The use of nutritional supplements and performance enhancing substances in patients in the Umhlanga area

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Johannesburg, 2020.

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In Memory of my Grandparents

Joosab Noor Mahomed

Khatija Noor Mahomed

Ahmed Gany

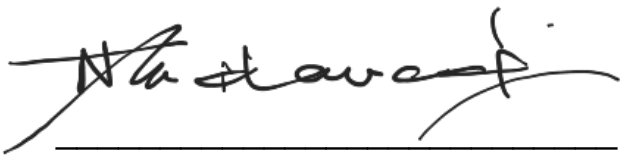
Zubeida Gany

DECLARATION

I Dr. Nazeer Ahmed Noor Mahomed, declare that this Research Report is my own, unaided work.

It is being submitted for the Degree of Master of Science in Medicine-Sports Medicine, at the University of the Witwatersrand, Johannesburg.

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



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Dr. Nazeer Ahmed Noor Mahomed

___5th_____day of_____October____2020____

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NOMENCLATURE

AAS: Anabolic Androgenic Steroids

ATP: Adenosine Triphosphate

DHEA: Dehydro-epiandrosterone

EPO: Erythropoietin

FDA: United States Food and Drug Administration

HGH: Human Growth Hormone

HMB: Beta-hydroxy-beta-methylbutyrate

IGF-1: Insulin-like Growth Factor-I

ISSN: International Society of Sports Nutrition

IOC: International Olympic Committee

PCOS: Polycystic Ovary Syndrome

PES: Performance Enhancing Substances

SAHPRA: South African Health Products Regulatory Authority

TUE: Therapeutic Use Exemption

WADA: World Anti Doping Agency

ABSTRACT

Background: Nutritional supplements play a key role in the lifestyle of a sizeable proportion of the population. The use of these supplements has grown substantially in the past decade. Nutritional sports supplements are dietary supplements commonly used by those involved in bodybuilding, athletics, and many other sports. Performance enhancing substances (PES) are defined as any substance that is used by athletes to heighten their abilities and enhance the performance in their sport participation.

Objective: To determine the use of nutritional supplements and performance enhancing substances (PES) by patients, in a selected group of medical and physiotherapy practices.

Methods: The study was conducted at a total of four practices, which were two private medical and two physiotherapy practices, located in the suburb of Umhlanga. The study consisted of data of completed questionnaires collected over a period of two months from 260 participants (n=260) aged between 18 to 55 years of age. The study used a cross-sectional method design with an anonymous self-administered questionnaire. Outcome measures of this study included the following; Age, gender, level of education, and occupation; Type of exercise, frequency, duration and intensity of exercise; Type of supplement used by the participants; Reasons for supplement and PES use; Source of information about supplements and PES; Attitudes and perceptions to the use of PES and nutritional supplements.

Results: The study consisted of data of completed questionnaires collected over a period of two months from 260 participants. The majority of the participants fell into the 26-35 year-old category (33%) , with the gender breakdown of the participants being 57% male(n=148), and 43% female(n=112). The participants varied from an educational background perspective, with 36.5% having attained a bachelor's degree. The majority of the participants exercised 1-2 times a week (32%) closely followed by those who exercised 3-4 times a week (31%). In terms of types of exercise, the majority of the participants performed strength related exercise (36%) followed by those who performed aerobic exercise (25%). Of the 260 participants in this study, more than half (60%) indicated that they did not consume supplements whilst 40% indicated that they use supplements. Of the participants, 95% answered

"No" to the use of Performance Enhancing Substances, whilst 5% (n=13) reported use of PES. The primary reason selected by the participants overall for supplement use is to meet nutritional needs (31%), followed by those using supplements to increase energy levels (22%). The primary reasons for the usage of PES selected by the participants, were to accelerate healing (24%), to meet nutritional needs (24%), and to improve sport performance (19%). Across all exercise types, multivitamin usage was the highest, with a mean of 41% followed by protein supplements with a mean of 27% across the various exercise types as illustrated in Table 5 below. In terms of PES, Human Growth Hormone (HGH) had the highest usage, at an average frequency of 43% across all types of exercise participation. 64% of participants believed that they felt they would experience improved performance by using supplements, followed by those who believed that using supplements would make them more powerful, muscular and better shaped (63%). Of the participants, 83% either disagreed or strongly disagreed that without using PES, they would not succeed in their sport, and 66% of participants were in agreement that PES use was considered acceptable within their social circle.

Conclusion: The results of this study signify a fairly extensive use of nutritional supplements and evidence of some use of PES amongst medical practice and physiotherapy patients in the Umhlanga area. From our study it is evident that physicians and healthcare providers such as pharmacists, do not sufficiently engage their patients in conversation with reference to nutritional supplements and PES. Further research is needed regarding healthcare practitioners knowledge about supplements and PES. Sports organisations and stakeholders should offer more education on the use of supplements and PES in sports.

CHAPTER ONE - INTRODUCTION

1.1 Introduction

Nutritional supplements play a key role in the lifestyle of a sizeable proportion of the population.[1] The use of these supplements has grown substantially in the past decade.[2]

Nutritional sports supplements are dietary supplements commonly used by those involved in bodybuilding, athletics, and many other sports.[1] Supplements may be used to replace meals, enhance weight gain, promote weight loss, or to improve athletic performance.[1] Among the most widely used are vitamin supplements, protein supplements, creatine products, weight loss products, testosterone boosters, or a combination of these.[1] A dietary supplement is a manufactured product that is intended to supplement the diet, and is taken most commonly by mouth as a liquid, pill, tablet, capsule, or powder.[2] A supplement can provide nutrients which are either extracted from food sources or which are synthetic, in combination or individually, in order to increase the amount of nutrient consumption.[2] The group of nutrient compounds includes minerals, vitamins, fatty acids, amino acids and dietary fibre.

Performance enhancing substances (PES) are defined as any substance that is used by athletes to heighten their abilities and enhance the performance in their sport participation.[3] People use PES to improve athletic performance, increase body weight, lower body fat composition, increase muscle size and strength, and accelerate healing after injury.[3] Common PES include Anabolic Androgenic Steroids (AAS), Human Growth Hormone(HGH), Insulin, Adrenaline/Ephedrine, and Erythropoietin (EPO).[4] These are all illegal in sport as they are prohibited by the sports governing bodies and the World Anti-Doping Agency (WADA).[1]

Dietary supplements are considered a food item as opposed to a drug item, because their ingredients are naturally present as components of what people eat.[5]

Many people, athletes and non-athletes alike, use supplements either as food supplements or as PES, or both.

Physiotherapists and General practitioners are primary health care professionals with a significant role in the promotion and treatment of injuries and disease. They

combine their comprehensive knowledge of the body and how it functions, with hands-on clinical skills to assess, diagnose and treat symptoms of illness, injury or disability. Primary health care professionals need to know a patient's medical and drug history in order to correctly and safely manage their patients conditions, it is therefore important for patients to disclose the use of supplements and PES to their primary health professionals as this has a direct impact on the diagnosis and treatment of injury or illness and to also avoid drug interactions**.**

1.2 Aim and Objectives

To determine the use of nutritional supplements and performance enhancing substances (PES) by patients, in a selected group of medical and physiotherapy practices in the Umhlanga area, Kwazulu-Natal, South Africa.

Study Objectives

1. To determine the extent and pattern of use of nutritional supplements and PES amongst patients in a select region of South Africa.
2. To establish the attitudes and perceptions these patients have towards using nutritional supplements and PES.
3. To observe for comparisons and differences between the different groups of patients in the study

1.3 Literature Review

1.3.1 The Supplements Industry

According to the estimates of the Nutrition Business Journal report, as at 2012, the value of the global nutrition and supplement market stood at about US$96 billion.[6] A year later, it was approximately US$104 billion globally.[6]

The effects of most dietary supplements have not been determined in randomized clinical trials. Supplement manufacturers are not required to conform to the same regulations as drug manufacturers do because regulatory authorities, such as the

United States Food and Drug Administration (FDA), consider supplements a food item as opposed to a drug.[1,7] As the supplements industry is largely unregulated, there is a potential for companies with sub-par manufacturing practices to sell their products to consumers.[8] The South African Health Products Regulatory Authority(SAHPRA) is responsible for monitoring, evaluation, regulation, investigation, inspection, registration and control of medicines, scheduled substances, clinical trials, medical devices and related matters in the public interest. Dietary supplements are not regulated and are not required to have pre-market safety evaluations, and while the manufacturer's statements and labeling must be truthful and not misleading, currently there is no approval process by SAHPRA. The responsibility is with the manufacturer to ensure the product is safe, and therefore it is difficult to monitor the safety of products that are imported into the country until after a safety warning is issued by the product's country of origin.[8]

As a result of the supplement industry not being regulated and with the responsibility falling on the supplements manufacturer to ensure the safety of and to correctly label their products, apart from supplements indicating the presence of certain active compounds, numerous non-hormonal nutritional supplements were found to be contaminated with non-labelled anabolic steroids.[1,9,10] Also, a study on 634 nutritional supplements purchased in 13 different countries performed in 2001 and 2002, established that about 15 percent of nonhormonal nutritional supplements, such as minerals, vitamins, proteins, creatine etc. contained anabolic androgenic steroids that were not declared on the label.[11]

Apart from mislabeling and quality issues such as contamination, other controversies around nutritional supplements include health problems from their use, adverse side effects, and a lack of effectiveness.[2,7,12]

The dietary supplement industry has produced a large quantity of supplements of questionable value, quality and content.[2, 13] A wide range of nutritional supplements exist on the market particularly designed for athletes, and these supplements are promoted for their performance-enhancing properties, for more rapid recovery during training, manipulation of body composition and reduction in illness and infection risks.[12,14] Still much of the evidence concerning the efficacy of these products present in the market do not fulfill the expectations their users might have.[2] A

potentially significant cause of the increase in positive doping cases among high-profile athletes is unintended doping through the use of nutritional supplements.[12,14] Due to these supplements being easily available without prescription and legally sold as supplements, athletes may assume that they do not contain prohibited substances.[14] A number of studies have shown that nutritional supplements can be contaminated with prohormones, and the supplements which are available in the South African market are no exception.[14] A study by Van der Merwe et al (2005) on nutritional supplements obtainable on the South African market, showed that in the region of 7% of supplements tested could be mislabelled or contaminated with prohibited substances.[14] According to this study, an athlete can fail a doping test through the intake of microgram amounts of prohibited substances in contaminated supplements.[14] There are considerable risks associated with the improper use of anabolic androgenic steroids and other hormones, and these substances should only be taken if directed by a physician for legitimate medical reasons.[12,14]

1.3.2 Dietary Supplements

1.3.2.1 Protein supplements

Protein is an essential macronutrient that helps repair tissue, and build muscle, enzymes and hormones.[15] Proteins are linked amino acids that naturally occur in foods.[15,16] Examples of foods that contain protein include milk, meats, fish, poultry, and soybeans. Protein supplementation can include protein powders, shakes and protein bars.[16] Protein powders are concentrated sources of protein from animal or plant foods, such as dairy, eggs, rice, soy or peas.

Common types of protein powders available as supplements include:

- **Whey protein**: This is a water-soluble milk protein that is well-liked among athletes. It is a complete protein, which means that it contains all of the amino acids the human body requires from food. The body absorbs whey protein quickly and without difficulty.[15,16]
- **Casein**: This type of protein is rich in glutamine, an amino acid that may speed up muscle recuperation after exercise.[15] Casein comes from dairy, making it not suitable for vegans and people with milk allergies. The body digests this protein more gradually.[15,16]

- **Soy**: Soy protein is a substitute to whey or casein protein for people who do not consume dairy. It in addition contains all of the essential amino acids.[15,16]
- **Egg white protein**: is easily digested and lactose free.[16]

Protein supplements are claimed to improve muscle growth and function, increase weight gain, increase lean muscle mass, and increase strength and power.[7,15,16] Protein supplements facilitate muscle repair and lessen muscle damage markers during recovery.[17] Potential side effects include renal complications, increased urinary calcium loss, and it may contribute to dehydration.[7,15,16] Due to the stress on the kidneys, individuals with kidney disease should avoid high protein diets and supplements.

Protein supplements are considered a legal dietary supplement and are not banned by sports governing bodies.[5,16]

The International Society of Sports Nutrition (ISSN) position stand on protein states that exercising individuals need in the region of 1.4 to 2.0 grams of protein per kilogram of bodyweight per day and that concerns that protein intake within this range is unhealthy are unsubstantiated in healthy, exercising individuals.[16] It is reported that athletes often consume greater amounts of protein, in the region of 2 to 4 grams of protein per kilogram of bodyweight per day.[17,18]

1.3.2.2 Androstenedione (Andro)

Androstenedione is produced by the gonads and the adrenal glands and is an anabolic androgenic steroid precursor.[11,16,19] It is a precursor to testosterone and presents the same prospective health risks as anabolic androgenic steroids.[11,19] It is claimed to increase muscle size, mass, and strength.[11,16,19] These claims are however scientifically unsupported but it is classified as an illegal substance.[16,19]

1.3.2.3 Dehydro-epiandrosterone (DHEA)

Dehydro-epiandrosterone(DHEA), referred to as a prohormone, is also an anabolic steroid precursor and leads to the production of testosterone.[11,20] DHEA is responsible for about 50% of testosterone production in men.[11,20] Prevailing research do not support the claims that DHEA's androgenic properties increase muscle mass similar to anabolic steroids.[11,16,20] DHEA appears on the World Anti-

Doping Agency (WADA) 2020 List of Prohibited Substances, however it is still available as a dietary supplement.[16,20] Several publications report that side effects of DHEA may include hepatic abnormalities, increased risk of cancer and the same potential health risks of AAS.[11,16,20]

1.3.2.4 Tribulus Terrestris

It is claimed that tribulus terrestris may be able to raise testosterone levels by stimulating the pituitary gland.[1,2,7,11] Research shows no effect on increasing testosterone levels or muscle mass or strength with the use of tribulus terrestris.[1,2,7,11] Tribulus has been shown to have no significant side effects, and is not prohibited by WADA.[2,7,11]

1.3.2.5 Beta-hydroxy-beta-methylbutyrate (HMB)

Beta-hydroxy-beta-methylbutyrate (HMB), is a metabolite of the amino acid leucine that helps decrease protein breakdown, in this manner it retains muscle strength and assists with improved body composition.[7,16,21] HMB may be taken as a tablet, capsule, or in a powder form. The amino acids glutamine, arginine, and leucine all have a function in the body's ability to decrease breakdown of the muscle cells following periods of intense activity, strength training, and during chronic disease states.[16,21] Leucine, the branched-chain amino acid, particularly, plays various roles in the body including the metabolism of protein, glucose homeostasis, action of insulin, and exercise recovery.[21] HMB studies have indicated possible ergogenic benefits such as anti-catabolic, as well as anabolic and lipolytic effects.[21] Supplementing with HMB may help reduce muscle protein breakdown and boost lean body mass, improve overall body composition, enhance strength and endurance, and maximize the results of training.[7,16,21] This is achieved by slowing muscle protein breakdown and speeding up protein synthesis, and also by preserving the structural integrity of muscle cells.[21] In 2013, the International Society of Sports Nutrition (ISSN) concluded that chronic consumption of HMB is safe in both young and old populations.[16,21] There are also no significant side effects with short term utilization of HMB and it is not prohibited by WADA.[7,16,21]

1.3.2.6 Creatine

Creatine is a naturally occurring compound derived from amino acids. It functions as a building block of protein.[2,7,16] Creatine is used to build muscle quicker and cut down on recovery time.[2,5,7] Research indicates that creatine appears to be an effective and reasonably safe supplement to help enhance lean body mass.[2,5,16] Creatine is essential for the regeneration of adenosine triphosphate (ATP). Without creatine, the body cannot produce enough energy at satisfactory rates during short, intensive exercise.[2,16] In muscle tissue, glycogen stores may also be raised by creatine, making energy more readily available.[2,7] Claims of its use include, an elevation in lean body mass, increased maximal energy production and performance, especially high intensity exercises of short duration such as sprints.[2,7,5,16] Other claims include, delayed fatigue in workouts and better recovery after workouts.[7,16]

Those with low inherent creatine levels are the most likely to observe results from taking a creatine supplement than those with normal stores.[7] A typical creatine loading phase is 20 grams for each day for 5–10 days, followed by a maintenance phase of 2–5 grams for each day.[7] When accepted creatine supplementation protocols are followed, the expected increase in intramuscular creatine stores are likely to enhance lean mass, maximal strength/power, and the performance of short-term high-intensity exercise.[22]

Potential side effects include gastrointestinal upset, diarrhoea, nausea, abdominal cramps, dehydration, and possible kidney effects.[2,7,5,16]

Research findings on creatine are not unanimous, however, creatine appears to be of assistance in short duration high intensity exercise such as sprints, football, and volleyball.[16,22] Creatine has not been found to benefit oxygen carrying capacity or aerobic exercise.[7,16]

Creatine is not prohibited by WADA.[7,16] The International Society of Sports Nutrition (ISSN) position stand on creatine monohydrate, is that creatine monohydrate is the most effective ergogenic nutritional supplement currently available to athletes in terms of increasing high-intensity exercise capacity and lean body mass during training.[7,16] It also states that creatine monohydrate supplementation is safe and that there is no compelling scientific evidence that the short-term or long-term use of

creatine monohydrate has any detrimental effects on otherwise healthy individuals.[7,16]

1.3.3 Performance Enhancing Substances

1.3.3.1 Anabolic Androgenic Steroids

Testosterone is the major sex hormone in males and plays a number of essential roles, such as the development of the male reproductive organs, the appearance of facial and pubic hair starting at puberty, muscle size and strength, bone growth, sex drive, sperm production and may also help to maintain a normal mood.[19,23,24]

The production of testosterone in men is controlled by signals sent from the brain to the pituitary gland.[19,24] The pituitary gland then relays signals to the testes to produce testosterone.[19] The amount of testosterone hormone in the body is closely regulated by a "feedback loop".[19] When testosterone levels rise too high, the brain sends signals to the pituitary gland to decrease production.[19,24]

Testosterone is formed in the ovaries and adrenal gland as well and is one of numerous androgens (male sex hormones) in females.[19] These hormones are considered to have significant effects on ovarian function, bone strength and sexual behavior.[19,23,24]

Anabolic steroids are a synthetic version of testosterone that can be taken orally, topically or by intramuscular injection.[19,23]

The illicit sale of anabolic steroids, for the most part over the Internet, is a multimillion dollar industry. “Steroid-stacking” refers to the practice of taking several anabolic steroids, usually in 6 to 12 week cycles, for their combined effects, and many users of anabolic steroids may inadvertently develop very high testosterone levels.[19,24]

Problems related to abnormally elevated testosterone levels in men include a low sperm count, reduction in testicular size and impotence.[19,23,24] Other problems related to abnormally elevated testosterone levels include prostate enlargement, acne, hypertension, increased risk of blood clots, aggressive behavior, mood swings

and irritability.[19,23,24] People who abuse anabolic steroids often experience severe mood swings or aggressive behaviour, referred to as “roid rage”.[19,23,24]

Among women, possibly the most common cause of an elevated testosterone level is polycystic ovary syndrome (PCOS).[24] The ovaries of women with PCOS contain numerous cysts. Symptoms of high testosterone levels in women include irregular menses, decreased fertility, excess or coarse hair on the extremities, face, trunk and pubic area, male-pattern baldness, hyperpigmentation, weight gain, as well as anxiety and depression.[23,24]

1.3.3.2 Human Growth Hormone (HGH)

Human growth hormone (HGH) is a hormone that is naturally produced by the body. Cells in the anterior pituitary gland situated at the base of the brain synthesize and secreted HGH.[23,25] Its secretion into the circulation follows a pulsatile pattern resulting in widely variable blood levels that are influenced by many factors such as gender, age, sleep, physical activity, fever, diet, stress and the environment.[25]

The most important role of HGH is to stimulate the liver to produce Insulin-like Growth Factor-I (IGF-I).[19,25] IGF-I plays a key role in organ growth and muscle protein synthesis and stimulates production of cartilage cells, resulting in bone development.[19,25]

Human growth hormone is prohibited both in and out of competition under section S2 of the World Anti Doping Agency’s (WADA) List of Prohibited Substances and Methods.[19,23,25,26] The following substances, and other substances with similar chemical structures or similar biological effects are prohibited under this section; Erythropoietins and agents affecting erythropoiesis, peptide hormones and their releasing factors including HGH, it's fragments and releasing factors, as well as other growth factors and growth factor modulators, related substances and mimetics.[26]

Some of the effects attributed to HGH, which may explain the appeal for its use as a doping agent include, the enhancement of muscle mass and strength (anabolic effect), the decrease of body fat (lipolysis), in addition to its tissue-repairing effects (recovery) on the musculoskeletal system.[19,23,25] The anabolic actions of HGH are

typically mediated through IGF-I and include increases in total body protein turnover and muscle synthesis.[25] Other performance enhancing substances also appear to be used synergistically with HGH, and as a result have an effect, although indirect, on muscle anabolism and athletic performance.[19,25]

Commonly reported side effects for HGH abuse are: diabetes in prone individuals; aggravation of cardiovascular diseases; muscle, joint and bone pain; hypertension; abnormal growth of organs; and accelerated osteoarthritis.[19,23,25] Because of the role that HGH plays in stimulating IGF-1 secretion, abuse of HGH may also lead to metabolic dysfunction and glucose intolerance.[23,25]

1.3.3.3 Erythropoietin (EPO)

Erythropoietin (EPO) is a peptide hormone that is produced naturally by the human body and is released from the kidneys.[19,23,27] It acts on the bone marrow to stimulate the production of red blood cells.[23,27] Increasing the number of red blood cells in the body increases the ability to deliver oxygen to tissues.[19,23,27] The amount of oxygen that the blood can carry to the body's muscles is improved by an increase in red blood cells. While appropriate use of EPO has a huge therapeutic benefit in the management of anaemia associated with renal disease, its misuse can lead to serious health risks for athletes who make use of this substance plainly to achieve a competitive edge.[27] By increasing red blood cell production, the effects of EPO can cause blood to clot in the arteries and veins, causing complications such as a heart attack, cerebral or pulmonary embolism.[23,27] The misuse of recombinant human EPO may also lead to autoimmune diseases with severe health consequences.[27] EPO is listed as a prohibited substance by sports governing bodies and WADA.[19,23,27]

1.3.3.4 Insulin

Insulin is a peptide hormone secreted by the pancreas. It is prescribed to diabetic patients for its main action of controlling blood glucose levels as it increases the transport of glucose into the cells of the body.[23,28] Insulin acts as an anabolic hormone, as it increases the transport of amino acids into the cells of the body, and it stimulates protein synthesis.[23,28] Insulin also inhibits protein degradation.[23,28] Bodybuilders, power lifters, and other athletes concerned with sheer muscle mass

prefer to use insulin as a way to preserve the muscular gains they've made, especially those who have used anabolic androgenic steroids or human growth hormone as well in their training.[19,27,29] For endurance athletes like cyclists and runners, insulin provides fuel for muscle cells and improves stamina by enabling them to load their muscles with glycogen "fuel" before and between events.[28] Athletes would need to take insulin and glucose simultaneously for a couple of hours in order to do this, infusing them using a technique called a "hyperinsulinaemic clamp".[28,29] Insulin is a potentially lethal drug and has serious consequences, with the user being at risk of developing hypoglycaemia.[28,29] If hypoglycaemia occurs for a prolonged period away from medical assistance it could potentially result in a coma and death.[28] The International Olympic Committee prohibited the use of this hormone by non-diabetic athletes in 1998.[28] Insulin is prohibited by WADA currently, both in an out of competition, unless the athlete is diabetic and has a Therapeutic Use Exemption (TUE) for that substance.[26]

1.3.4 The Use of Supplements

The use of nutritional supplements among medical patients has been reported to be between 40 and 60 percent.[6,30] Adequate scientific rationalization for extensive use of nutritional supplements in healthy, young populations is lacking.[31] The most commonly used nutritional supplements include multivitamins, protein and creatine supplements.[1,2,6,7] A study on nutritional supplement use by patients in a rural family practice by Sobal et al, reported that supplements were taken by 54 percent of patients during the previous six months and the major reasons cited for their use was the desire to assure good nutrition and to reduce fatigue.[30] In a study on dietary supplement use by patients at a family practice clinic by Eliason et al in 1996, improved nutrition, disease prevention, and treatment of fatigue appeared to motivate most of the patients taking supplements.[15] Two thirds of the patients declared that they had informed their physicians about the use of supplements, but only 23 % of the physicians had in actual fact recommended the supplement to their patients.[15] These patients received information about supplements from the media, general knowledge, and friends or family rather than their physicians.[15] The findings of this study supported the importance of physicians inquiring about the use of supplements and talking with their patients about nutritional supplements.[15,30]

Appropriate, evidence-based use of nutritional supplements have been demonstrated to show significant clinical benefit in the management of disease related malnutrition especially in the acutely ill and in older patients.[32] Studies reviewed in patients with predominantly chronic conditions suggest that oral nutritional supplements do produce demonstrable clinical and functional benefits.[33] A pragmatic approach to nutritional and sports supplements is needed in the face of the evidence that some supplements can beneficially contribute to a sports nutrition plan and enhance performance.[34]

Elite and recreational athletes make use of nutritional supplements in the hope of improving their performance, achieving superior sporting results and improving their physical appearance.[2,6] This may be achieved by attempts to increase muscle mass and muscle strength, with the aim of improving physical strength and endurance, or losing weight to become faster and leaner, such as in sports like dancing, gymnastics or swimming.[2] Alternatively athletes may be trying to gain weight which would be of benefit in sports such as wrestling or boxing.[2,6] Worldwide use of supplements in all athletes in general is estimated to range over 40 %.[2,6] The United States Olympic Committee conducted research in 2004 and found that about 90% of athletes use some form of dietary supplements.[2] High demands such as these, have resulted in a multitude of products in the market with specific applications to exercising individuals.[2,6]

1.3.5 Performance Enhancing Substances – Reasons for their use and preventative strategies

The prevalence of gym users use of performance enhancing substances have been examined by a number of studies.[18] They indicate that PES are commonly used, ranging from 1- 12% in an open population, from 3-31% with gym users and from 16-50% among bodybuilders.[18,29]

Anabolic Androgenic Steroids have also been linked to the abuse of alcohol, morphine, and other addictive substances.[3] Adolescent athletes are faced with more pressure from coaches, peers, and parents to perform well.[4] Some of the adolescent athletes are using nutritional supplements or PES to cope with the pressures of competition.[4] There was an indication that more education on PES was needed from the majority of participants in a study by Gradidge et al in 2010.[4]

Given the likely adverse health effects with the use such drugs, it is important to develop and implement preventative strategies.[18] The three social psychological determinants proved to be the most significant to the intention to use performance-enhancing substances are: perceived use by others, personal norms and beliefs about performance improvement.[18] Users expected more positive effects of these drugs on their performance than non-users.[18,29] They felt that their bodies would be more muscled, more powerful, and better shaped.[18,29] They also held the belief that these valued outcomes would be achieved in a smaller period of time than if they used no drugs at all.[18] Important predictors of use were personal norms and perceived use by significant others.[18] Therefore preventative interventions should endeavor to influence the process of social influences and personal norms.[18]

Findings of a study by Jalilian et al in 2011, supported that implementing an AAS abuse preventative programme among gym users and adolescents would be effective to improve resistance skills not to use AAS.[3] Athletes and patients in the general population need to be aware of the problems that may possibly follow supplement use, and sport authorities need to make sure that guidance and nutritional education for athletes is of the highest standard.[29]

The purpose of this study was to determine the use of nutritional supplements and PES in a sample of 260 male and female patients between 18 to 55 years of age in the Umhlanga area(n=260). This would help to establish whether a patient awareness and education programme regarding these supplements and PES is warranted in this area.

CHAPTER TWO - METHODS

The study used a cross-sectional method design with an anonymous self-administered questionnaire. The questionnaires were used to collect the data required to achieve the objectives of the study.

Outcome measures of this study included the following;

- Age, gender, level of education, and occupation.
- Type of exercise, frequency, duration and intensity of exercise.
- Type of supplement used by the participants.
- Reasons for supplement and PES use.
- Source of information about supplements and PES.
- Attitudes and perceptions to the use of PES and nutritional supplements.

The questionnaire had been adapted from a study that investigated performance enhancing substance use in Johannesburg Boys high school sport.[4] The reliability and validity of the study was tested in a pilot study by professionals practising in the fields of sports medicine and biokinetics at the Centre for Exercise Science and Sports Medicine at the University of the Witwatersrand. The questionnaire was formulated to obtain responses on the use of nutritional supplements and performance enhancing substances (PES) in the population as well as their attitudes and perceptions regarding their use and whether further patient education is required concerning nutritional supplements and performance enhancing substances.

The study population was set in Umhlanga, an affluent residential, commercial and resort town north of Durban on the coast of Kwa-Zulu Natal, South Africa (Map of Study site- Appendix E).[35] Men and women aged between 18 and 55 years old, irrespective of race or socio-economic background were included in the study.

The study was conducted at a total of four practices, which were two private medical and two physiotherapy practices, located in the suburb of Umhlanga. The study consisted of data of completed questionnaires collected over a period of two months from 260 participants.

Ethical clearance for this research study was obtained from the University of the Witwatersrand's Human Research Ethics Committee, (Ethics clearance number M180232- Appendix A).

A meeting was arranged with the researcher and each individual doctor and physiotherapist at their respective practices, explaining the purpose of the study and requesting their assistance in recruiting participants from their patient base. The receptionists, doctors and physiotherapists received training about the aims and objectives of the research, the terminology used in the research as well as the research questionnaire. The receptionists at the respective practices informed patients of the study and helped with answering any questions from the participant, including explaining the terminology and research questions to the participants, and if needed, referring any queries to the physiotherapist or doctor. The doctors and physiotherapists assisted the participants in understanding the research questions, including terminology, and helped to answer any queries from the participants.

After obtaining permission by the healthcare practitioners, arrangements were made to conduct the research. Sixty five subjects were recruited from each study site. Patients were informed of the study by the receptionist of the practice, whilst in the waiting room awaiting their appointment. Patient participation in the study was voluntary, and by completing the questionnaire they were consenting to their participation in the study. Participants were requested to answer the questions truthfully and honestly, and were assured complete anonymity. The receptionist and practitioner from the respective practices were available to answer or clarify any questions from participants in the study.

The participants were asked about their age, gender, level of education and occupation. Participants were also asked to answer questions related to the type, frequency, duration and intensity of exercise they performed. They were asked about the types of sport they participated in and were able to select multiple options. The study also assessed the attitudes and perceptions of the participants towards supplements and PES, using Likert scales (figure 3.9 and figure 3.10). The participants were asked to respond to 14 statements rating their level of agreement or disagreement to each of the statements.

When patients had completed the questionnaire, they were asked to drop the completed questionnaire into a confidential sealed box at the reception desk of the respective practice. Confidentiality was maintained at all times, and no personal details of the participants were collected. Participants were requested not to participate in this study more than once. The questionnaires were available for completion at these four practices over a period of two months. The completed questionnaires were collected by the researcher from the sealed boxes weekly, at the participating practices.

Statistical Analysis

Statistical analysis was prepared using Microsoft Excel Analysis ToolPak 2016. Descriptive statistics were applied to the data collected from the study. Distribution and cross tabulation was generated, Chi-square was used to compare proportions. The hypothesis that more than a minimum of 40% of data acquired would be relevant and used to analyse the behaviours and associated usage of nutritional supplements and PES in this study. The p-value yielded (0.89) indicates the null hypothesis to be acceptable. The significance level used was 0.5. The Chi-square test observed a value of 0.016, therefore there is a good fit between observed values and expected values.

CHAPTER THREE – RESULTS

The study consisted of data of completed questionnaires collected over a period of two months from 260 participants.

3.1 Demographic data

The majority of the participants fell into the 26-35 year-old category (33%) , with the gender breakdown of the participants being 57% male(n=148), and 43% female(n=112) (figure 3.1).

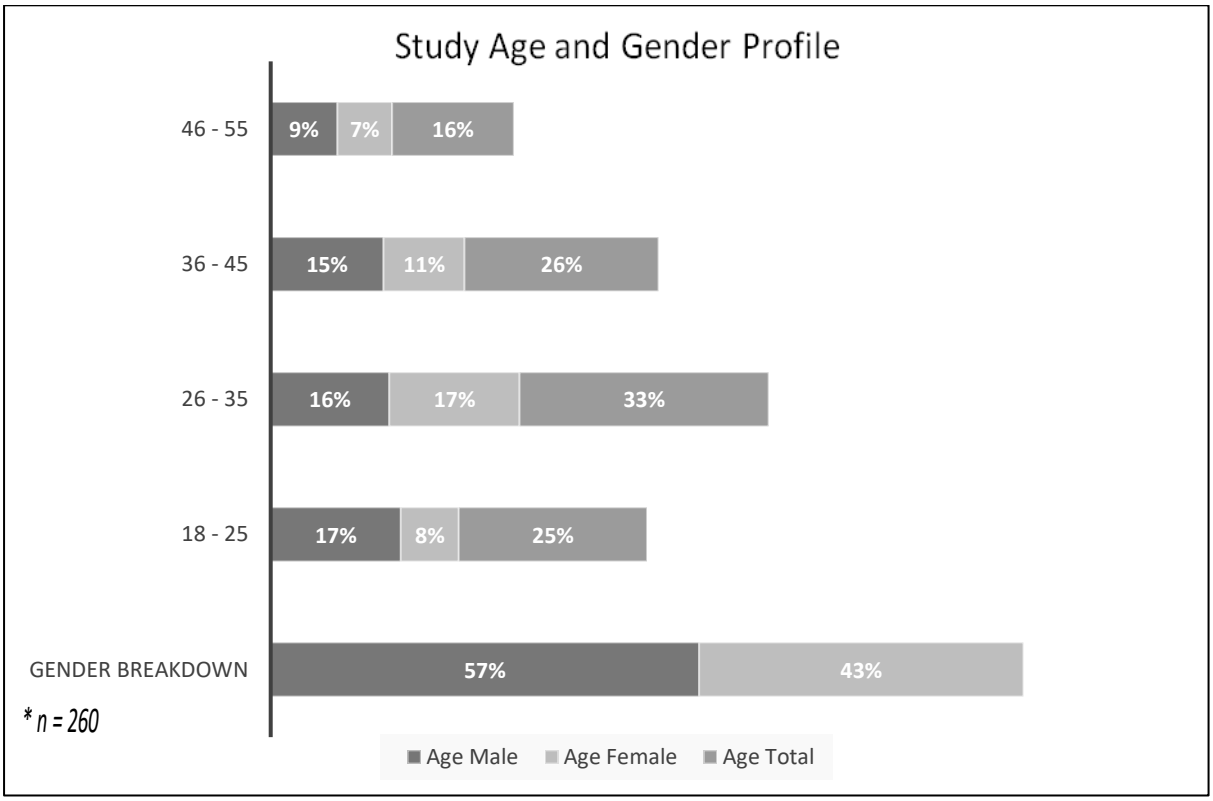


Figure 3.1. Age and gender profiles of the participants (n=260)

The participants varied from an educational background perspective, with 36.5% having attained a bachelor's degree. The next largest category of participants were those who had obtained a college education (no degree) making up 19.2%. This was followed by participants who completed high school (15.8%), thereafter Masters Degree (9.6%), Professional (7.7%) and Doctoral Degrees (1.5%). The remaining participants were made up of those who had completed primary school (0.8%) and those who had no schooling (0.4%).

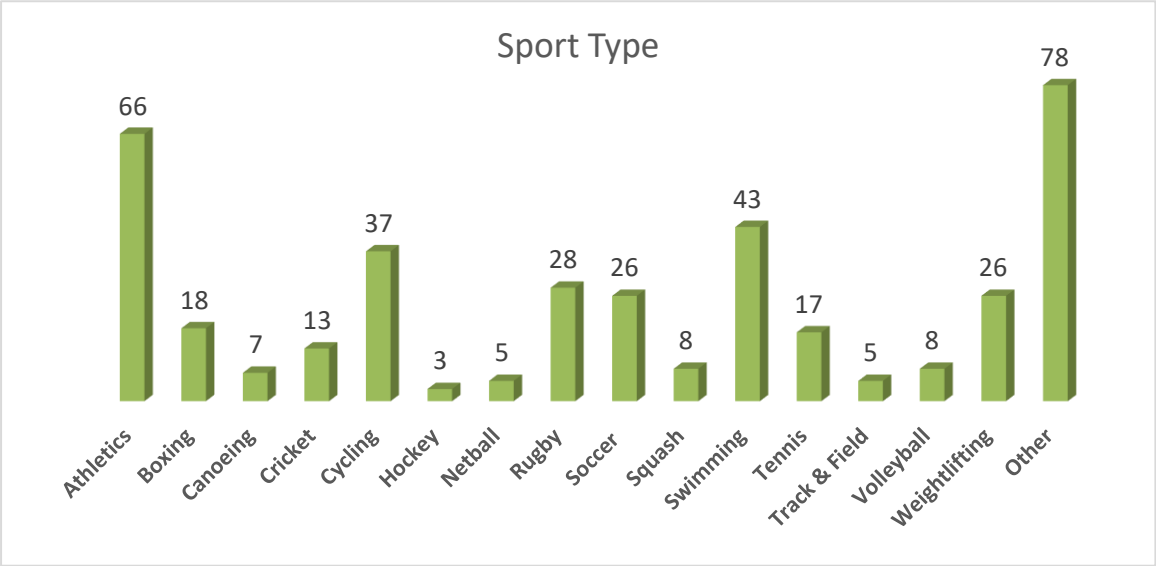
3.2 Exercise Frequency

The majority of the participants exercised 1-2 times a week (32%) closely followed by those who exercised 3-4 times a week (31%). Participants who exercised more frequently were made up of those who exercised daily (7%) and those who exercised 5–6 times a week (18%). The remainder of the participants either did not exercise at all in a week (10%) or did not indicate their exercise frequency (2%) in the questionnaire (n=260).

3.3 Exercise and Sport Type

In terms of types of exercise, the majority of the participants performed strength related exercise (36%) followed by those who performed aerobic exercise (25%) and thereafter those that did flexibility type exercise (21%) and those participants who performed both strength and aerobic exercise (17%). The remainder of the participants performed anaerobic exercise (8%) and no exercise (10%).

Of the participants that played sports (53%), the majority were in the group that played sports recreationally (76%) followed by those who played professionally (24%). Sport varied in type extensively, with most being in athletics (figure 3.2).



** n=388 as those participants who played sports were able to select more than one type of sport*

Figure 3.2 Sport participation by types of sport

3.4 Prevalence of Supplement and Performance Enhancing Substance Usage

Of the 260 participants in this study, more than half (60%) indicated that they did not consume supplements whilst 40% indicated that they use supplements.

Of the participants, 95% answered “No” to the use of Performance Enhancing Substances, whilst 5%(n=13) reported use of PES.

Figures 3.3 and 3.4 illustrate the prevalence of supplement and PES use in the male and female population of the study. It is evident from these figures that the highest usage both of supplements (53%) and PES (11%) were found in females between the ages of 46 – 55 years. In all other age groups, males are higher users of supplements than females. It is evident from these figures that the highest usage of supplements for males was found in the 18 – 25 year old category (60%) whilst the use of PES was found most in males between the ages of 35 – 45 years (12%).

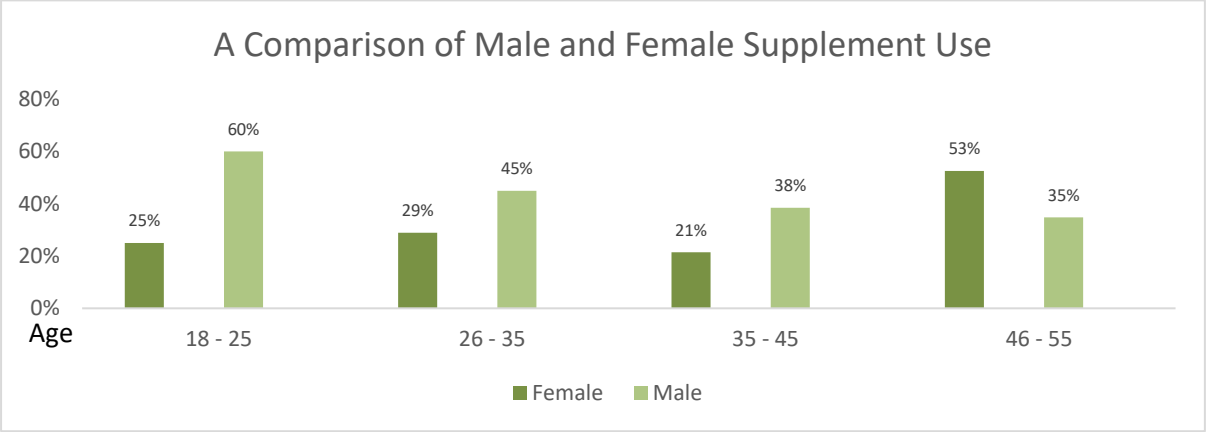


Figure 3.3 A Comparison of Male and Female Supplement Use

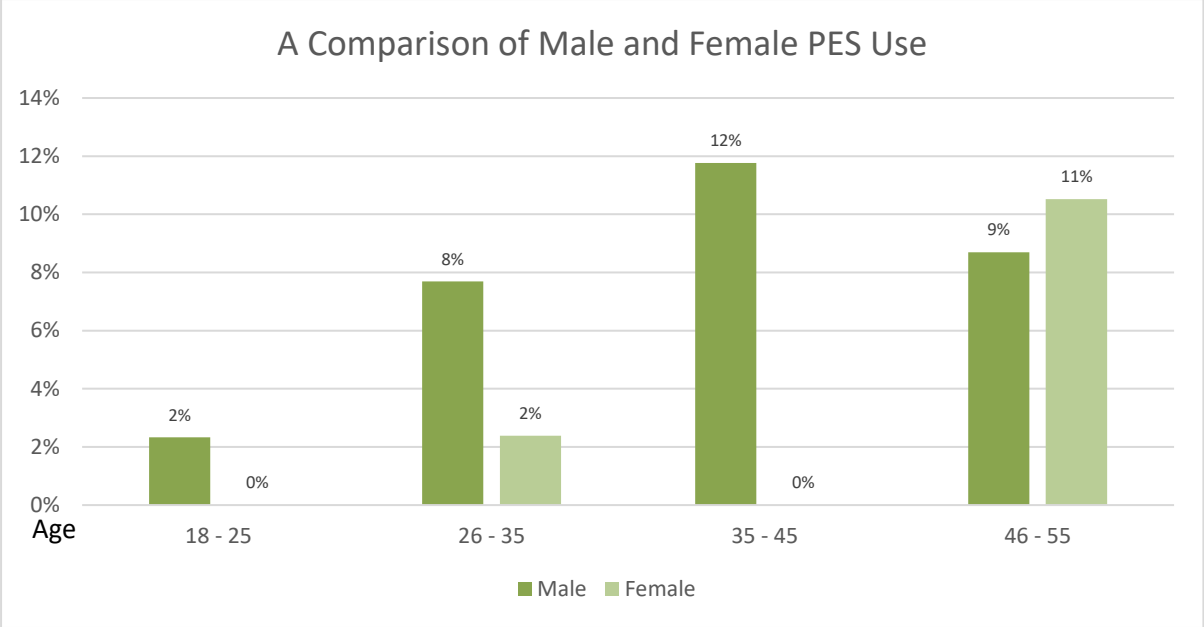


Figure 3.4 A Comparison of Male and Female PES Use

As illustrated in Figure 3.5, the participants in the study across all age groups varied in their use of supplements and PES, with the maximum use of supplements found in 18 – 25 year olds (49%), and the maximum use of PES found in 45-55 year olds (10%).

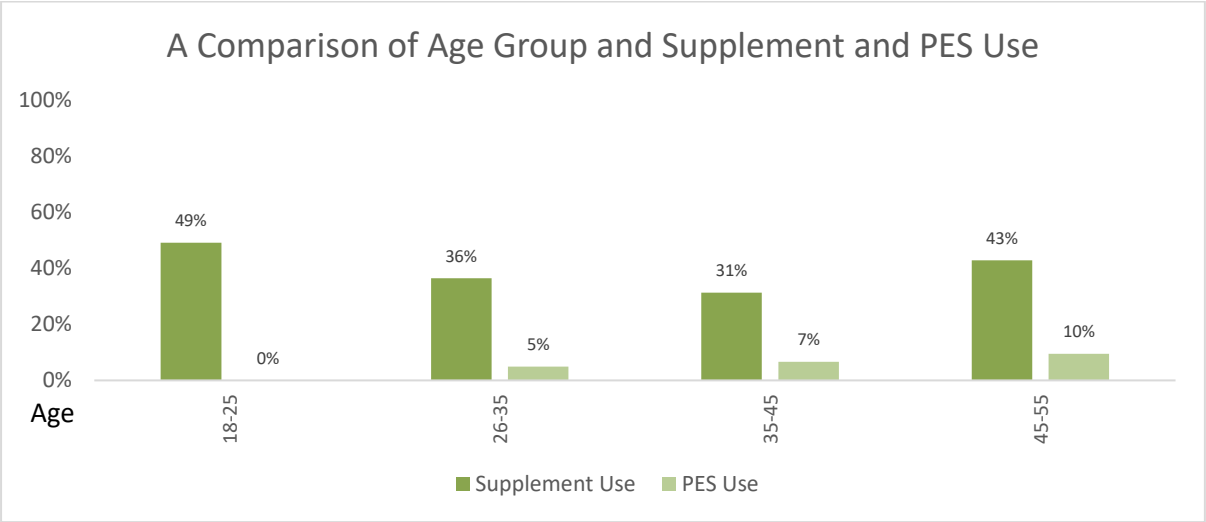


Figure 3.5 A Comparison of Age Group and Supplement and PES Use

As illustrated in Table 1, the highest usage of both supplements (44%) and PES (11%) was found in those participants who had completed high school.

The second highest usage of PES was found in those participants that had a bachelor's degree (7%).

Table 1: A Comparison of level of Education and Supplement and PES use

Education	Supplement Use	PES Use
No Schooling	0%	0%
Primary Completed	0%	0%
High School Completed	44%	11%
Some college/No degree	38%	2%
Trade/Technical/Vocational	43%	3%
Bachelors Degree	41%	7%
Masters Degree	44%	2%
Professional Degree	25%	0%
Doctorate Degree	25%	0%

3.5 Types of Supplements Used

In terms of supplement usage, 40% (n = 103) of the participants in the study indicated that they did use supplements, however 10% (n =27) indicated that they did not consume supplements, but did select a/many supplement types. Therefore to determine the type of supplement used (Figure 3.6), the participants that selected "no" but did select a supplement type were included in the calculation (n=130). Figure 3.6 illustrates that the top three types of supplements used were multivitamins (38%), proteins (27%) and "fat burners" (10%).

Of the total participants who indicated when they use supplements (n=151), most participants consumed supplements before training (54%), followed by supplement use after training (37%) and supplement use during training (9%). The frequency of use of supplements amongst the participants indicated that the majority of participants (30%) used supplements daily, followed by four times a week (13%), three times a week (13%) and twice a week (13%). Participants who used supplements five times a week (10%), and six times a week (7%) were in the minority.

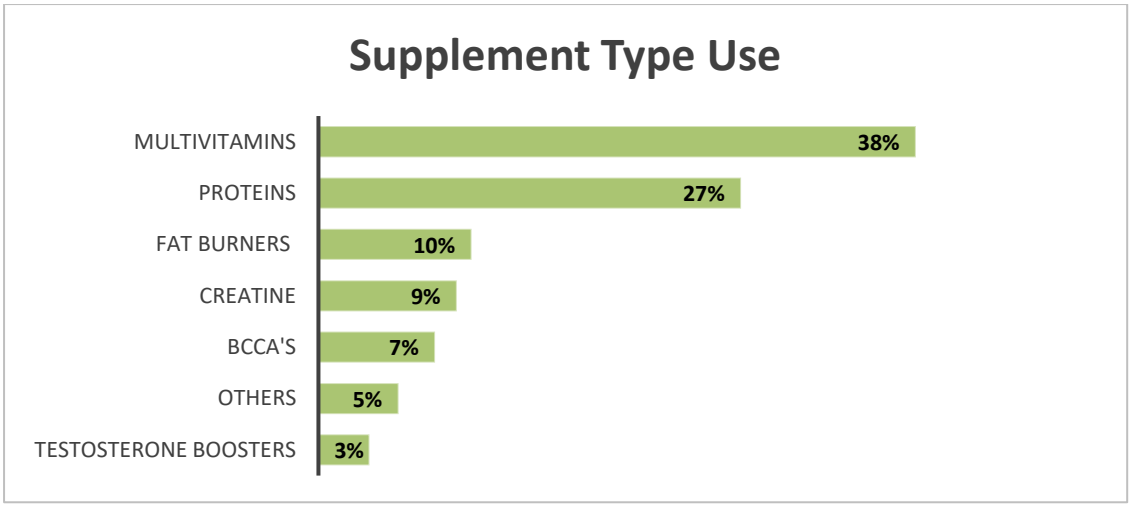


Figure 3.6 Supplement Type Use

*n=214

BCAA's=branched chain amino acids

As illustrated in figure 3.7, supplement brand usage showed USN™ (20%) to be the most popular brand. Next was Futurelife™ (14%); followed by Nutri tech™ (8%), Muscle tech™ (8%) and Evox™ (8%). Twenty one percent of "Other" category were brands that were not documented in the survey.

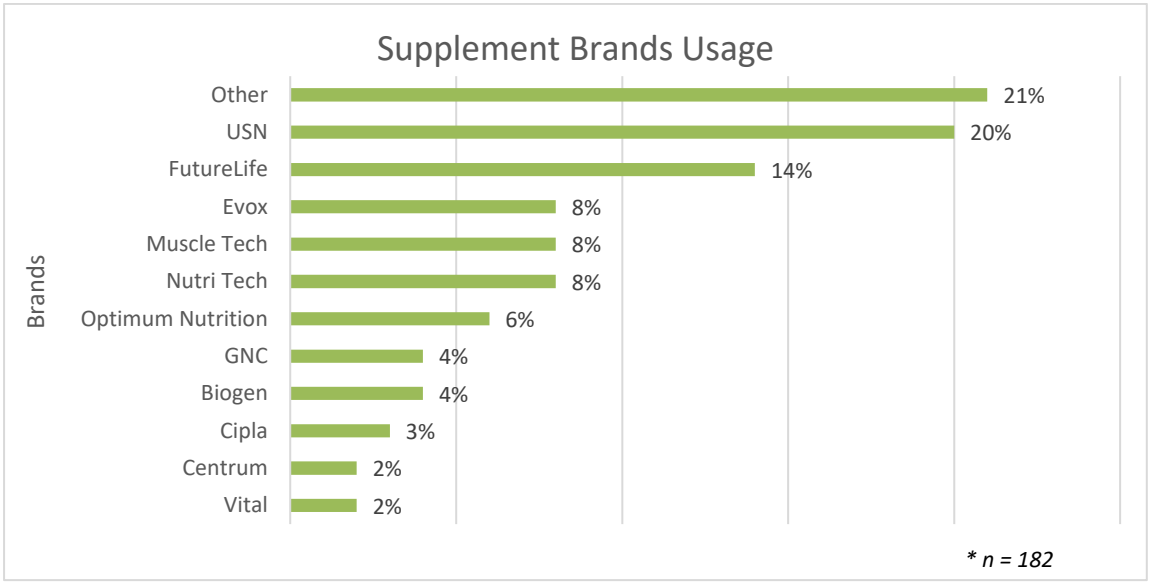


Figure 3.7 Supplement brand Usage

The table below reflects the most common supplement brands stated by those participants who chose other supplement brands. It is evident that Biogen represents the largest (25%) of the "Other" brands.

Table 2: A Selection of Other Supplement Brands used by participants

Supplement Brand	Usage
Biogen	25%
Centrum	13%
SSN	6%
Vital	9%

** n = 32. This represents a sub data set of the "other" category of supplement brands indicated by participants. Only the brands that had more than 2 selections were included in the table*

3.6 Reasons for Supplement and PES Usage

The primary reason selected by the participants overall for supplement use is to meet nutritional needs (31%), followed by those using supplements to increase energy levels (22%) (Table 3). Only 1% of the participants reported that they felt social pressure to use supplements, and this was present within males only. 15% of males selected coping mechanism as a primary reason for supplement use as compared to 8% in females.

Table 3: A Comparison of the Primary Reasons for Supplement Use in Males and Females

Primary Reasons for Supplement Use	Male	Female	Total
Meet Nutritional Needs	28%	37%	31%
Increase Energy Levels	18%	31%	22%
Improved Sport Performance	16%	9%	14%
Coping Mechanism	15%	8%	13%
Suppress Appetite (Decrease Body Weight)	10%	9%	9%
Increase Appetite (Increase Body Weight)	8%	1%	6%
Recreational / Social Use	5%	4%	5%
Peer / Social Pressure	1%	0%	0%

** n = 265. Participants were able to select more than one primary reason for supplement use.*

The primary reasons for the usage of PES selected by the participants, were to accelerate healing (24%), to meet nutritional needs (24%), and to improve sport performance (19%) (Table 4).

Table 4: A Comparison of the Primary Reasons for PES Use in Males and Females

Primary Reasons for PES Use	Male	Female	Overall
Meet Nutritional Needs	25%	0%	24%
Accelerate Healing	25%	0%	24%
Improved Sport Performance	20%	0%	19%
Coping Mechanism	15%	0%	14%
Increase Muscle Size and Strength	10%	100%	14%
Increase Appetite (Increase Body Weight)	5%	0%	5%
Suppress Appetite (Decrease Body Weight)	0%	0%	0%
Peer / Social Pressure	0%	0%	0%
Increase Energy Levels	0%	0%	0%
Recreational / Social Use	0%	0%	0%

** n = 21. Participants were able to select more than one primary reason for supplement use.*

3.7 Information Sources

As noted in figure 3.8, the top 3 sources of information by supplement users were online (18%), family/friend (16%) and personal trainer (16%), whereas the information sources for PES users differ slightly with information being obtained from a pharmacist at (18%) a general practitioner (18%) and online sources (14%).

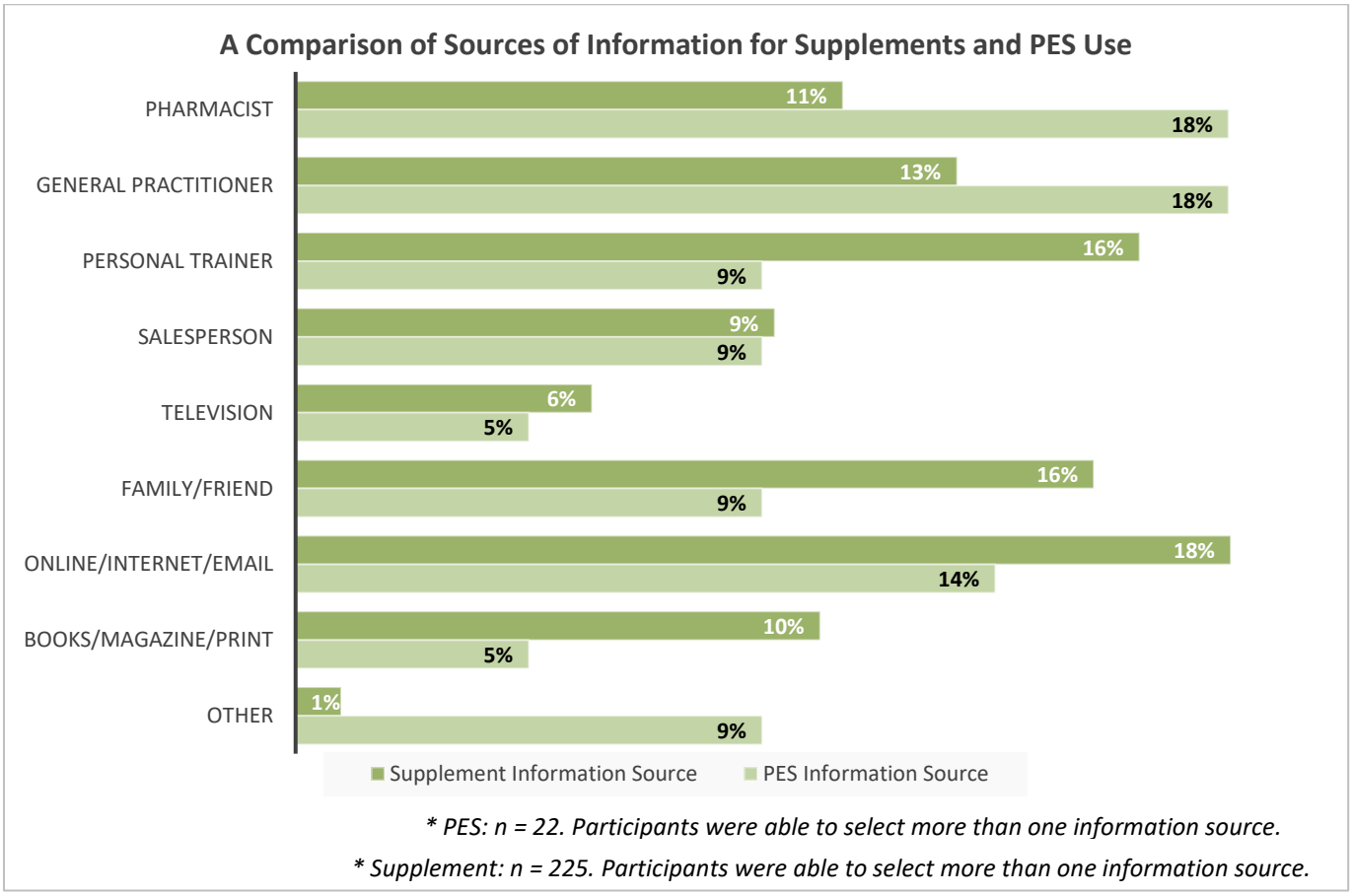


Figure 3.8 Information Sources for Supplement and PES Users

3.8 Exercise and Sport Type by Supplement and PES Use

Participants used various types of supplements, based on the exercises they performed. Similarly, the type of PES used also varied by types of exercise.

It is evident in Table 5 that across all exercise types, multivitamin usage was the highest, with a mean of 41% followed by protein supplements with a mean of 27% across the various exercise types as illustrated in Table 5 below.

In terms of PES, Human Growth Hormone (HGH) had the highest usage, at an average frequency of 43% across all types of exercise participation. Table 5 indicates the detail of the type of supplement and PES used against the different types of exercise performed by the participants.

Table 5: A Comparison of Supplement and PES Use by Exercise type

Supplement Type	Exercise Type					
	Aerobic	Anaerobic	Strength	Flexibility	None	Mean
Multivitamins	42%	33%	31%	33%	67%	41%
Protein Supplements	22%	33%	31%	30%	17%	27%
Creatine	8%	11%	10%	10%	0%	8%
Testosterone Boosters	5%	2%	4%	5%	0%	3%
BCCA's	9%	13%	9%	12%	0%	9%
Fat Burners	11%	4%	9%	11%	8%	9%
Other	3%	2%	6%	0%	8%	4%

PES Type	Exercise Type					
	Aerobic	Anaerobic	Strength	Flexibility	None	Mean
Anabolic Androgenic Steroids	30%	0%	33%	43%		27%
Human Growth Hormone	40%	50%	40%	43%		43%
Insulin	20%	0%	13%	0%		8%
Other	10%	50%	13%	14%		22%

** BCCA's= Branched Chain Amino Acids*

***PES: n = 34. Participants were able to select more than one primary reason for supplement use.*

****Supplements: n = 412. Participants were able to select more than one primary reason for supplement use.*

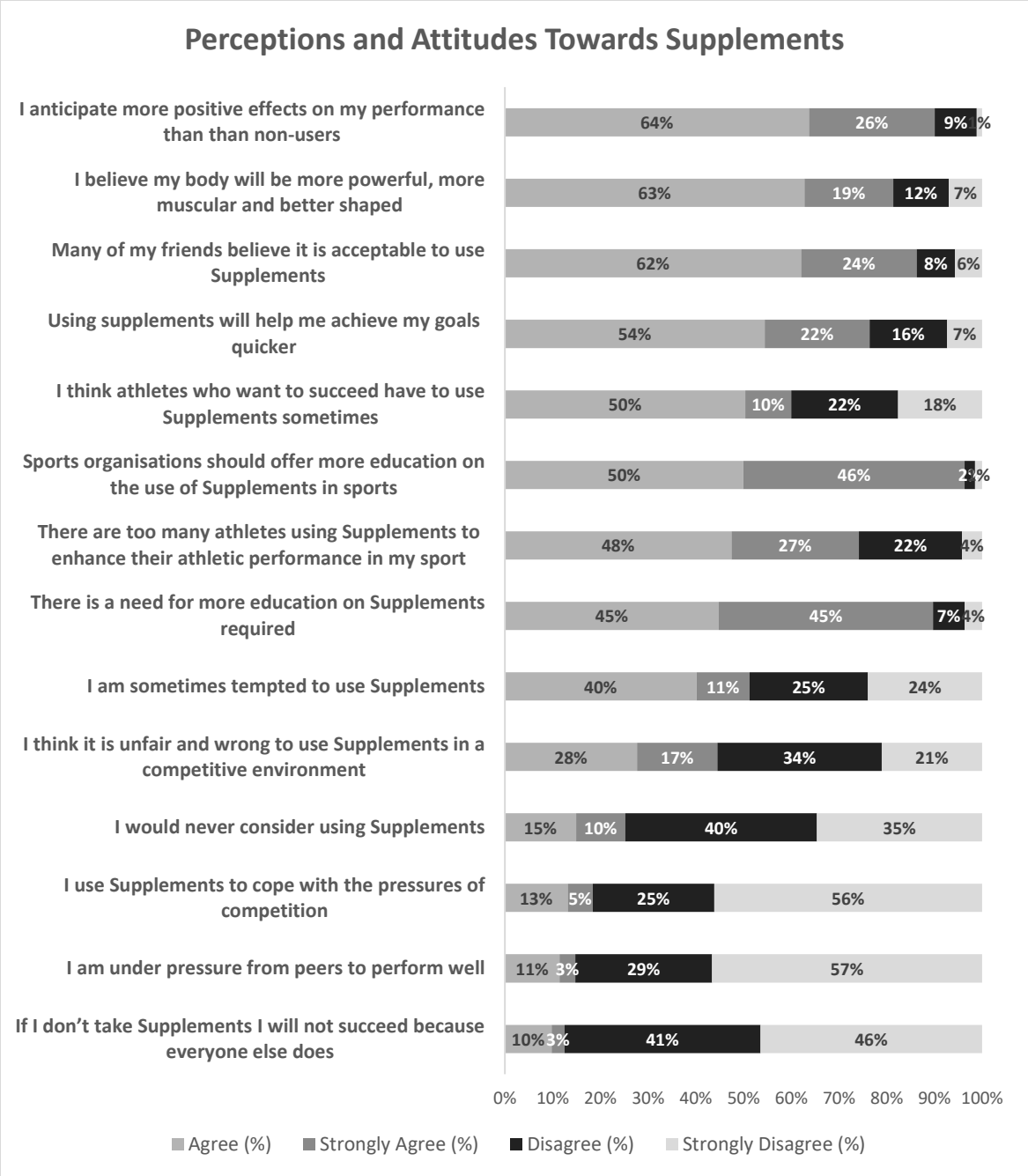
Table 6 below displays that PES and Supplement use was the highest amongst those participants that participated in Athletics(29% and 15% respectively). PES use by swimmers was 19% as compared to supplements at 8%.

Table 6: A Comparison of Supplement and PES Use by Sport type

Sport Type	PES	Supplements
Athletics	29%	15%
Boxing	5%	6%
Canoeing	0%	2%
Cricket	0%	4%
Cycling	5%	8%
Hockey	0%	0%
Netball	0%	2%
Rugby	10%	11%
Soccer	10%	7%
Squash	0%	2%
Swimming	19%	8%
Tennis	5%	4%
Track and Field	0%	1%
Volleyball	0%	4%
Weightlifting	5%	9%
Other	14%	18%

3.9 Perceptions and Attitudes towards Supplements

64% of participants believed that they felt they would experience improved performance by using supplements, followed by those who believed that using supplements would make them more powerful, muscular and better shaped (63%). 62% of participants indicated that their friends also believed it was acceptable to use supplements, suggesting a societal acceptance of the use of supplements.



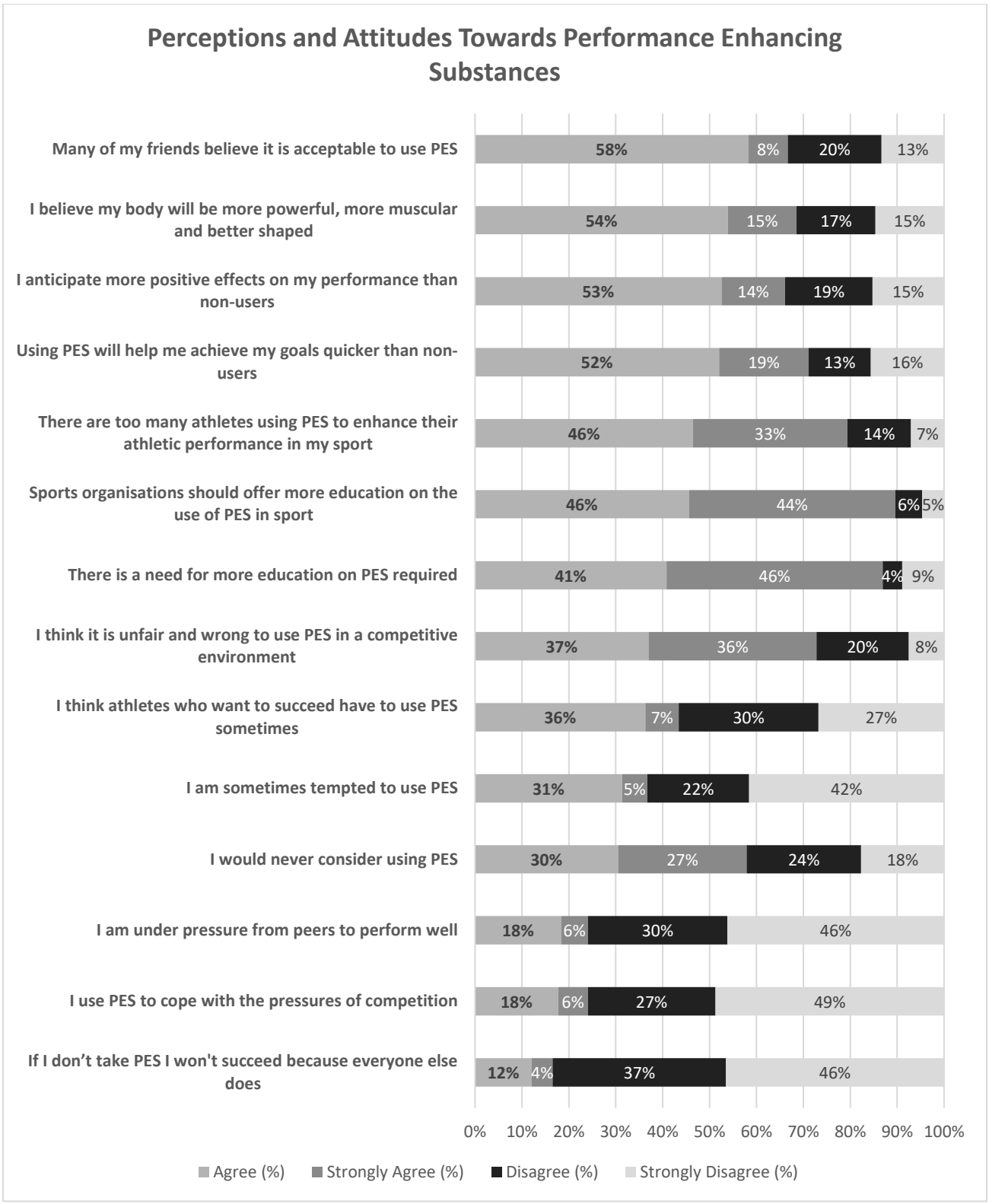
n=1677. Each participant was required to provide a response to all 14 statements.

Figure 3.9 Likert Scale: Attitudes and perceptions towards supplement use

3.10 Perceptions and Attitudes towards Performance Enhancing Substances

Of the participants, 83% either disagreed or strongly disagreed that without using PES, they would not succeed in their sport, and 66% of participants were in agreement that PES use was considered acceptable within their social circle.

90% of participants were also in agreement (Strongly Agree 44% and Agree 46%) that sports organisations should provide more education on the use of PES in sport, and that in general there is a need for more education on PES (Agree 41%, Strongly Agree 46%).



** n = 2347. Each participant was required to provide a response to all 14 statements.*

Figure 3.10 Likert Scale: Attitudes and perceptions towards PES use

CHAPTER FOUR – DISCUSSION AND CONCLUSION

4.1 Discussion

In this study, we investigated the use of nutritional supplements and PES by patients in a group of medical and physiotherapy practices in the Umhlanga area of Kwazulu Natal in South Africa, to determine the extent and pattern of use of nutritional supplements and PES amongst patients in a select region of South Africa, to establish the attitudes and perceptions these patients have towards using nutritional supplements and PES, and to observe for comparisons and differences between the different groups of patients in the study.

Of the study's participants (n=260), 33% were in the 26-35 year old category, while 16% of participants were in the 46-55 year old category. Of the participants, 57% were male, with females making up 43% of the participants (Figure 3.1). A third of participants had obtained a bachelor's degree and the majority of all participants identified themselves as being in the business field, followed by office administration, technical services, and arts, design and media. The least common occupation was in the field of education.

63% of participants had exercised a few times per week and participants who had exercised more than four times per week were in the minority. 10% of participants did not exercise at all in a week. Most participants performed strength related exercise, and 25% of participants performed aerobic exercise. Half the participants (53%) in the study indicated that they played sports, with 24% of this group indicating that they played sport professionally.

Of the 260 participants in this study, 50% of the participants reported using supplements whilst only 5% of the participants reported using PES. This compares to a study by Hasan et al (2009) where 63.9% of patients reported use of supplements.[36]

The most frequent sports played by the participants were athletics, swimming, cycling, rugby, soccer, and weightlifting (Figure 3.2). Amongst the male participants, 18 – 25 year old males were the majority that consumed supplements while 35 – 45 year old males formed the largest group that used PES. Amongst the female participants, 46 –

55 year old females were the majority that consumed supplements and also formed the largest group that used PES (Figure 3.3 and Figure 3.4). Our findings do fit in with the results of a study by Kirk et al (1998) which found that female supplement users tended to be in their forties and fifties and that age was associated with supplement use, with older subjects progressively more likely to use dietary supplements compared to the younger age group.[37]

It is evident in this study that middle-aged men use PES more commonly, and this is likely as a result of the natural decline in testosterone and other hormones with advancing age, and also because this population of men may still be competing with younger men. This notion is supported by the fact that most PES use was AAS. It is also noted in this study that men in the age group 18-25 used PES less than older men. This is similar to a finding by Cohen et al (2007), which found that AAS use was more common in middle-aged men as opposed to younger men between 18-25 years old.[38] This may be because there level of fitness was better than older men and they felt less of a need to use PES, or because they may have been professional athletes who were afraid of being caught doping. The influence of media and medical propaganda of the need for testosterone supplementation in middle-aged men is unknown.

The most common types of supplements used were multivitamins (38.32%), protein supplements (27,10%), fat burners (9,81%) and creatine (9%) (Figure 3.6). This is similar to a study by Hasan et al (2009), where the most common type of supplement used were vitamin supplements (48.2%).[36] Compared to a study by Eliason et al (1996), where in a study of dietary supplements in a family practice clinic, 82% of the supplements taken were vitamins and minerals, while 18% were other supplements for example herbal products, high dose vitamins, as well as protein and amino acid products.[15] In the study by Hasan et al (2009), the other most common types of supplements used differed from our results with herbal medicines (26.4%), ginseng (4.7%) and traditional Chinese medicine (4.0%) used most commonly after vitamin supplements (48.2%).[36]

More than half of the participants in our study consumed supplements before training, followed by those who used supplements after training. The study revealed that about a

third of participants used supplements on a daily basis and that USN was the most popular brand of supplement used. We can surmise that effective marketing may account for this.[39,40] The primary reason for supplement usage was to **meet nutritional needs** and to **increase energy levels** (Table 3). This relates to the study by Eliason et al (1996) where patients professed the most common benefits from supplements to be energy improvement and nutrition (29%), followed by prevention of cancer or immune enhancement (24%), and in treating musculoskeletal conditions.[15] In our study the primary reasons for the usage of performance enhancing substances were to **accelerate healing**, for **nutritional reasons** and to **improve sport performance** (Table 4). Most supplement users obtained information online, or through family or friends or from a personal trainer (Figure 3.8). Participants who reported using PES however, obtained information mostly from pharmacists or general practitioners or online (Figure 3.8). Less commonly, PES users received information from personal trainers and family or friends. This implies perhaps that PES users are looking for information from safer, reliable and professional sources, such as healthcare professionals rather than family or friends. Educating pharmacists and general practitioners about PES use may therefore help in reducing harmful use of these substances. In comparison, the internet was the main source of information (74%) in a study on PES use in adolescent athletes.[41] With the access to often unreliable and incorrect information on the internet available to the general public, especially the younger generation, this poses an additional challenge in preventing the use of PES.

In this study, it was noted that participants (50%) commonly used supplements and a large number (62%) indicated that their friends believed it was acceptable to use supplements, suggesting a societal acceptance of the use of supplements. In a study by Bojsen-Moller (2010), it was noted that recreational athletes displayed an extensive use of dietary supplements reflecting an open, relaxed and ambivalent attitude to supplements that has been observed in modern societies in general.[42]

It was noted in the study that 10% of participants who indicated that they did not use supplements, went on to select a type of supplement in the questionnaire. This suggests that 10% of the sample population did not understand the definition of a

supplement, and may not have requested clarification from the participating healthcare practice. This also indicates that increased awareness and education on supplements may be required.

The participants were asked to respond to fourteen statements rating their level of agreement or disagreement to each of the statements to assess their attitudes and perceptions towards supplements and PES. As illustrated in Fig 3.11, the majority of participants agreed or strongly agreed that a need for more education on supplements is required and that sports organisations should offer more education on the use of supplements in sports.

A very high number of participants (90%) believed that they anticipate more positive effects of supplements on their performance, hence the usage of supplements to enhance performance (Figure 3.9). This is very likely due to the strong and aggressive marketing by the supplements industry.[39,40] There is extensive use of nutritional supplements and thus physicians should certainly enquire about the use of supplements from their patients. Physicians should assist with dietary counseling for their patients as this could result in better-informed choices with respect to the use of nutritional supplements related to health, performance and recovery.[43]

As illustrated in Fig 3.10, **73%** of participants agreed or strongly agreed that it is unfair and wrong to use PES in a competitive environment. 66% of participants either agreed or strongly agreed that many of their friends believed it is acceptable to use PES. **Eighty percent of participants** responded that they felt there are too many athletes using PES to enhance their performance in their sport and to the need for more education on PES. Seventy percent of participants anticipated more positive effects on their performance with PES, and expected that they will achieve their goals quicker using PES than non-users. It is important that anti-doping organisations and policy makers facilitate dialogue with PES users, and should also reach out to pharmacists, general practitioners and personal trainers who as we have shown in this study, play an important role in disseminating information about PES. Commercial gyms should caution their members about the use of PES, and similar to the Danish anti-doping

effort, commercial gyms could be encouraged to sign up to a national anti-doping scheme.[42]

In our study, although we found a high number of participants to be using nutritional supplements, a very small number of participants admitted to the use of PES (n=13). A study on the prevalence of use of performance enhancing substances by Dutch fitness centre members, displayed an overall prevalence of 8.2%.[44] In a quantitative analysis of inquiries submitted to the Danish anti-doping authorities on the use of PES among recreational athletes, approximately 15% of the enquirers were users of PES and an additional 15% considered using such substances.[42] Although the cohort in the aforementioned study is not comparable to our study, it provides an indication of the prevalence of PES use in recreational athletes. In the population we have studied, the prevalence of PES use was 5% (n=13). This low number may be an accurate reflection, but may also be attributed to participants fear to disclose their use of PES despite assurances of anonymity. The use of PES could also have been low because participants did not feel informed enough to use them. Anonymous polling over the internet may assist future studies in better determining prevalence of PES use in a population.

The majority of participants (73%) reported to be against the use of PES and also felt that more education on PES (87%) is required (Figure 3.10).

In our study, protein supplements, creatine and fat burners were more popular than testosterone boosting supplements, however this would be reasonable as testosterone boosting supplements are used by men almost exclusively and our study included both male and female participants, hence the overall use of testosterone boosting supplements appeared lower than protein, creatine and fat burning supplements. Testosterone boosting supplements are used by males to naturally elevate their testosterone levels. In our study, all six respondents (3% of participants) who reported using testosterone boosting supplements were male. As testosterone boosting supplements are used primarily by men and as this study included both genders, this would explain the low percentage of use amongst total participants. Vitamin supplements and herbal substances may not be as harmless as the public perceives

them to be.[1,5,7,9,12,45] Ninety percent of testosterone boosting supplements claimed to increase testosterone hormone levels, however these claims were supported by data in only 24.8% of these supplements.[46] Herbal supplements that are intended to increase testosterone levels are poorly studied yet remain popular among aging men who seek to increase their testosterone levels without standard testosterone replacement therapy.[46] There is often the expectation that supplements will enhance testosterone more naturally, however this does not appear to be the case.[46] It is important that patients have a reasonable picture of what can be expected, as well as the risks of supplementation. As cited in a recent study in the World Journal of Men's Health by Clemesha et al (2019), on testosterone boosting supplements, this emphasizes the need for evidence-based patient education materials.[46] There is a need for further research and education around the subject of testosterone boosting supplementation and this may be addressed by involving and educating male sexual health practitioners, general practitioners and pharmacists by raising awareness on this subject potentially through continuing medical education (CME) events and research presentations.

As seen in Figure 3.10, only 13% of supplement users received information from their general practitioner, and also only 18% of PES users received information from their general practitioner. Findings from a study by Eliason et al (1996), on the use of dietary supplements by patients in a family practice clinic, supported the importance of physicians discussing nutritional supplements with their patients.[15] In their study, physicians were informed about the use of supplements by two thirds of patients, but only 23% of the physicians had in fact suggested the supplement to their patients.[15] Improved nutrition, the treatment of fatigue, and disease prevention appear to motivate the bulk of patients consuming supplements in their study.[15] As these motivations are all within the physicians sphere of influence, physicians should enquire about the use of dietary supplements.[15,45] They should also be informed enough to guide their patients.[15,45] A study by Ben-Arye et al (2017) found that doctor-patient communication concerning dietary and herbal supplement use to be poorer during hospitalization than in primary care settings, and recommended educating physicians about dietary and herbal supplements and improving doctor-patient communication.[47]

4.2 Limitations

A limitation of this study is that people who take nutritional supplements or PES may have completed the questionnaire with poor focus and concentration as they may have been attending a general practitioner or physiotherapist for a medical problem or injury and the questionnaire could have been distracting to them. Other limitations of this study are that due to our use of a self-administered questionnaire, respondents may not have been always truthful with their answers, and there may have been differences in the understanding and interpretation of the questions. This is observed in the discrepancy noted in the study that 10% of participants who indicated that they did not use supplements, went on to select a type of supplement in the questionnaire. Although questions of uncertainty with regard to the questionnaire were dealt with, absolute clarification could not be provided at all times. This study took place among male and female patients in Umhlanga, South Africa, which is one region reflecting one type of population, therefore the results of the study cannot be extrapolated across all populations. Designs for future studies should take these factors into consideration.

4.3 Conclusion

The results of this study signify a fairly extensive use of nutritional supplements and evidence of some use of PES amongst medical practice and physiotherapy patients in the Umhlanga area, with the main users both of supplements and PES to be older females, and the main users of supplements to be younger men whilst the main users of PES was middle-aged men. From our study it is evident that physicians and healthcare providers such as pharmacists, do not sufficiently engage their patients in conversation with reference to nutritional supplements and PES. Further research is needed regarding healthcare practitioners knowledge about supplements and PES. Sports organisations and stakeholders should offer more education on the use of supplements and PES in sports. By extension, additional research is needed in this field amongst people who are involved in gym training, weightlifting and specific sports. Sports clubs in particular, athletics, swimming, cycling, rugby, soccer, and weightlifting as well as gyms, personal trainers, and sporting organizations should be involved in helping with

education and awareness campaigns together with internet and social media awareness campaigns in relation to the use of supplements and PES.

4.4 Recommendations

Education on the use of supplements in sports may be achieved by supplement manufacturers, pharmacists, physiotherapists, dieticians, general practitioners as well as sporting federations, WADA, SAIDS, and other stakeholders, starting forums and discussions with the general public and recreational athletes about what supplements are about, how they may be safely used, as well as their risks and benefits. General practitioners may not be knowledgeable enough on the subject of supplements and PES, and further research regarding general practitioner knowledge about supplements and PES is recommended. Future studies should elaborate on the results of the present study and include any missing variables. Future studies could investigate the association relating to sport type and PES use.

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6. APPENDIX

Appendix A: Human Research Ethics Committee Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Nazeer Ncor Mahomed

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M180232

NAME: (Principal Investigator)	Nazeer Noor Mahomed
DEPARTMENT:	Centre for Exercise and Sport Medicine Umhlanga Med Family Practice Bodha and Virannha Physiotherapy Umhlanga Rehab Centre Sports Medicine Umhlanga
PROJECT TITLE:	The use of nutritional suplements and perfomance enhancing substances in patients in the Umhlanga area
DATE CONSIDERED:	23/02/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Demitri Constantinou
APPROVED BY:	Prof C Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	30/04/2018

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

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

16/05/2018
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix E: Map of Study Site