", "home-fried chips" and "samp with beans" were other fast food options that were eaten by household members on Friday evenings and Saturday afternoons. Most participants enjoyed eating the main meal on Sunday because of the variety of food served on this day.

Going to the mall was the main household activity, particularly at the month end, when caregivers had money. Participants said that they didn't go out as a family to eat, but would go out individually with friends at the end of the month when there was money, or if they had saved their own.

Individual factors that influence food choices

The relevance of eating breakfast and personal food choices

Most participants said: "Breakfast is the most important meal of the day" and "Breakfast gives you energy. It boosts the system". However, the majority said that they didn't eat breakfast. Very few adolescents ate breakfast every morning. The majority of those without the time to eat breakfast would "buy something to eat before school started" or "ask a friend to buy them something to eat". Those who could afford it bought "fat" cakes which were sold at most schools before classes commenced. A few of the participants ate sweets and potato crisps purchased from community vendors before attending school.

Behaviour relating to dieting and physical activity

Dieting was defined by participants as "food deprivation", "eating a balanced diet" or "eating less food". Most participants thought that "only fat people should diet", or "those who were unhappy with the way they looked", or "those who wanted to get in shape". Some cited dieting practices included drinking lemon water, only eating snacks, missing dinner and not eating carbohydrates. Some of the women said that they had tried to diet, but stopped prematurely "as it was very hard". In general, portion size reduction was a popular way of managing weight. Some consumed snacks, rather than meals, such as crisps, that were sold at school to lose weight. A major source of excess energy was reported to derive from foods deemed to be unhealthy, such as energy-dense snacks. Yet "junk food" was preferred owing to its affordability, availability and the fact that there was a large available variety of it.

All of the participants said that exercise was "important for good health", but very few participated in any physical activities. A few said that exercise was only necessary for "fat people to lose weight", while others believed that "everyone should exercise to keep fit and prevent illness". Most had participated in exercise at some time. They said that they had stopped because of concerns about "community safety", "getting tired quickly", "lack of support or someone to exercise with", "sweating", "concerns about what others would say if they saw them running", and because of time management conflicts with respect to studying. Those who were physically active participated in running, cycling (using a stationary exercise bike at home), walking, going to the gym, street dancing and street soccer. The few participants who said that they ate and cooked vegetables and salads, as well as small portions of food, also took part in regular exercise, such as jogging or playing soccer. Most of the teenagers who ate chips, sugared beverages and fast foods, such as *kotas*, did not cook at home or participate in exercise. They also took part in sedentary activities.

Discussion

The aim of this study was to recount the narratives of young urban adolescent women with regard to dietary and physical activity practices across various levels of influence, including the self,

household, school and community. There was a high prevalence of overweight and obesity in this study, as observed in other urban studies.[29-31]

Dietary practices

The findings from this study show that respondents were able to articulate an understanding of healthy dietary practices, and why less healthy food choices involved a health risk. However, there was a disparity between what they knew and what they practised. Only a few participants routinely made healthy food choices. This finding is similar to the results observed in high-income settings, such as the USA, in which it was demonstrated that knowledge alone did not enable adolescents to adopt healthy eating behaviour.[32] The association of nutrition knowledge with dietary behaviour was found to be weak ($r = 0.10$) following a meta-analysis of literature on adults, adolescents and children.[33]

In this study, female adolescents reported common dietary practices, including the consumption of fast foods, such as *kotas* and "fat" cakes, and a low intake of fruit and vegetables at home and at school, as well as meal skipping. The consumption of these foods seemed to be driven by economic reasons as these foods were affordable and accessible, unlike fruit and vegetables. At household level, a limited income and the increasing time and cost of food preparation for families could be important in the shifting of family dietary practices to less healthy choices.

The narratives of the adoloscents suggest that currently schools do not provide healthy and affordable food options, either for breakfast or lunch. Our findings show that young women wanted to have more choices to buy healthy foods, were aware of the poor quality of food sold at their schools, but bought it anyway. This is in line with quantitative evidence with regard to grade 7-10 students in Cape Town, where the majority of the food consumed at school was also purchased at school, and to a large extent these were unhealthy choices.[16]

Physical activity

Listening to music, watching films, street dancing, going to the local mall, drinking alcohol and visiting friends were popular leisure time activities for the adolescents in this community. While street dancing was mentioned, but "formal" exercise was not. Limited community resources, such as youth recreational and sporting facilities, and community safety, were reported as contributing factors to limited participation in physical activities by these young women. Outside of performing household chores, participants were also not physically active at school or home. As with diet, we observed that our findings in relation to physical activity were similar to those in high-income countries. For instance, Pearson et al[1] found that physical activity was low in adolescent females aged 12-16 years in the UK. The majority of participants in this study had knowledge of the benefits of physical activity, but few had experienced these benefits.

Future direction

The value of examining multiple contexts that influence eating and physical activity practices is highlighted by the combination of a conceptual framework and an innovative approach using duo interviewing. Within this environment, where a significant proportion of the young women were either overweight or obese, it was clear that the consumption of convenient food took place in all social contexts. The results strongly suggest that choosing less healthy food options at home, school and within the community are often driven by cost and accessibility. Unhealthy eating, coupled with limited engagement in physical activity within these social settings, is troubling. It appears that despite the fact that Soweto is economically disadvantaged relative to high-income country communities, its individuals share similar behavioural patterns with those in high-income country communities, which suggests the advancement of epidemiological and nutritional transition.

The study findings suggest that there is a need to act, given the burgeoning obesity epidemic in South Africa. Possible interventions could target specific social contexts. In our study, the young women said that they respected the elders in their community, which means that the latter could be important resource to utilise when encouraging teenagers to make healthier food choices. The fact that adolescents viewed the lunch box as more suited to younger children renders it a less appealing intervention strategy. Interventions to improve the availability of affordable healthy foods at school might have more success than those that focus on lunch brought in from home. Studies are needed to assess the cost and effectiveness of lunch subsidies to increase the availability of healthy foods, such as fruit, within schools. Such approaches worked in several studies in which the availability of fresh fruit, vegetables and vending snacks containing less fat in high-school settings were increased by between 10-50%. Weekly sales of the items also increased by up to two-fold in some cases.[34-36] The consumption of fast food, e.g. the *kota* (mean total energy 5 970 kJ), needs to be addressed. One option would be to encourage vendors, both formal and informal, to sell healthier, less energy-dense products.[9]

The participants in this study knew the importance of breakfast, but most of them did not eat it before school. Cross-sectional and longitudinal research has shown that young people who regularly eat breakfast are less likely to be overweight than those who skip it.[37,38] Despite the health benefits, young people are more likely to skip breakfast than any other meal.[39] Furthermore, these results show that some students would benefit from breakfast programmes, such as Maryland Meals for Achievement (MMFA), which provides free breakfasts to classes. A study that evaluated the impact of serving breakfast in the classroom as part of the school day using the MMFA programme reported improvements in the students' performance, attendance, attention and behaviour.[40] The results of this study suggest that there is potential for breakfast programmes to be considered as a potential intervention tool in the urban South African context.

It might be beneficial to consider indoor physical activity facilities. Street soccer and street dancing could be encouraged, as some of the participants said that they already took part in these activities, which were also viewed as appropriate for female adolescents. Most participants in this study were involved in church activities, currently reported to be sedentary in nature. Thus, churches could be considered as a potential vehicle for intervention in terms of

the promotion of physical activity. Churches have the potential to provide a safe environment in which adolescents could engage in exercise. For example, in the USA, churches (60 in eight North Carolina counties) were used as a vehicle in a five-year randomised study to identify barriers and motivators of dietary changes in African Americans in order to develop culturally sensitive interventions.[41]

Conclusion

This study demonstrates that the behaviour pertaining to diet and physical activity exhibited by female adolescents in the Sowetan context is not dissimilar to that of adolescents in disadvantaged urban communities in high-income countries. The study participants were aware of the benefits of healthy eating and the need for physical activity, and had knowledge of obesity and non-communicable disease risks. Eating less healthily was favoured in community, family and school settings owing to the cost, convenience and availability of such food. Limited community resources and safety were primary reasons for limited participation in physical activities. The findings show the importance and need for immediate intervention efforts that are sensitive to socio-cultural contexts and realities within this community. Clearly, a multifaceted approach using interaction with various community stakeholders (churches, schools and vendors), government, families and the young women themselves, would be essential to target the rapidly rising rates of adolescent obesity and the subsequent risk of CVD in the Sowetan population. There is also a need to understand whether or not the same challenges exist for the male adolescents within this community, where the obesity rate is currently much lower than that in females, but nevertheless rising over time.

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Appendix N: Paper 3

Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa

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Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa

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Abstract

Background: Dietary behaviours and physical activity are modifiable risk factors to address increasing levels of obesity among children and adolescents, and consequently to reduce later cardiovascular and metabolic disease. This paper explores perceptions, attitudes, barriers, and facilitators related to healthy eating and physical activity among adolescent girls in rural South Africa.

Methods: A qualitative study was conducted in the rural Agincourt subdistrict, covered by a health and sociodemographic surveillance system, in Mpumalanga province, South Africa. Semistructured "duo-interviews" were carried out with 11 pairs of adolescent female friends aged 16 to 19 years. Thematic content analysis was used.

Results: The majority of participants considered locally grown and traditional foods, especially fruits and vegetables, to be healthy. Their consumption was limited by availability, and these foods were often sourced from family or neighbourhood gardens. Female caregivers and school meal programmes facilitated healthy eating practices. Most participants believed in the importance of breakfast, even though for the majority, limited food within the household was a barrier to eating breakfast before going to school. The majority cited limited accessibility as a major barrier to healthy eating, and noted the increasing intake of "convenient and less healthy foods". Girls were aware of the benefits of physical activity and engaged in various physical activities within the home, community, and schools, including household chores, walking long distances to school, traditional dancing, and extramural activities such as netball and soccer.

Conclusions: The findings show widespread knowledge about healthy eating and the benefits of consuming locally grown and traditional food items in a population that is undergoing nutrition transition. Limited access and food availability are strong barriers to healthy eating practices. School meal programmes are an important facilitator of healthy eating, and breakfast provision should be considered as an extension of the meal programme. Walking to school, cultural dance, and extramural activities can be encouraged and thus are useful facilitators for increasing physical activity among rural adolescent girls, where the prevalence of overweight and obesity is increasing.

Keywords: Adolescent, Barriers, Eating, Facilitators, Girls, Healthy, Practices, Physical activity, Pairs, Agincourt

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Background

The eating habits of children and adolescents are of public health interest globally because of growing evidence relating poor childhood nutrition to obesity and increased risks of type II diabetes, metabolic syndrome, and cardiovascular diseases later in life [1]. The recent rapid increase in the overall prevalence of obesity in children and adolescents indicates that environmental factors, and particularly behaviours linked to diet and physical activity, are central to the causation of obesity [2]. South Africa, as a country in economic and health transition, is facing a triple burden of morbidity and mortality from infectious diseases including HIV/AIDS, noncommunicable diseases (NCDs), and violence and injuries [3]. One result of this transition is the increase in obesity prevalence as a risk factor for NCDs [4]. Other risk factors associated with obesity include high energy density diets, high consumption of sugar-sweetened beverages, large portion sizes, eating patterns (such as meal-skipping), high levels of sedentary behaviour and low levels of physical activity [2]. Recently, the World Health Organization (WHO) conducted a survey of physical activity levels in 51 mainly low- and middle-income countries. Among participants aged 18 to 29 years, the prevalence of inactivity was 13.2% in males and 19.1% in females [5]. In a South Africa-based study conducted among females aged 15 to 55 years, where the rate of obesity was 28.9%, women with lower physical activity were found to be at greatest risk for increased body mass index [6]. In the 2013 South African National Health and Nutrition Examination Survey (SANHANES-1), 50.2% of participants aged 18–24 years of age were reported to be inactive [7].

According to the Youth Risk Behaviour Survey conducted in South Africa in 2002 and 2008, among adolescents aged 13 to 19 years (n = 9224), the combined overweight and obesity prevalence almost doubled in black males (6.9% to 11.5%). Among female participants, the prevalence increased significantly from 30% to 37.6% over the same 6-year period [8]. SANHANES-1 reported that in adolescents aged 15 to 17 years of age, the combined prevalence of overweight and obesity was 27.3% in females and 8.8% in males [7]. The risk of overweight and obese youth becoming overweight adults has been demonstrated in a review study [9], and the tracking of both physical activity and diet between childhood and adulthood has also been confirmed [10].

Evidence from rural Agincourt (Mpumalanga province) in South Africa highlights the high prevalence of overweight and obesity among black African females. The prevalence steadily increased with age, reaching 25% by late adolescence. Central obesity risk (waist circumference cut-offs) also increased with puberty and peaked at 35% by early adulthood in females [11].

There is an impetus to investigate in greater depth the gender differences and environmental factors within households, schools, and the community that contribute to adolescent obesity risk. Among urban females in Soweto, South Africa, we found that both at school and during visits to shopping malls, food was commonly shared and money pooled by friends to make joint food purchases [12]. The majority of participants did not prioritise eating breakfast at home, but purchased vetkoek (fried dumplings made from wheat flour) from vendors before school. Lunchboxes were not commonly brought from home; participants preferred to have spending money to purchase food from the school shop. Kota (a quarter loaf of white bread filled with fried potato chips and ample processed meat or cheese), vetkoek, and snacks (maize crisps) were popular lunch choices because of affordability, convenience, peer influence, and palatability. Respondents reported minimal physically active recreational activities. Barriers to activity were the lack of facilities and concerns about community safety [13]. Little research has explored the perceptions of facilitators of and barriers to healthy eating practices and physical activity within rural South African female adolescents.

The aim of this study was to explore perceptions and attitudes of adolescent girls in rural South Africa regarding healthy eating practices and physical activities, in order to learn about rural and urban similarities and differences, using previous findings from Soweto.

Methods

Study setting

This study was conducted in rural Agincourt, a subdistrict of Bushbuckridge, Mpumalanga province, northeast South Africa. The study site lies close to the border with Mozambique, bordering the Kruger National Park conservation area. It provides the foundation for the Rural Public Health and Health Transitions Research Unit of the Medical Research Council (MRC) and University of the Witwatersrand, South Africa (the MRC/Wits-Agincourt Unit). The Agincourt Health and Socio-Demographic Surveillance System (AHDSS) spans an area of 420 km^2 comprising a subdistrict of 27 villages with traditional and elected leadership. The AHDSS was established in the early 1990s with an initial focus on district health systems development, subdistrict health centre networks and referral systems, and training of clinically oriented primary health care nurses [14,15]. In this region, there are high levels of unemployment (between 40 and 50%) and low income levels. Housing types range from traditional mud structures to brick houses built on plots of farm land that are generally insufficient to support subsistence farming. Consequently, crops grown mostly supplement the family diet [11].

Study design and data collection

We employed the "duo-interview" method to encourage in-depth discussion [16,17]. This approach has previously

been successfully applied in urban Soweto. Eleven duo semistructured qualitative interviews were conducted with participants aged 16 to 19 years of age and their close friends residing within rural Agincourt. A close friend was defined as "Someone of your own age group who you know very well, with whom you meet regularly (i.e. a couple of times a week), are engaged in activities with, hang out and/or chill out with, and with whom you share emotional moments. This can be someone from the same neighbourhood, and not necessarily from the same school."

The sampling and recruitment for this study was done through the AHDSS. Information about the study was discussed with the volunteers and caregivers during the recruitment process. All participants aged 18 years and older gave informed consent. Written consent was obtained from caregivers for those participants aged less than 18 years. Ethics approval for the survey was provided by the University of the Witwatersrand Human Research Ethics Committee (Medical) (M 090427). The current research has adhered to the guidelines for Qualitative research guidelines (RATS) at outlined on http://www.biomedcentral.com/authors/rats.

Fieldwork was conducted by the study manager (TG) with a field worker and transcriber whose first language was Shangaan (the local vernacular) and who resided within Agincourt. The principal researchers (MHS and KE) trained the field workers, including practice interviews that were conducted to ensure that the field worker was conversant with the interview schedule. The interview guide was piloted on two pairs of friends who were not part of the study population, after which changes were made to make the guide more understandable for study participants [18]. The principal researcher (MHS) offered technical assistance during data collection and quality-controlled the interviews.

The interview guide was designed to explore the following: dietary and physical activity practices, attitudes towards healthy eating and physical activity including barriers and facilitators, understanding of health risks associated with obesity, eating and exercise practices at school and outside school, attitudes towards weight control, body image, cultural beliefs, and family factors. The interview schedule domains were informed by the Triadic Influence on Behaviour Model [19-21], which presumes that the intentions behind certain behaviours derive from three streams of influence: the cultural environment, the social environment, and biological and personality factors. Cultural factors represent the broad macro-environment, including religion and ethnicity. The social environment represents the immediate microenvironment, including influences such as household structure, parenting, peers, community, and factors relating to the physical environmental. Biological and personality factors represent stable intrapersonal influences, originating in inherited dispositions (gender and age) and personality characteristics. The Triadic Influence on Behaviour Model has previously been successfully applied in nutrition research [22,23]. Each interview lasted for approximately 70 minutes and was digitally recorded.

Data handling and analysis

Debriefing sessions were held daily by researchers after the fieldwork to discuss issues and themes emerging from the interviews and to ensure consistency of question meaning. Preliminary analysis occurred concurrently with the continued administration of interviews to identify emergent sub-themes to be pursued in subsequent interviews. Data saturation was reached by the 11th interview. The 11 recorded interviews were transcribed and translated into English by the field worker. Four of the transcribed interviews were randomly selected for a quality check by an external local bilingual transcriber. The researchers who developed the interview schedule listened and the principal researcher (MHS) read the transcripts horizontally (individually) and vertically (across different transcripts) to identify recurrent themes in the data. A co-researcher (KE) read a sub-sample of the transcripts to cross-validate the coding. Thematic content analysis was used [24] and themes were identified according to questions asked in the interview guide. The study findings are presented using similar domains as per the interview schedule structure.

Results

Perceptions related to healthy eating practices

Participants believed that traditional foods—specifically miroho (green leafy vegetables), locally grown legumes, vegetables and nuts—are good for health and that their consumption can prevent and cure illness. Participants' personal attitudes towards certain food items were influenced by traditional beliefs within their households and the community. Quotes below illustrate perceptions of healthy foods:

> *"Healthy foods are foods that make you live better. With unhealthy food, you will live, but it is not the same as healthy food: it makes you gain weight and become sick. Like carrots—when you have eaten them, they make your eyes whiter and clean. Beetroot and spinach are very important for the human body because they add blood, and spinach makes you healthy in your body." (pair 3)*

> *"Healthy foods are vegetables because they don't have fat and you get vitamins and everything in them, unlike meat. It's not in meat that we get vitamins and everything. Meat is making us sick but I've never heard someone say that she is sick because of eating vegetables —they are not causing illness. Food that we are allergic to, which means it's unhealthy because it is not good for*

you, and everything that makes you uncomfortable after eating, I can say is unhealthy" (pair 5)

"Healthy food according to my understanding is food that builds your body and protects you from illness, like vegetables. Unhealthy food is food that doesn't build our body, like sweets, chocolate, and food with a lot of oil." (pair 6)

"I think that breakfast is very good. You won't work without eating and you won't get power without eating, so you have to take breakfast first to be able to do all your activities." (pair 3)

More than half of the participants believed that breakfast was the most important meal of the day, based on what they had heard and had been taught in school and at local clinics. Most believed in the benefits of breakfast, although many did not eat breakfast at home owing to limited choices or lack of food.

Some mentioned the consequences of not eating breakfast, such as loss of concentration in class or headaches.

"I didn't eat today. I'm unable to eat in the morning. I eat at around 12 PM, and it is uncommon that I have breakfast. I think breakfast is healthy, because according to law we must not skip breakfast, but I'm used to it, I don't eat breakfast, I am fine, I don't feel hungry, and I don't have a headache. If I eat breakfast I won't have my lunch." (pair 5)

There were also signs of embarrassment. It seemed that some participants did not want to voice an opinion about breakfast, as they laughed when asked about their breakfast practices—they said they just get up in the morning, bathe, and go to school. For some participants, skipping breakfast was a coping mechanism to prevent feeling hungry, because they said that if they ate breakfast they would feel hungry sooner before lunch and would not be able to concentrate in class. Very few participants (two) who reported eating breakfast had more than one option available to them. Pap (a maize-based staple) and tea were the most common options among those who consumed breakfast.

Factors facilitating healthy eating practices

Most participants associated good health with local home-grown foods. Factors that increased consumption of fruits and vegetables were their taste and the feeling of health experienced after eating a particular fruit or vegetable. Family vegetable gardens, which were located within household yards, in vegetable fields outside household yards, at nearby schools, or out in the open fields, enabled healthy eating. Common vegetables grown were beetroot, tomatoes, and green leafy vegetables such as spinach, lettuce, and miroho. According to participants, female caregivers within households collected edible wild green leaves that grow outside the rainy season to eat with pap. Based on interviews, locally grown vegetables were also sold by community members at affordable prices and neighbours often shared with each other. In the few households that did not have vegetable gardens, participants stated that they sourced vegetables from relatives or friends.

The influence of the female caregiver on the foods families consumed was cited as a major factor in facilitating healthy eating practices within households. Based on data from a majority of interviews, vegetable gardens were mainly cultivated by female caregivers who believed that locally grown vegetables were good for health; they cooked vegetables for their families even if some household members did not like eating them.

The quotes below illustrate factors that facilitate healthy eating practices.

"I feel great and healthy when I have eaten lettuce; I just feel good and it makes me happy. I like to cook food for Sunday. I like cooking and making salads, beetroot, pumpkin, and cabbage. Salads are healthy. Healthy food makes a person's body always be good, but food that has lots of oil, they say, causes high blood pressure and illness for a person. To eat some is not a problem, but she must have a limit in order not always to eat it. I like mango because it is nice. When it is ripe and you eat it, it tastes good. And lettuce—I like it and everything that is grown in the garden; I just like it." (pair 4)

"According to youth, they think healthy food is meat, but grannies and our parents think it is vegetables." (pair 1)

"Old people are afraid to eat food with oil because they say it causes illness. They want you also to cook miroho." (pair 3)

"I like oranges, and when you have eaten them they are good in the body and make you feel great. Then I fell in love with them." (pair 8)

Health education messages in clinics, magazines, and church youth gatherings were recognised as encouraging healthy eating practices. Local schools with government-supported meal programmes provided cooked meals such as beans with soup, samp (dried corn kernels that have been stamped and chopped until broken but not as fine as mielie-meal or mielie rice) with beans, or tihove, a traditional dish consisting of boiled samp with locally grown crushed nuts. These also served as facilitators of healthy eating practices.

"Everywhere, like when we are in a place that is crowded like the clinic, they teach people that we must eat healthy food in order to help our bodies." (pair 5)

"When we attend church conferences, they give us carrots, beetroot, cabbage, and a small portion of meat; they also add pumpkin and porridge or rice." (pair 3)

"At school, we get free healthy food during break. Monday we get pap, Tuesday we get samp, Wednesday rice with soup, Thursday samp with beans, and Friday we get pap with soup or beans." (pair 6)

Factors acting as barriers to healthy eating practices

Factors cited as barriers to healthy eating practices were household poverty, the affordability and accessibility of healthier food, peer influence, and aspirations to purchase more socially desirable convenient fast foods. According to the participants, most households do their grocery shopping once a month when they receive money from family members who work in cities far from home. Limited money and transportation means households only purchase basic necessities once a month, including mealie-meal (a maize-based staple), chicken feet, and frozen chicken. Most of the girls mentioned strict grocery lists to which households stick. Groceries purchased monthly often ran out sometime during the month, after which families could only afford to eat pap and miroho that they bought or picked from the fields, as they would have to wait for the end of the next month to purchase more groceries. Eating home-grown vegetables is believed to be a sign of poverty or lack of food, while meat is a sign of wealth or civilisation. Fruits were often cited as "luxuries" or "extras" and were bought only if there was money left after purchasing staple foods. It appeared that fruits were not easily accessible within the community.

"They think it is a sign of better status when eating meat every day." (pair 5)

"My family doesn't like miroho and vegetables from the garden, we just like meat and anything from the fridge. When we eat vegetables, we only eat salads and it is not every day that we grow them. They are very scarce." (pair 1)

Some participants said that they could not bring lunch boxes to school because of limited household resources. They mentioned food items they wished were available for lunch boxes, such as bread, polony (processed deli meat), "Russian" (processed sausages), eggs, "everything that tastes good", and juice. For those who took lunch boxes to school, the choice was limited to what was available at home. Because of limited lunch money and resources at home, in most cases they were only able to take dry bread augmented with atchar (a pickle made with unripe mangoes and chillies, prepared in oil) or buy vetkoek, because it is affordable.

Some respondents brought lunch money that they stated was insufficient to purchase options that they perceived as relatively healthy, which resulted in them buying cheaper snacks from school vendors. Among items sold by vendors outside the school gate, the majority of participants mentioned bread, vetkoek, kota (a quarter loaf of white bread filled with fried potato chips and ample processed meat or cheese), deep fried potato chips, snacks such as crisps and sweets, sugar-sweetened beverages, atchar, and plates of food with pap and chicken or beef. Based on the interviews, few vendors outside schools sold fruit, which was generally more expensive than snacks—this absence is a barrier to healthy eating. Most participants shared money and food with friends just to make sure they have something to eat.

"I don't feel good about the free food we get at school, because they don't cook well. After eating it, I have stomach cramps, so we decided to stop eating the free food at school. If we don't have money for lunch, we just walk around the schoolyard until lunch is over; if we have some money we buy vetkoek and niknaks (from vendors). We like junk food because we don't have enough money to make our stomachs full. I don't like vegetables, I just eat, even if they are healthy, I don't care about that. When it comes to carrots, I don't get the taste of it." (pair 1)

"Usually I take lunch money. When I use it, I buy some snacks and iced lollipops. If we don't get food at school, I buy kota, niknaks, and vetkoek (sold by school vendors)." (pair 5)

"I like kota when it has everything on it: bread, Russian, cheese, chips, and atchar." (pair 10)

Peer perceptions were also a barrier to healthy eating. Participants mentioned concerns about their peers' reactions if they ate miroho, since frequently eating meat or fast food items is seen as a sign of better economic status.

Perceptions related to physical activity

The majority of participants believed that physical exercise promotes good health, because exercise boosts the body's

ability to fight against illnesses and helps to prevent illness. Even respondents who did not participate in physical activities stated that physical activity is good for health.

"It's good to exercise. If you exercise, you could lose weight, and it is necessary that every person exercise. At school I'm in athletics and netball. Just now we are writing exams, but [previously] I was always exercising. When I exercise, I'm not lazy and my body is always right; I don't get the flu easily." (pair 5)

"I think to exercise is good, but I don't do it. I'm unable to run or jump, but when my friend says we must do it, I try to do it." (pair 10)

"Young people should exercise so that the illnesses that are common nowadays cannot get us soon." (pair 3)

Practices and factors facilitating physical activity

Most of the schools have a variety of physical activities during school breaks, after school, and during life orientation classes. Most students participate in games such as skipping rope; street dancing; sporting activities including netball, soccer, and volleyball; and a variety of traditional dances. There appears to be positive peer influence promoting physical activity, with active encouragement by friends.

"We like dancing and singing. We play songs on our cell phones and then we dance. Sometimes we just play with kids on the street; we play netball and skip rope." *(pair 3)*

"It is good because after playing ball, my friend wants to sit down, saying that she is tired. Then I force her, and I set up the clock so that now we will play for twenty minutes—after ten minutes she will play for the whole time we have set." (pair 10)

Some students walk long distances to and from school, and thus get an opportunity to exercise. At home, most participants were involved in physical household chores such as cleaning, cooking, and working in the vegetable garden or the fields.

"We walk when we go to school. It takes me twenty minutes when I walk fast and forty minutes when I walk slow. I also run, in order to always feel good in the body. During break, we dance the kwaito dance, and we play netball. After school we have netball, ladies soccer, and volleyball. We play netball. When it comes to cultural dances, we have muchongolo, xibavhana, and xipenede [different types of local cultural dances]. We also clean our classrooms after school; then we come home. When we get home, we wash dishes and clean the house." (pair 6)

Factors acting as barriers to physical activity

Some participants mentioned that in more senior grades, the school discouraged them from participating in extramural activities. They were encouraged to use that time for studying instead, as sports would disturb them. Most of these participants were involved in sports in junior grades.

"They don't allow us to play netball or any sports. When you are in grade 12, you don't participate in anything. Even singing they don't allow us. They don't allow it because it will disturb us. This year we are doing nothing at all—like when they[learners in lower grades] go to soccer, we used to go with them just to support them. After school we used to participate in Sarafina dance last year; this year we did nothing at all." (pair 3)

Despite peer encouragement, a barrier to exercise was peer gossip. Many girls expressed concerns about how they looked when exercising and what their female and male peers would say about them.

"At school there is netball, soccer, ladies soccer, and volleyball. I don't participate in any activity. My problem is that people who are playing ball at school are talking a lot, and I don't like to talk." (pair 8)

Discussion

Within a rural South African setting, adolescent girls could articulate an understanding of healthy eating. They were aware of healthy versus unhealthy foods, and the benefits of locally grown foods. Most study participants associated healthy foods with health benefits such as prevention of illness and feelings of wellness. Similar perceptions about healthy foods were shared by young females in an urban setting in Soweto, where we have previously investigated the meaning of healthy eating [13]. In both settings, participants described healthy eating in terms of specific foods—in particular, fruits and vegetables, and the benefits of eating these foods, such as improved immune system function and protection from illness. In the current study, the participants described healthy foods as having less fat and including traditional and locally grown foods. The knowledge of health benefits attached to traditional foods imparted by female caregivers and their involvement in household agriculture and food preparation were important factors enabling adolescent girls to eat more healthily. A strong facilitator of healthy eating at the household level was the availability of family-grown vegetables within households or from

neighbours, relatives, or local vendors. Interestingly, participants generally did not view the availability of miroho as facilitating healthy eating, but rather as a sign of poverty.

Poverty and food insecurity are factors that are barriers to healthier eating. For a majority of participants, unavailability of food for breakfast at home meant their not eating anything before going to school. For the few who did eat something, pap with tea was most common. Most young women felt that they did not have the resources to eat a healthy diet because of limited choices and restricted access to healthy foods. Given these findings, students may benefit from breakfast programmes such as the Maryland Meals program for Achievement, which provides free breakfast in classrooms. This is currently not common practice in South African government-supported high schools. This approach, where breakfast was supplied in the classroom as part of the school day, caused improvements in performance, attendance, attention, and behaviour [25]. It will play a major role in facilitating healthy eating practices in a community that is reported to have increased household food insecurity due a high prevalence of HIV/AIDS [26].

However, it appears that peer pressure and cultural beliefs may hinder the consumption of traditional foods, as eating miroho is considered a sign of poverty. There is a strong aspiration to consume more meat and fast foods, because they are associated with better economic status and are therefore more desirable. With the benefits of poverty reduction that economic transition brings to South African urban and rural settings [27], it is concerning that healthy traditional and local eating practices could erode as communities adopt unhealthy eating behaviours.

The school meal programme provides cooked meals to school students who otherwise would not have had any food. However, adolescents mentioned that fruit was rarely available, and that the meals served might not be the "healthiest", with reports of stomach cramps. Increasing the availability of healthy foods through the school meal programme or reduced/subsidised food prices would facilitate healthy eating. This is supported by findings of a systematic review of United Kingdom-based studies examining barriers to and facilitators of healthy eating among young people aged 11 to 16 years. Adolescents overall believed that greater availability of healthy foods would facilitate healthy eating [28]. However, in the current study, despite Agincourt participants acknowledging the school meal programme, they expressed a strong desire to have the financial resources to purchase convenience foods such as fried chips and sugar-sweetened beverages from school vendors. These findings are in line with the systematic review conducted by J. Shepherd et al. in 2006, where young people mostly preferred fast food for its taste and for the ability to choose what they ate [28].

As rural communities transition and become more urbanised, it is important that lessons from urban areas are acknowledged. In a similar study conducted in an urban setting, Soweto girls were skipping breakfast at home and consuming it at school, where school vendors sold unhealthy high-energy options such as vetkoek and snacks instead. Compared with their rural counterparts, urban girls reported consuming more fast foods at home during weekends (such as kota and vetkoek for breakfast) owing to its greater accessibility, convenience, and cost. Some urban girls even replaced supper during the week with kota outside the home, which resulted in reduced sharing of family meals. In rural settings, because of the increasing cost of living, economic challenges, and increasing availability, access, and popularity of fast foods, it is possible that adolescents will consume more fast food. This could cause a decline in the consumption of locally grown and traditional vegetables among adolescents.

It is important to consider the impact of poverty and food insecurity, the importance of informal food vendors in rural communities, the food composition of school meal programmes, and the aspirations of youth (including taste preferences and the emotional connotations of food) when envisaging interventions to promote healthier dietary behaviours. Clinics were also reported to provide health education messages that promote and encourage healthy eating practices.

While urban girls in the Soweto study also participated in house chores, the majority did not walk long distances to and from school, as did their counterparts in the current study, and some even used transportation [13]. In both settings, dancing (street and traditional) can be employed in interventions to increase physical activity. These findings are in line with a study conducted in rural Limpopo province, Dikgale village, where adult women were found to be highly active because they walked with increased intensity for long distances owing to transport limitations, and participated in household work, yard work, and farming activities [29]. In a United States study of Florida adolescents aged 13 to 14 years, walking to school was associated with greater overall levels of vigorous physical activity throughout the day compared with travelling by car, bus, or train [30].

Schools play a major role in facilitating and promoting physical activity among female students. However, schools need to encourage older adolescent learners at higher grades to participate in physical activity in order to encourage ongoing activity after they leave school. Based on recent findings in the same community, increased resources through innovative local organisations such as schools should assist in prioritising the provision of equipment and facilities for non-classroom activities [31]. In a South African township-based study among secondary school students in Durban, inadequate sports

facilities were cited as the primary reason for nonparticipation in sports by black students [32].

Conclusions

The findings of this study will help to formulate strategies to address barriers and build on known facilitators of healthy practices among female adolescents in rural areas, thereby creating conditions that encourage healthy eating practices and physical activities.

As the nutrition transition advances in rural South African settings, it is necessary to protect and promote the availability of and access to locally grown foods and traditional dishes, in order to encourage healthy eating among female adolescents. Female caregivers and the elderly in the community can play an important role in teaching young females about the health benefits of traditional foods, because they are primarily involved in preparing family meals. Food availability in relation to food poverty needs to be addressed. This is a major barrier, because adolescents know about the benefits and importance of consuming breakfast. School meal programmes should be expanded and improved as a contribution to healthy eating among adolescents who do not have sufficient access to healthy options at home.

Physical activities that adolescents currently engage in, such as household chores, walking long distances, and traditional dancing, should be preserved and encouraged in a society with an increasing prevalence of overweight and obesity. Extramural activities at school should be promoted, and sports facilities strengthened. Future studies should explore how other community-based structures such as churches and clinics can be employed to promote and protect healthy eating practices among adolescents. These interventions are vital to help reduce the prevalence of overweight and obesity among young girls and thus reduce the risk of future cardiovascular and metabolic disease.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MHS, SN, KK, and KE were involved in the initial conceptualisation of the research question and interview guide. MHS and TG collected the data. MHS coded the data with assistance from KK and SN. MHS was responsible for the data analysis, with input from KE, AI, SN, KK, and AI. MHS took the lead in drafting the manuscript, with input from SN, KE, AI, TG, and KK. All authors read and approved the final manuscript.

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