THE USE OF PERFORMANCE ENHANCING SUBSTANCES BY ADOLESCENT MALE ATHLETES IN SELECTED JOHANNESBURG BOYS' HIGH SCHOOLS

Philippe Jean-Luc Gradidge

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of MSc (Med) in the field of Biokinetics

Johannesburg, 2010

Declaration

I, Philippe Jean-Luc Gradidge, declare that this research report is my own work. It is being submitted for the degree of MSc (Med) in the field of Biokinetics at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

…….. (Signature of Candidate)

day of 2010.

Dedication

This work is dedicated to

Katherine, my love.

Publications from the research report

1. *Gradidge P, Coopoo Y, Constantinou D.* Attitudes and perceptions towards performance-enhancing substance use in Johannesburg boys high school sport. South African Journal of Sports Medicine. 2010; 22 (2):32-36

2. *Gradidge P, Coopoo Y, Constantinou D.* The use of performance enhancing substances by high school boys <http://web.wits.ac.za/NewsRoom/NewsItems/PerformanceEnhancingSubstances.htm>. University of the Witwatersrand, 2010

Conference presentations arising from the research report

1. Gradidge, P., Coopoo, Y. Constantinou, D. Title of oral presentation: "The Use of Performance Enhancing Substances by Adolescent Male Athletes in Selected Johannesburg Boys' High Schools." Medical Research Council Research Day, September 2009, Cape Town – Received 1st Prize in the Public Health Category.

2. Gradidge, P., Coopoo, Y. Constantinou, D. Title of oral presentation: "The Use of Performance Enhancing Substances by Adolescent Male Athletes in Selected Johannesburg Boys' High Schools." South African Sports Medicine Association 13th Biennial International Congress 21 - 23 October 2009, Durban.

3. Gradidge, P., Coopoo, Y. Constantinou, D. Title of poster presentation: "The Use of Performance Enhancing Substances by Adolescent Male Athletes in Selected Johannesburg Boys' High Schools." Wits 2nd Postgraduate Cross Faculty Symposium, 20 – 21 October 2009, University of Witwatersrand, Johannesburg.

4. Gradidge, P., Coopoo, Y. Constantinou, D. Title of oral presentation: "The Use of Performance Enhancing Substances by Adolescent Male Athletes in Selected Johannesburg Boys' High Schools." School of Therapeutic Sciences Research Day, 12th August 2009, University of Witwatersrand, Johannesburg.

5. Gradidge, P., Coopoo, Y. Constantinou, D. Title of poster presentation: "The Use of Performance Enhancing Substances by Adolescent Male Athletes in Selected Johannesburg Boys' High Schools." Public Health Association of South Africa Conference, 30th November to 2nd December 2009, International Convention Centre, Durban.

Abstract

Introduction: Performance enhancing substance (PES) use is a major concern currently facing adolescent sport. The youth have become more competitive in sport, with some using substances and supplements to improve their performance. Unfortunately, some of these adolescent athletes are using substances that are both harmful to their health and prohibited.

Aim of study: To establish the attitudes and perceptions towards and the use of PES, including prohibited substances and food supplements, by adolescent male athletes, in selected Johannesburg boys' high schools.

Method: The study design was a cross-sectional study using a self-administered questionnaire. Male adolescent high school learners involved in 1st and 2nd team competitive high school sport in seven Johannesburg boys' high schools were invited to volunteer to participate in the study. Questionnaires were completed under conditions similar to an examination, where participants were not allowed to communicate with each other. Demographic data was analysed using descriptive statistics.

Results: The sample size was 100. Results indicated that the prevalence of PES use amongst the participants was 30%. The use of prohibited substances was found, including growth hormone (5%), anabolic androgenic steroids (4%), and adrenaline (4%). Food supplement use was also found in this sample, including creatine (32%), protein (61%), carbohydrate (54%), caffeine (57%) and vitamin (61%) supplementation. Most of the participants (83%) that used PES started using them when they were over 15 years old. The majority of the participants (42%) played rugby as their main high school sport.

Conclusion: The findings indicate that there was generally a low prevalence of ergogenic substance use in Johannesburg boys' high school sport for performance enhancement. Substances such as anabolic androgenic steroids (4%) and growth hormone (5%) were found to be used by the learners. The anti-doping attitude of the learners may be improved by education programmes, which aim to decrease the prevalence of prohibited PES use in adolescent sport.

Acknowledgements

I would like to acknowledge the assistance of the following people:

- Prof. Yoga Coopoo and Prof. Demitri Constantinou for their supervision and assistance with questionnaire development, Department of Education permission and ethical clearance.
- Dr. Rosemary Crouch, Prof. Aimee Stewart and Prof. Susan van Zyl for their help at the writing retreats.
- Dr. Tobias Chirwa and Dr. Steve Olorunju for guidance in the analysis process.
- My family for their support.
- The Johannesburg boys' high schools that participated in the study as well as those that participated in the pilot study.
- The high school learners that volunteered to participate in the main study.

Contents

List of figures

Figure

List of tables

Definition of terms

Adolescent: A young person who has undergone puberty but who has not reached full maturity; a teenager. [1]

Athlete: An athlete was defined as an individual who participated in competitive high school 1st or 2nd sports teams regularly.

Doping: The use of a drug or blood product to improve athletic performance. [1]

Ergogenic aids: "Substances or procedures that are thought to improve physical work capacity or athletic performance." [2]

Ergolytic substances: These include substances that may impair an athlete's performance. [3]

Performance enhancing substance: "Any substance taken in non-pharmacologic doses specifically for the purposes of improving sports performance. A substance should be considered performance enhancing if it benefits sports performance by increasing strength, power, speed, or endurance (ergogenic) or by altering body weight or body composition. Furthermore, substances that improve performance by causing changes in behaviour, arousal level, and/or perception of pain should be considered performance enhancing." [4]

Performance: "Performance or fitness is determined by the individual's capacity for energy output (aerobic and anaerobic processes and oxygen transport), neuromuscular function (muscle strength, coordination and technique), joint mobility and psychological factors (example motivation and tactics)." [2]

Youth: The period between childhood and maturity. [1]

Abbreviations

1st: First

2nd: Second

µg – micrograms

AAP- The American Academy of Pediatrics

AAS- Anabolic androgenic steroid

AFSSA - Agence Française de Sécurité Sanitaire des Aliments [5]

AIDS: Acquired Immune Deficiency Syndrome

ATP- Adenosine triphosphate [6]

BC: Before Christ

CHO- carbohydrate

CNS – central nervous system

Code- World Anti-Doping Code [7]

HIV: Human Immuno-deficiency Virus

Hon: Honorary

IAAF- The International Association of Athletic Federations

IOC- International Olympic Committee

ml – millilitre

mg - milligram

NCAA - National Collegiate Athletic Association

NHL – National Hockey League

OTC – over-the-counter

PES- Performance enhancing substance

RDA- Recommended Dietary Allowance

RPE – rate of perceived exertion

SAIDS- The South African Institute for Drug-Free Sport

USA – United States of America

WADA- World Anti-Doping Agency [7-12]

CHAPTER 1: INTRODUCTION

Doping and prohibited performance enhancing substance (PES) use is possibly one of the main concerns facing sport these days. [13] Performance enhancing substance use may be a way of improving performance output, however, when banned substances are used for this purpose, it is considered unethical. [13] The Olympic Charter stated that involvement in sport is a practice that is a fundamental right for every human being and that people should engage in activity with a comprehension that the virtues of 'friendship, solidarity and fair play'. [14] However, according to Clisby (2005), [13] using drugs to enhance performance still remains common practice amongst athletes, even though there have been considerable efforts made by sports organisations and medical experts to try to eradicate the problem. Athletes are given rewards for their efforts at nearly all levels of competition, which may result in some of them ignoring the virtues of the Olympic Charter [14] to achieve success in sport. Not winning competitions or not coming in first place can be viewed as being unsuccessful in sport by some athletes. [14] Knowing this, adolescent athletes and their coaching staff can often risk and forfeit much to try to accomplish winning over competition and ensure that performance is at an optimal level at all times and at all costs.

The enhancement of performance in professional competitive sport has developed into a dilemma which includes medical, ethical and legal concerns for today's sportspeople and sports organisations. This is mainly due to the monetary rewards associated with winning competitions. Noakes (2006) [15] also believes that there is a multitude of evidence to suggest that the extensive use of banned substances has essentially created a warped view of elite athletes. This implies that the common use of banned PES has essentially distorted the perception of the more elite range of athletic performance. Furthermore, taking of prohibited PES has increasingly become common practice in adolescent sportspeople. [16]

The nature of youth sport today has changed significantly, being impacted by elite and professional sport so that the focal point is no longer on strictly playing for the sake of enjoyment or the encouraging the development of the virtues in the Olympic Charter, [14] but has on the contrary turned into a win-at-all-costs competitive mindset, transforming most youth sports programmes into no more than younger versions of adult programmes. [17] Just as the competitive nature of professional sports has led to athletes doing whatever they can to be placed ahead of competitors, sometimes placing their well-being at risk; it has also become evident in youth sports. [17] Many of the adolescent athletes who do not believe to be successful at a competitive level choose to take

forbidden PES, allowing them to improve their athletic performance, help with recovery from training and increase their physical appearance. [18] These substances are also taken to increase muscle mass, strength and stamina beyond their usual limits. However, using banned PES can cause serious harm to the health and well being of the adolescent. [13]

According to Powers & Howley (2004), [19] evidence shows that prohibited PES are being utilized by young athletes; some as young as 13 to 14 years of age, in order to improve their performances in sport. A report by The Mayo Clinic (2009) [18] on performance enhancing drugs and youth showed that adolescents tend to deny their mortality and take risks that adults would not normally regard as safe practice. This practice would place adolescents at a higher risk of taking banned substances to enhance performance than adults.

De Merode (1999), [20] chairman of the International Olympic Committee (IOC) Medical Commission at the time, argued that the use of PES in sport seems to have started ever since sport became an activity that people commonly became involved in. De Merode [20] also stated that "the transformation of sport from the reality our grandfathers knew, to today's high-level sport has unleashed a phenomenon that brings with it major financial implications that have somewhat obscured the traditional role of sport as a vehicle of the old ethical and moral values." He felt that the attractiveness of extraordinary riches has logically lured many athletes. [20] It seems as if some adolescents have adopted this path, possibly seeing illicit PES use as a way of showing superiority in the crowd.

In the early 1970's Van der Burgh (1975)[21] wrote that the dilemma of drug use in South had reached endemic levels. Van der Burgh's lament is still voiced in research, policy and service delivery circles today. Moreover, Coopoo and Jakoet (2000) [22], in a study investigating substance abuse and knowledge thereof, found that there has been an increased prevalence of prohibited substance use by South African athletes. For this reason, comprehensive and integrated research on the nature and extent of banned PES use in adolescent athletes is needed in South Africa.

There are currently three South African studies on the prevalence of prohibited PES use in adolescents published. [23-25] All these studies were done more than ten years ago. Thus, recent comprehensive research and knowledge on the nature and extent of prohibited PES use among young adolescent athletes is still lacking in South Africa.

1.1. Problem statement

Doping and banned PES use in high school sport is a dilemma that has not received much attention, and although research does exist in this area, current South African literature is still lacking, especially concerning adolescents. The study investigated the prevalence of doping and banned PES use in male adolescent athletes from Johannesburg boys' high schools.

1.2. Aim of study

To establish the attitudes and perceptions towards and the use of PES, including prohibited substances and food supplements, by adolescent male athletes, in selected Johannesburg boys' high schools.

1.3. Objectives

1. To determine to what extent male adolescent athletes were using PES and establish which of the common PES male adolescent athletes were using.
2. To establish the attitudes and perceptions adolescent male athletes had towards using PES.

CHAPTER 2: LITERATURE REVIEW

Many adolescents are involved in potentially dangerous behaviour, such as engaging in experimenting during a period of their lives where they are trying to deal with the tasks of adolescent development, which includes discovering sexual characteristics and identity, becoming free from family, gaining a sense of accomplishment and self esteem, and discovering a group of individuals they can identify with. [26] This review of the literature considers a historical overview of PES use and anti-doping initiatives. The ethical issues regarding PES use in sport were investigated to determine some of the moral concerns facing doping in sport. Selected nutritional ergogenic aids are discussed, as well as a discussion of selected banned PES used in sport. Adolescent use of PES in sport was reviewed to determine the prevalence of selected PES in sport. Finally, the literature regarding the attitudes and perceptions towards doping and PES use in sport are also discussed.

2.1. Historical overview of performance enhancing substance use

The idea of taking synthetically made or natural substances to enhance performance in competition has been in existence ever since ancient times. As early as the 3rd century BC, athletes were using PES to enhance their performance. [27] From having drinks of mixed comprised of various substances to ingesting naturally grown foodstuffs or products that contained the supposed secrets of eternal life, athletes have always had an unquestioning confidence in anything that grants them vigour, supremacy, intellect, good looks, wellbeing, and immortality. [28,29] Ancient Olympic athletes and Roman gladiators used mushrooms, plants and concoctions made of wine and herbs when they competed in Circus Maximus, which dated as far back as 776 BC. [29,30] Athletes were apparently able to compete beyond their normal capabilities through the stimulatory effects of a variety of plant species in speed and endurance competition. [30,31]

These rituals were not confined only to the ancient Greeks and Romans, because research shows that other ancient cultures around the world had similar rituals to allegedly enhance performance. [12,13] For example, the Australian aborigines chewed the pituri plant, the Norse warriors ate hallucinogenic mushrooms, Zulu warriors used an alcoholic beverage made of grape skins in order to enhance their prowess in battle, and many other ancient cultures around the world had similar traditions. [32]

The Zulu warriors called this alcoholic beverage ‘dop’, which is one possibility of where the word ‘doping’ stems from, however, there is also evidence that it may be derived from the Dutch word ‘doop’. [12,33] The term doping is generally used now to describe the use of prohibited substances to

improve performance by cheating. [13,34] According to Clisby (2005) [13], it was not until the 19th century that doping became commonplace.

In more recent times, the 19th century Industrial Revolution re-introduced sport as a form of recreation and physical activity. In 1886, the first reported PES-related mortality occurred when a Welsh cyclist, Arthur Linton, overdosed on the drug trimethyl. [13] A decade later, 1896 marked the beginning of the Summer Olympics, where PES use in sport had become common. [13] The problem of doping became more noticeable at the 1904 Olympic Games in St. Louis. [12] It was made public that the marathon runner, Thomas Hicks, was found to be receiving several doses of a drink made of a mixture of brandy and strychnine during the race. [12] He won a gold medal and kept it, albeit, he collapsed and it took many doctors to revive him and he then had to be rushed off to hospital. [12]

Subsequently, the early part of the 20th Century, saw the further development of PES using secret formulae. [30] The use of mixtures of strychnine, heroin, cocaine, and caffeine were routinely used [35], until in the 1920's, when heroin and cocaine could only be obtained by prescription. The 1930's saw the peak of strychnine use in sport and the introduction of amphetamines as the preferred stimulant for the athletic population.[30] During the 1930's, German Nazi doctors created anabolic steroids, which were designed with the aim of raising the aggression levels of their troops. [13,30] Following World War II, the athletic environment also started to use anabolic steroids to enhance performance.

During the 1950's, the Russians, using captured German doctors, developed new anabolic steroids with the purpose of conveying a political declaration through the success of Russia's athletes competing internationally. [30] The 1952 Summer Olympics, held in Helsinki, saw the debut of Russia's involvement in the Olympic competition. [36] It was alleged that the Soviet athletes used anabolic steroids during this competition. [13] These allegations were substantiated with evidence provided by a member of the Russian team physicians at the World Weight-lifting Championships two years later in Vienna. [13]

By the early 1960's, the abuse of PES in sport had become extensive, which is reflected in the number of athletic deaths from PES, based on such substances found in their systems. [37] The 1960's Olympics in Rome saw the death of Knud Jensen during a 100 kilometre cycling time trial. [38] The autopsy indicated amphetamine and nicotinyl nitrate in his blood. [38] Seven years later Tommy Simpson died during the Tour de France. [37] The autopsy showed traces of amphetamine, methyl

amphetamine and cognac in his blood. The investigators also discovered amphetamines in his cycling jersey pocket and in his suitcases. [37]

The fall of the Berlin Wall in 1989 saw the uncovering of a secret doping programme that had exposed Manfred Ewald, the long-serving East German sports chief, and his former medical director Dr Manfred Hoeppner. [39] The two had organized state-funded programmes, called State Plan 14.25 in the 1970s that doped athletes frequently without informing them. These well-documented doping programmes by the East German Sports Medical Service produced a harvest of gold medallists. These athletes, many of them adolescent females, subsequently experienced harsh health problems, which included early mortality. [40]

2.2 Selected Performance enhancing substances

The American Academy of Pediatrics (AAP) [4] defined PES as "any substance taken in non-pharmacologic doses specifically for the purposes of improving sports performance. A substance should be considered performance enhancing if it benefits sports performance by increasing strength, power, speed, or endurance (ergogenic) or by altering body weight or body composition. Furthermore, substances that improve performance by causing changes in behaviour, arousal level, and/or perception of pain should be considered performance enhancing". Studies that have investigated the prevalence of prohibited and legal PES use in adolescents are discussed.

2.2.1. Selected prohibited substances

2.2.1.1. Ephedrine /adrenaline

Ephedrine, also known as adrenaline, is a type of sympathomimetic that has been banned together with its derivatives for a long time by anti-doping authorities. [13] The structure of sympathomimetics are very similar to that of amphetamine, but little investigation has been done to conclude that these substances have performance enhancing characteristics, with the exclusion of the substance ephedrine. [41-43] An international study examining the use of ephedra, which is derived from ephedrine, found a low prevalence (2.3%) in adolescent athletes involved in strength-type sports at the high school level. [44] Likewise, Coopoo and Jackoet (2000) [22] found a similar low prevalence (2%) among elite senior South African athletes. On the contrary, an investigation done during routine drug testing for American collegiate athletes found a higher prevalence of ephedrine usage (13.3%) for performance enhancement. [45]

The use of therapeutic dosages of ephedrine has not conclusively been shown to improve performance, although the use of dosages higher than the therapeutic level can show enhancements

in performance. [13] Research has demonstrated that when ephedrine is used in combination with caffeine, endurance activity duration may be increased as well as showing improvements in anaerobic performance. [46-48] Further possible benefits include increased energy, increased level of aggression, increased fat loss, and improved reaction time. [49,50] The safety of ephedrine use in sport has always been a concern as several harmful effects have been shown including arrhythmias, myocardial infarctions, stroke, unexpected death, seizures, in addition to adolescent athletes developing a dependency on it. [51-53] These adverse effects seem dangerous to health and well-being and therefore adolescent athletes should avoid using this substance for performance enhancement. Ephedrine use in sport is banned when the urine concentration is more than 10 µg/ml. [10]

2.2.1.2. Anabolic androgenic steroids

Anabolic androgenic steroids (AAS) are synthetically produced compounds that are derivatives of the hormone testosterone, and which are also structurally linked to it. [13] Athletes from a broad selection of sport, especially explosive sports such as shot put, javelin, power lifting and bodybuilding, have used AAS to improve their performance. [13] Although the use of AAS is reportedly higher with professional athletes, the prevalence of its use among adolescents and leisure athletes is high. [13] Clisby (2005) [13] attributes the high incidence due to an aspiration to achieve better results in sport or to dissatisfaction with body image. Current international literature [54-62] shows a prevalence of AAS use for sport from 0.7% up to 12%. The South African study on AAS use in adolescents found a prevalence of 6.37%. [24]

A position stand issued by the American College of Sports Medicine (2006) [63] has established that muscle strength gains and increases in aerobic power attained by engaging in training at a higher intensity and good nutrition could be enhanced by using AAS in some athletes. The use of AAS has a masculinisation effect in both athletic and non-athletic users, which encompasses an increased total body weight, increased muscle mass, decreased fat mass, and increased muscle strength. [64-66] An increased number of muscle fibres, as well as the development of existing muscle fibres, produce these modifications in body composition. [67] However, since AAS use has effects on many systems in the body, a multitude of adverse effects can be found.

The long term use of AAS may result in liver problems such as intra-hepatic cholestasis, reflected by jaundice, and also hepatic peliosis. [13,68] The use of AAS has been shown to result in negative lipid profiles, specifically related to decreased levels of high density lipoprotein (HDL) cholesterol and increased levels of low density lipoproteins (LDL) cholesterol, which are potential risk factors for the development of coronary artery disease. [13,69-71] Evidence has indicated that high blood pressure may

be apparent in some athletes as a result of water and sodium retention after doping with AAS. [72] There are also potential risks of obtaining infections from using non-sterile needles, sharing infected needles, and using AAS products that were illegally prepared in contaminated conditions. [73] One of the potential life threatening viral infections that abusers of AAS can acquire from using needles is HIV, which may progress to AIDS. [73] Several changes to the skin may also develop as a consequence of AAS use including acne, chronic facial erythema (rosacea), closed cysts on the surface of the skin (sebaceous cysts), greasy skin and hair, inflammation of one or more hair follicles (folliculitis), recurring boils (furunculosis) and an increase in body and facial hair. [13,73]

Some of the other concerning adverse effects of AAS use include the potential to influence the athlete's psychosocial behaviour, for instance becoming irritable, changes in mood, alterations in sexual desire, increased potential for psychotic behaviour and an increase in aggression. [13] Reliance is common and athletes who decide to stop using AAS can have withdrawal symptoms, such as mental depression, tiredness, and low sex drive, sleeplessness and body dysmorphic disorders such as anorexia nervosa. [13] In males, the use of AAS results in a decrease in the size of the testes of approximately 20% and sperm production is reduced or ceases. [13,74] Usual side effects affecting the more sexually mature males can include gynaecomastia (which is a result of the alteration of some AAS into oestriadol), breast pain, continuous erections (priapism), and an increased rate of urination urge. [13,75] Side effects specifically affecting adolescent males include acne, increasing penis size, inexplicable blackening of the eyes and increasing rate of erection. [75]

In females, menstrual abnormality is common with AAS use if the dosage is enough to inhibit the secretion of gonadotrophin. [13,74,75] Other common symptoms resulting from the hormonal imbalance can produce breast shrinkage, distorted libido, hirsuitism, deepening of the voice, clitoromegally and male pattern balding. [13,74] AAS use also results in muscles and veins being clearly prominent. [74] As a result of these and many other adverse effects, the use of AAS in sport has been prohibited since 1976. [12] Anabolic androgenic steroid use seems to be common worldwide despite the fact that it has been proven to be harmful to health and well-being.

2.2.1.3. Growth hormone

Human maturity and growth is strongly influenced by human growth hormone (hGH), one of the body's chief hormones involved in development and growth. [74] The anterior pituarity gland synthesizes and secretes the hormone hGH in a pulsatile manner during the day. [13] The liver metabolizes hGH with the half-life of the plasma being approximately twelve to forty five minutes. [74] This hormone has successfully been produced synthetically for therapeutic purposes in the treatment of growth disorders such as dwarfism during childhood. [13]

The attractiveness of synthetic growth hormone as a PES to improve muscle strength and muscle mass is as a result of the assumed action of the hormone to increase the production of protein and enhance lipolysis. [76] Also, there is evidence that suggests a decrease in fat mass. [77,78] Athletes intending to use growth hormone as a performance enhancer can take a dosage of twenty times the therapeutic level. [79] South African studies have tended to focus on investigating the use of growth hormone as a therapeutic agent rather than for performance enhancement. [80] Albeit, Calfee et al. (2006) [81], in an international study, found that 3.5 to 5% of high school and college athletes used growth hormone in conjunction with AAS regularly for performance enhancement. The use of growth hormone can result in many harmful side effects.

Exceeding the recommended dose of growth hormone can result in acromegaly in adults and adolescents and cause gigantism in the child. [74,79,82] The effects of long term growth hormone use is not well-known, however, the side effects of endogenous hGH over-secretion are clear and well established. [81,82] Individuals with acromegaly experience symptoms such as weakness, shortness of breath, myopathy, and a decreased tolerance for exercise. [81-83] Some of the main side effects include changes in skeletal structure, enlargement of the fingers and toes, lengthening of the jaw and orbits. [74,81] Interestingly, the method of removing hGH through cadaver-attained pituarity gland extraction (for non-therapeutic purposes) is still commonplace on the black market and the risks of infectious disease transmission, such as Jacob-Creutzfeldt disease, Hepatitis and HIV, is high due to a strong possibility of the hGH being attained from unhygienic cadaver sources. [84] The sale of growth hormone through illegal channels does not guarantee the athlete a pure product, thus further increasing the risk of infectious disease transmission. [84]

2.2.1.4. Insulin

The pancreas produces the hormone insulin which helps to regulate the concentration of glucose in the body. [13] The nature of insulin is anabolic, thus causing the growth of cells, speeding the conversion of glucose into glycogen, and increasing the production of protein. [6,13] It slows down the output of glucose from the liver, thus enhancing the storage of liver glycogen. [85] Lipogenesis, or the synthesis of fatty acids, is increased and protein catabolism is inhibited. [6,13,85] Therapeutic insulin is mainly used to treat Type 1 diabetes mellitus, however, it is also abused in some sports because of its anabolic nature in increasing protein synthesis. [13] Green (2004) [86] argued that insulin used for PES possibly has a greater influence on the body through its ability to deter "lipolysis, glycolysis, gluconeogenesis, proteolysis, and ketogenesis." Nevertheless, because of the negative effects insulin used for PES has on body composition and increasing fat mass, its use can decrease performance, particularly with explosive sports like sprinting. [13,85] Furthermore, a major risk of

insulin use in sport is hypoglycaemia, which if unrecognized, may lead to lasting neurological damage or even result in mortality. [13] Thus, it appears that the use of insulin as PES has more of an ergolytic effect than an ergogenic one and an incidence of insulin use for performance enhancement was not found in South African studies.

2.2.2. Nutritional ergogenic aids

A vital part of an athlete's training programme is nutrition, and a well balanced diet with the recommended amount of calories may likely provide the needed nutrients. [87,88] It is possible, nevertheless, that for a variety of reasons, athletes may not be able to have a diet that fully meets the required dietary needs and therefore may choose dietary supplements with the purpose of enhancing performance and avoiding any deficiencies. [88] Even though several people utilize supplements, individuals participating in sport and exercise represent a considerable part of the people buying nutritional supplements. [88] Athletes may opt to use a dietary supplement for various reasons, including the prevention or treatment of an identified nutrient deficit, to aid in providing a more practical solution to meeting nutritional RDA, to help in providing an ergogenic effect, and as consequence of a belief that all the best athletes are using them. [89] Many of these nutritional supplements may unfortunately be contaminated with banned PES. [89-94] Athletes may be innocently and ignorantly purchasing contaminated nutritional products over the internet [90], which could be harmful to them and potentially place them at risk of testing positive for a doping violation. [92]

2.2.2.1. Caffeine

The majority of people around the world consume caffeine, which can be found in soft drinks, chocolate, tea, coffee and a variety of medicines for treating migraines and other conditions. [13] Athletes take caffeine mainly for its effects on the central nervous system (CNS), which includes enhanced attentiveness, reflexes, and concentration. [95] Besides having these characteristics, caffeine can enhance the utilization and mobilization of fatty acids, which produces a muscle glycogen sparing effect which may prolong the onset of fatigue in endurance events. [95] Caffeine has been removed from WADA's prohibited list of banned substances in 2004, but has been included in the 2009 Monitoring programme. [10] This programme is inclusive of substances that are not banned in sport, and that WADA screens with the intention of detecting models of abuse in sport. [11] Caffeine is usually combined with other stimulants such as ephedrine to produce enhancing effects. [96]

A meta-analysis of 21 studies with 109 effect sizes showed that rate of perceived exertion (RPE) was decreased by 5.6% and that performance during exercise improved by 11.2% when caffeine supplementation was compared with a placebo. [97] However, regression analysis also showed that

this RPE related to about 29% of the reported inconsistency in performance improvement, and the results showed that caffeine decreased RPE for the duration of exercise which partially gives more clarity to the enhancement in performance when using caffeine supplementation. [97] The Canadian study investigating use of doping in non-elite adolescent athletes found a prevalence of 40% caffeine use. [57] A study investigating the use of drugs in sport at tertiary South African institutions in 2004 found a 67% prevalence of caffeine use by athletes. [98] The author however strongly suspected that the athletes had assumed that they were being asked about coffee intake rather than use of caffeine products for performance enhancement. [98] In another South African publication, Meltzer et al. (2004) [99] published a set of guidelines on the use of nutritional supplements for sport enhancement. The authors noted that although caffeine had been removed from the prohibited list, athletes still need to familiarise themselves with caffeine-containing products to ensure that the side effects of using it are minimised. [99]

The adverse effects of high doses of acute caffeine ingestion are well known, including hypokalemia, increased blood glucose levels, tachycardia, and decreased irritability tolerance levels. [100] A case study of overdose in a male adolescent who consumed 6 – 8 grams of caffeine found the usual signs of acute caffeine ingestion, but more serious adverse effects including respiratory alkalosis and angina were also noted. [100] Consequently, supplementation with caffeine seems to provide athletes with a perceived enhancement of performance, however, doses higher than the upper limit of 300mg per day [101] are not recommended in adolescent athletes.

2.2.2.2. Creatine supplementation

Researchers at Harvard University showed that consuming creatine can vastly increase the content of stored creatine in the muscle tissue. [102] Creatine is an amine substance that is mainly found in small quantities in the skeletal muscle tissue. [13] It is produced primarily in the kidneys and liver, and is taken up actively by the body's muscle cells. It is believed that about 95% of the creatine in the human body is stored in muscle tissue, with a third presenting as free creatine and two-thirds presenting as phosphocreatine. [103] The remaining 5% of the creatine found in the human body is stored in other parts of the body including the brain, heart and other tissue. [104] Kreider et al. (1998) [105] and Hultman et al. (1996) [106] showed that supplementation with creatine increases the skeletal muscle total creatine levels by as much as thirty percent and that of phosphocreatine by about twenty percent. This phenomenon was later confirmed and there is now universal consensus of the effects of creatine supplementation. [107-109]

Adenosine triphosphate (ATP), a substance which is the key energy exchange compound, is involved in transferring the energy necessary for metabolism. [6] It is chiefly supplied by the breakdown of glucose during cellular respiration. [6] During high intensity exercise such as power lifting, shot put, high jump, and other activities, phosphocreatine becomes the preferred source of ATP replenishment after normal ATP stores become exhausted after five to ten seconds of intense effort. But phosphocreatine is exhausted after a further five to 15 seconds of high intensity training. [76,104,110] Hence, much of the research investigating the effectiveness of creatine supplementation in sport has shown statistically significant improvements in high intensity training activities, but have shown small or contradictory benefits in aerobic activity such as long distance cycling or canoeing. [76,111,112]

Some of the adverse effects of creatine supplementation include suppressed endogenous creatine synthesis , altered renal function, elevated muscle and liver enzymes, electrolyte status and blood volume, gastro-intestinal distress, muscle cramping and muscle injury/strains. [2] The usefulness of creatine supplementation in treating conditions of the muscular system, and neuromuscular system is documented, [113] however, the Agence Française de Sécurité Sanitaire des Aliments (AFSSA) is an example of an institution that has banned creatine as an enhancer of performance in France. [5] In spite of this, creatine use in sport has not been banned by World Anti-Doping Agency (WADA) and its use continues to remain accepted in other countries. Creatine supplementation has been shown to increase adults athletes' base strength, however, there have not been any studies confirming this evidence in individuals who are younger than 18 years old. [114,115] Also, there is no evidence of the safety of creatine use in minors. [116]

A study done in 2001 investigated the knowledge and prevalence of creatine use in adolescent athletes at high schools found that there was a high prevalence of creatine supplementation (75%).[117] The participants of this study suggested that more information and advice on the proper use of creatine supplementation could be given (26% reported adverse effects). [117] In relation to another study investigating the prevalence, regularity and model of creatine use among male and female high school athletes, a total of 8.2% of the participants indicated creatine use. [118] These participants also expressed a belief that the product enhanced their performance; nevertheless, they felt that more research needed to be done regarding creatine use in adolescent sport. [118] Research done by Harris (2005) [2] in South Africa found that the prevalence of creatine use was 46% in participants that played first team high school rugby, and 1% indicated AAS use. Eighty-eight percent of the sample played rugby at level of 1st team and the majority (73%) were 17 and 18 years old. [2]

2.2.2.3. Protein supplementation

Protein supplements are often taken by athletes, especially where the accelerated increase in muscle mass for apparent sport enhancement is an important factor. [119] In moderation, protein supplementation can be an important part of athletes' balanced diet. The functions of protein in adolescence are to sustain, restore and build body and muscle tissue; to act as hormones, enzymes, immunoproteins, and transport structural proteins. [120] Proteins are therefore an essential part of a well balanced diet, however, Mottram [119] comments that there was not any sound investigational proof to substantiate the theory that supplementing with protein improved metabolism or resulted in muscle mass increases. Further, Lambert et al. (1993) [121] showed that commercial oral amino acid supplementation failed to increase the concentration of serum growth hormone levels in male body builders. The suggested protein requirements for adolescents are about 0.9 grams of protein per kilogram of body mass per day; however, the typical adolescent generally has approximately 1.3 grams of protein per kilogram of body mass per day. [122] Further, protein needs for adolescent athletes have not specifically been investigated, but adolescent athletes might require slightly more protein than adult athletes. [122] Excess use of protein supplementation can lead to dehydration. [119] This is as a result of an excess amount of urea being produced with associated water loss, thus increasing the risk of muscle cramp, renal damage and harm to thermoregulation. [119] The use of protein supplementation in sport may benefit some athletes and fall under the food supplement category, hence does not appear on WADA's restricted list of substances.

2.2.2.4. Carbohydrate supplementation

The most resourceful fuel for adolescents is carbohydrates, which have been recognized as important for muscle activity during physical activity since 1901. [123] Petrie et al. (2004) [124] found that the average intake of carbohydrate (CHO) in adolescents was 300 grams per day, whereas adolescent athletes ingested more carbohydrates (500 grams per day on average). The potential benefits of carbohydrates include the ability to release energy more than three times quicker than fuel from fat. [125] Also, they can be utilized as an instant source of energy through the conversion of the carbohydrate source into glucose in the blood stream. [123,125] Yet, the amount of carbohydrates that can be stored as muscle and liver glycogen is limited and these stores must be replenished to allow the athlete energy for endurance activity. [123,125] The higher the intensity and duration of exercise, the greater the reliance on CHO as a fuel source for energy production.

The amount of carbohydrates used during activity depends on the intensity and duration of training. [126] Even though investigations have shown that endogenous CHO has a sparing effect in physically active adolescent males during long distance cycling, the significance of this outcome remains

unclear. [127] A number of investigations have shown that even though adolescent athletes indicated beneficial effects after using a CHO replenishment drink post exercise, there were no major effects shown on their performance. [128] There is a lack of evidence existing concerning adverse effects CHO supplementation in adolescent athletes under 18 years old. [4] The full understanding of the effects of CHO supplementation on the physiology of adolescents during development is not well-known. [81] However, there is a place for CHO drinks to serve as a source of energy during endurance type activity where athletes may perform in hot climates for long periods, such as long distance running races in the peak of South Africa's summer. [129,130] In addition, Noakes (2004) in his book, Lore of Running, commented on the science of carbohydrate-loading. [130] This method of increasing CHO storage by consuming large amounts of CHO rich foods approximately three days prior to endurance events, permits the athlete to perform with higher levels of energy during competition, and thus increase time to fatigue. [130] Adolescent athletes using the method of CHO loading for endurance type activity should take note of the loading procedure to avoid gastrointestinal problems during competition. [130]

2.2.2.5. *Vitamin supplementation*

Other nutritional substances such as vitamin and mineral supplements have also been shown to be commonly used in adolescent athletes. More research is required in order to quantify its effects on sport performance. The role of vitamins in the body is to act as regulators during metabolism, which may influence several of the physiological courses of action necessary to sport performance or physical activity. [131-134] For instance, a number of the B-complex vitamins play a role in carbohydrate and fats processing for the production of energy, which is essential when involved in physical activity of different intensities. [131-134] In addition, a variety of B vitamins are important in the formation of haemoglobin, which is a key determinant of oxygen consumption throughout endurance training. [131-134] Moreover, oxidative injury to the cell and sub-cellular structure is prevented by vitamins C and E, which act as antioxidants and therefore may help to optimize performance during training. [131-134]

On the whole, research done by health professionals believe that it is not important for people following a balanced diet to use vitamin supplements, albeit, they might possibly advocate them for some populations, for example the aged, vegetarians, and females of childbearing age. [135,136] A number of health professionals have noted that the majority of individuals do not use a favorable quantity of vitamins in their diet, and thus show that it is necessary for all individuals to consume vitamin supplements. [135,136] Also, excess quantities of many vitamin supplements can lead to severe problems with health and upper limits of tolerance have been instituted for several vitamins. [137] For instance, excess quantities of niacin can result in damage to the liver. [137] There has not been enough

research in adolescent use of vitamins; however, the safe and careful use of vitamin supplementation can help avoid a diet that is suboptimal and aid during periods of heavy exercise training. [137] Therefore, vitamin supplementation could be advocated to reduce the effects of fatigue in those involved in regular, strenuous training.

2.3. Ethical issues concerning performance enhancing substance use in sport

The American Academy of Paediatrics (AAP) issued a document in April 2005, on PES use in sport. [4] The document inquired about many statements concerning the supposed anti-doping fight and how it may be successful. The document argued that the youth need to be taken into account for a more restrictive moral and ethical anti-doping structure to be effective. The policy statement recognized that the adolescent group naturally felt indestructible and regularly disregarded any implication that PES use may create a health risk or hamper their suitability for sport. [4] Also, adolescents are extremely anxious about their self image. [4] The AAP directs health care providers to encourage health and not performance. However, Clisby (2005) [13] argues that there are contradictory opinions as to whether health care providers should be drawn into the observation of PES use by athletes. On the one hand, numerous authorities believe that health care providers would take the opportunity to promote PES use in adolescents. [13] On the other hand, several other authorities believe that health care providers have an obligation to observe their clients, thus avoiding any health risk to the athlete [13]. The AAP document showed that anti-doping policies and agencies need to reassess their priorities, and place the more likely and actual danger of prohibited PES use to minors at the forefront. [4]

The ethical and moral dilemma of doping and prohibited PES use in sport has arguably surfaced because of a number of reasons. Some of these include media pressure to win, prevalent attitudes that doping is necessary to be successful, public expectations about national competitiveness, financial rewards for winning, desire to be the best in the world and to become famous. [13,95] Other reasons include performance-linked payments to athletes from governments and/or sponsors, coaching which emphasises winning as the only goal, and unethical practices condoned by national and international sports federations. [13,95] Furthermore, the competitive characteristics of athletes, the unreliability of medical professions to improve performances, and psychological beliefs in aids to performance are also some of the reasons for the dilemma of doping and restricted PES use in sport. [13,95]

The motives for using PES in sport may be different, but combinations of the above reasons exist in most of the athletes taking prohibited PES. [13] Banned PES use in sport may possibly be seen as an easy alternative for hard training programmes by some adolescents because it would place them at an advanced level from the rest of the competitors. However, it is through hard work and perseverance in sport that "the virtues of dedication, perseverance, endurance and self-discipline" [138] help develop the character of adolescents. This outlook on success in sport has been voiced by Lance Armstrong, who commented in his book, "Every second counts", on the value of hard training and a positive mindset, ultimately placing oneself at the forefront in competition. [139] Kalusha (2010) [140], president of the Zamibian football association, observed that PES use was not part of his life as a soccer player. He stressed that discipline and fair play on and off the soccer pitch become part of the professional soccer players' life and those athletes be taught and persuaded to make the right decisions. [140]

2.4. Anti-doping initiatives

The International Association of Athletics Federations (IAAF) banned the use of doping substances in sport and became the first international sporting body to do so in 1928. [12] Many other sporting bodies followed the IAAF's example, however limitations to doping use continued to be fruitless because no drug tests were carried out. The use of prohibited PES seemed to be common practice amongst athletes within the global sporting community before the introduction of doping testing programmes in the late 1960s.

The deaths of many high profile athletes in the 1960's [12,37,38], led the International Olympic Committee (IOC) to create The IOC Medical Commission in 1967, which prohibited the use of doping to enhance performance. [13] The IOC implemented anti-doping measures and first initiated drug testing at the Olympic Winter Games in Grenoble and at the Mexico Summer Olympic Games in 1968. [12,13] Globally, sporting bodies maintained anti-doping programmes all through the latter part of the 1960's and early 1970's. [49] However, technology was inadequate and inaccurate and suspected athletes were not disciplined because of this inconsistency. [49]

It was not until the Munich Olympics Games in 1972 that the IOC successfully commenced full-blown drug testing using advanced techniques such as mass spectrometry and radioimmunoassay. [13] An important breakthrough in drug testing occurred in 1974 when the IOC introduced a reliable test method, which led to anabolic steroids being banned in 1976. [12] This resulted in many athletes being

banned after testing positive for steroid use, mainly in sports which rely on strength, such as the power lifting and shot put events. [12]

In the 1980's, the drug testing techniques were significantly refined and the IOC introduced gas chromatography and mass spectrometry, which allowed for more reliable and precise results. [141] This more advanced technology resulted in numerous athletes being disqualified at the 1983 Pan American Games in Caracas. [13,141,142] Many of these athletes tested positive for banned PES and many others withdrew without competing, which is believed to have been an attempt to evade facing the drug testing programme. [49]

In 1999, the IOC prepared a World Conference on "Doping in Sport" in reaction to an appalling finding of a substantial quantity of PES and doping-related equipment by the French police at the 1998 Tour de France, also aptly named the "Tour of Doping." [143] At this conference, the World Anti-Doping Agency (WADA), was established with its task to work separately from the IOC, leading the struggle against banned PES in sport. [12,95] WADA's objectives are twofold: Firstly, to defend the athlete's basic right to participate in sport that does not involve doping, and therefore encourage healthiness, integrity and fairness for all athletes globally, and secondly, to guarantee harmonized, corresponding and efficient anti-doping programmes both internationally and nationally with consideration of exposure, prevention and avoidance of prohibited PES use in sport. [144] Apart from WADA's testing programme, the organisation is also strongly involved in the dissemination of information and education regarding doping in sport. [144]

2.5. South African anti-doping initiatives

In South Africa, The South African Institute for Drug-Free Sport (SAIDS), a statutory body funded by The Department of Sport and Recreation South Africa [145], is responsible for carrying out a drug testing and education programme and also works with international agencies to aid the fight against drugs in sport. This public body, which was established by an Act of the South African Parliament, Act No. 14 of 1997 (amended 2008), has the constitutional authority to carry out countrywide drug testing programmes on athletes, with or without any notice, in- and out-of-competition. [145] [145] The South African Institute for Drug-Free Sport as a WADA signatory is required to be code compliant within WADA and other organisations (such as the Supreme Council of Sport and United Nations Educational, Scientific and Cultural Organisation) as a National Anti Doping Agency in South Africa. [145]

The aims of the entity consider the need "to promote participation in sport, free from the use of prohibited substances or methods intended to artificially enhance performance, thereby rendering impermissible doping practices which are contrary to the principles of fair play and medical ethics, in the interest of the health and well-being of sportspersons; and to provide for matters connected therewith." [145] These objectives are clear in intending to encourage sport participation that is free from the taking of prohibited substances, including prohibited doping methods. SAIDS publishes an annual list of drugs as issued by WADA that are based on the South African brand names.

2.6. Attitudes and perceptions towards performance enhancing substance use

Prohibited PES use in sport seems to be the chief source of distress facing sport in modern times. [13,146] According to Clisby (2005) [13], the use of drugs to improve performance is common among athletes, despite strong efforts to hamper its increase in sport by sports organizations. The Olympic Charter's virtues [14] have yet to become a reality in sport today as doping goes against this creed and its influence on sport has continued to grow ever since early civilization has had a curiosity with chemically enhancing performance in competition. Self-reported surveys propose that professional and elite athletes usually have negative attitudes regarding use of PES in sport, and hold to the attitude that doping tests should remain in sport. [146] In fact, most of these elite athletes indicate that additional educational initiatives would be welcomed by them so that they are more informed of the issues facing doping. [146]

Literature and the sporting bodies worldwide proposes that the attitudes and perceptions of athletes are to blame for the abnormal behaviour of taking banned PES to enhance performance. [147,148] For example, research by Schwerin and Corcoran (1992) [149] shows that users of AAS were rated negative when compared to non-users with regards to intellect, gladness, self-confidence, relaxation, social boldness and holistic optimistic effects. Anabolic-androgenic steroid users were shown to be less rule-orientated, reliable, sincere, and have less self-control than non-users. [150]

Despite the dominant view that prohibited PES use is essentially against the core reason for sport participation, [151] its use in sport has become common practice, with some individuals, including some scientists, expressing a liberal attitude to its use, disputing that it should be used for the efficiency of outcome. [152,153] For example, Melia et al. (1996) [154] showed that 74% of general Canadian high school students (11 to 18 years old) were of the opinion that doping in sport was dishonest, which is in keeping with the finding that 94% of French high school athletes (mean age of 16) from a range of sports, reported that using drugs in sport is dishonest. [155]

Doping has been shown to be a tool to achieve a target and not the ultimate target itself. [156,157] For example, one athlete may want to achieve a place on the 'A' team, while another may want to gain monetary rewards from winning. Therefore, if doping is a way of achieving goals, then doping behaviour should include attitudes towards this end goal and attitudes towards doping as a means to achieve these goals. An attitude that is in favour of doping could perhaps be changed through educational strategies aimed at behaviour change.

A review into drug misuse in sport showed that there is a need for good quality education on use of prohibited PES in sport. [158] Public and recreational sports need to be targeted as well as elite competitive sport in the fight against doping. [159] A continuum between public and elite sports exists, where public sports may perhaps develop into an environment where elite athletes are examples to adolescent and amateur athletes competing at the public level. [159] Anti-doping organisations addressing the doping dilemma should be consistent and regular in disseminating information and developing education strategies to allow for successful reduction in the incidence of doping and banned PES in adolescent sport. [160] An anti-doping programme would benefit from including an integrated team of key players, such as coaches, parents and health professionals, to address doping in adolescent sport. [141] Lucas Radebe, former national South African soccer player and Leeds United captain, emphasised the importance of education to deter the use of doping in sport. [161]

It appears that educational strategies need to be applicable and relevant to adolescent athletes, and perhaps should be introduced early on to try increase anti-doping attitude and positive behaviour. Singh (2010) [162] reflected this sentiment by acknowledging that the adolescents were at risk and argued that anti-doping projects should focus on educating the youth and mentoring athletes. These anti-doping strategies may be successful in discouraging the use of prohibited PES in youth sport.

2.7. Adolescent use of performance enhancing substance use in sport

Nutritional supplements can be an important part of an adolescent athlete's dietary needs. The careful use of vitamin supplementation by adolescent athletes may aid in achieving a well balanced diet during times of heavy training. Vitamin and mineral supplement use have been shown to be approximately 20-25% in the general adolescent population in the USA. [163] However, five international studies examining the prevalence of dietary supplement use in young high school athletes found a prevalence of vitamin supplement use ranging from 41% to 61%. [164-168] In moderation, supplementation with protein appears to also form an essential part of adolescent

athletes' balanced diet. A prevalence of 12% protein supplement use was indicated in collegiate female athletes who used nutritional supplements no less than once a month to improve their performances. [169] In contrast to this study, an investigation found a higher prevalence of protein supplement use (35%) in adolescents athletes in grades 10, 11, and 12. [170] Nutritional supplements such as protein, carbohydrates and vitamins can aid in accomplishing proper nutrition, however, adolescent athletes using them must ensure that excess ingestion of any one of these is avoided to keep within recommended dietary allowance for their age group. Although nutritional supplements may aid in offering ergogenic enhancement to adolescent athletes, the substances that are prohibited in sport can sometimes propose quicker means of attaining enhancement.

This was shown in an investigation done in Quebec, Canada, which tried to establish if doping also occurred at the non-elite adolescent athlete level. [57] The results of the study showed that multiple substances and supplements were used by the adolescent athletes for performance enhancement, including growth hormone (1.2%), AAS (1%), beta blockers (1.3%), amphetamines (1%), pseudoephedrine – Sudafed (6.4%), erythropoietin (0.8%), caffeine (40%), vitamin supplements (26.6%). [57] The majority of the participants reported using foods that contained caffeine in addition to using nutritional supplements and some seemed to increase caffeine supplementation during times of competition. [57] A number of the participants (6.4%) indicated taking Sudafed containing pseudoephedrine just before a National Hockey League (NHL) game to enhance performance. [57] Compared with Schaefer et al. (2006) [44] found the prevalence of ephedra use, which is a derivative of ephedrine, to be slightly lower (2.3%) in adolescent involved in football, weightlifting and track and field high school sports. [44] In relation to this finding, Coopoo and Jakoet (2000) [22] also showed a prevalence (2%) of ephedrine in their study that investigated the prevalence of doping in elite South African adult athletes. In contrast, a higher prevalence of ephedrine usage of 13.3% was found in elite USA collegiate athletes at a routine doping test. [45]

Similarly, Kayton et al. (2002) examined the use of ergogenic aids and nutritional supplements in male and female competitive adolescent athletes. [171] The survey found that 26% of the females and 12% of the males indicated using ephedrine-containing products. [171] This study showed that the use of ephedrine, which is banned by WADA, [10] is prevalent both locally and abroad, and that banned substances are being used by adolescent athletes. However, an investigation done in South Africa showed that some nutritional supplements contain traces of banned substances such as ephedrine. [91] Van Der Merwe and Grobbelaar (2004) [91] investigated unintentional doping by testing nutritional supplements that were sold in Bloemfontein, South Africa. Traces of banned substances, such as

ephedrine (1.5 to 7.3 mg/capsule), were found in a number of these supplements (33.3%). The researchers showed that banned substances could possibly be found in nutritional supplements and recommended that athletes be more aware of this. [91]

International research investigating contamination of nutritional supplements showed similar outcomes. [92,93,172] A study by Geyer et al. (2004) [93] showed that there was a presence of AAS in approximately 15% of the 634 tested nutritional products available commercially. Similarly, Watson et al. (2009) [92] found a urinary concentration of 19-norandrosterone, which exceeded WADA's limit of 2ng.mL^{-1}, after ingesting 19-norandrostenedione supplement. The researchers concluded that the ingestion of this dietary supplement seems to result in temporarily raising the levels of the urinary metabolites 19-norandrosterone and 19-noretiocholanolone in excess of 2ng.mL^{-1} in some people. [92] This would seem an adequate amount for a positive doping violation. [92] The exact reason for the presence of banned substances in nutritional supplements is not known. [92] However, Maughan (2005) [94] argued in an investigation regarding the contamination of nutritional supplements that it could be done deliberately to increase the effectiveness of a commercial product. This theory seems plausible. However, the use of prohibited substances in dietary supplements to achieve commercial success seems immoral and should not be allowed. Dvorak (2010) [173] argued that athletes should rather focus on attaining a well balance diet rather than relying on commercial supplements that could be contaminated. Interestingly, there was also a prevalence of banned substance use for recreational purposes found in South African studies. [174-176]

Research done by Madu and Matla (2003) [174] showed that the prevalence of banned substance use for recreational purposes by adolescents was 19.8% in Pietersburg, Limpopo, South Africa. The mean age of initial drug use was 14.9 years, and the learners indicated use of these illicit drugs at social parties, and when fatigued. [174] A similar survey done among high schools in the rural KwaZulu-Natal region found that grade 10 learners used a variety recreational substances on a regular basis. [175] The finding of the study showed interesting results amongst the male learners. [175] Fifty-three percent indicated alcohol use, 17% indicated use of cannabis, 7% indicated use of cocaine, and 13% reported smoking above one cigarette a day. [175] In relation to this study, an investigation done by Rottcher (2005) [176] found that the use of street drugs was prevalent amongst adolescents in grades 10, 11 and 12. The study showed that 39% smoked dagga (marijuana), 3% indicated use of ecstacy, and 7% indicated use of prescription drugs. [176] Furthermore, the study found that 3% of the male adolescents were using drugs regularly. [176]

A survey conducted in 1999 by The Sports Information and Science Agency together with the South African Institute for Drug-Free Sport demonstrated that athletes in South Africa felt that doping drug use was on the rise in sport and that there needed to be more doping tests carried out. [177] The problem of drug use seems to have reached adolescents both on and off the play ground. Virtues such as fair play and integrity may partly be able to address the problem of substance abuse both in and out of the sporting arena; however, studies have shown that there evidence of doping with AAS in adolescent athletes. [54,58-60]

Faigenbaum et al. (1998) [54] found that 2.7% of the entire amount of USA high school learners utilize AAS. Other investigations by authorities in anti-doping research indicated that in the USA, AAS use in male adolescents was 3 to 12% and AAS use in female adolescents was 1 to 2%. [60] Research conducted in Sweden using a sample of 5,827 learners, aged between 16 and 17, demonstrated that 3.6% of adolescent 16 year old males and 2.8% of adolescent 17 year old males use AAS. [62] This investigation displayed that these adolescents additionally abuse alcohol and prohibited substances more often than adolescents of a matching age group who do not take AAS. [62] Research done in Thuringia, Germany, found that 15.1% of adolescent athlete participants indicated that they had used a substance that was on WADA's list of prohibited substances. [55] These banned substances included AAS (0.7%), growth hormone (0.4%), stimulants (2.4%), cannabis (13.2%), diuretics (0.1%), cocaine/heroin (2.2%) and erythropoietin (0.3%). [55] Moreover, the results showed that the average knowledge regarding doping (60%) and the participants anti-doping attitude were poor, however were not significant unless the learners ages were taken into account. [55] The researchers concluded that an improvement of specific doping knowledge was needed and their anti-doping attitude needed to be changed. [55] Banned substances such as AAS appear to be prevalent internationally despite many potential side effects and physiological harm; however, the use of AAS use in adolescent sport has also been established in South Africa. [23,24]

A South African study done by Schwellnus et al. (1992) [23] on AAS use in matric pupils in the Western Cape region found that the prevalence of AAS use amongst male adolescent sport participants was 12.5/1000. Notably, this was the first study done recording the prevalence of the use of AAS in adolescent South African high school learners. [23] However, the study displayed a weakness by not including all high schools in the Western Cape area. Thus, the low prevalence of AAS found could only be applied to white high schools in the Cape Peninsula area and not to the entire South African adolescent population. [23] In relation to this study, Lambert et al. (1998) [24] investigated the prevalence of AAS use in adolescents in two regions, Western Cape and Gauteng provinces, of South

Africa. These two investigations were of vital importance to this study because they were the only similar studies done in South Africa, nearly ten years ago.

2.8. Summary

The above literature supports the view that the nature of adolescent sport has changed considerably in recent times. Professional sport has motivated and inspired adolescent sport to the position where it is no longer based purely on enjoyment, but has become a win-at-all-costs competitive environment, [17] thus changing adolescent sport programmes into smaller versions of competitive adult sport programmes in which doping has become an instrument to attain the ultimate end of winning at all costs [156,157].

CHAPTER THREE: RESEARCH METHODOLOGY

In this chapter the means in which the survey was done will be explained. It consists of the study design, study population, the measuring instrument, and the procedure of the survey, ethical considerations and lastly the way in which data were analyzed.

3.1. Study design

The study utilised a cross-sectional, descriptive study design with a self-administered questionnaire.

3.2. Study population

Sample size was determined to be 117, with the inflation factor increasing the sample size to 123.

3.2.1. Source of participants

The sample for the study included high school learners from the monastic public and private Johannesburg boys' high schools. All seven of these high schools were invited to participate in the study, and five of the headmasters granted permission to carry out the study. The Department of Education (appendix 6) gave permission to conduct the study.

3.2.2. Sample selection

A sample of participants was derived from male adolescent high school learners, aged between 15 and 18 years, involved in 1st and 2nd team high school sport from the monastic Johannesburg boys' high schools.

3.2.2.1. Sample size

The sample size was determined by considering the study by Lambert et al. (1998). [24] The prevalence of anabolic androgenic steroids (AAS) use among male adolescents matriculants involved in first team sport was 63.7/1000 in Johannesburg, whilst the prevalence of AAS use in the total sample was 140/1000 [24]. With an assumption that the prevalence of AAS use ranges from 64/1000 to 140/1000 (0.64% to 0.14%) [24] in the Johannesburg schools and with 80 percent power and 95% confidence, a sample size of 117 participants was determined. To allow for non-response, an inflation factor was used to compute the new sample size of 123 participants.

3.2.2.2. Inclusion criteria

- Male adolescent high school athletes from the full squad of the first and second sports teams.
- Learners ≤18 and older than 15 years of age.

3.2.2.3. Exclusion criteria

- Female
- Male adolescent high school athletes who were not willing to volunteer to participate in the study.
- Male adolescent high school learners who were not involved in sport.
- Not involved 1st and 2nd high school sports teams

3.3. Measuring instrument

3.3.1. The questionnaire

The study was carried out using a self administered questionnaire that was developed as the data collection tool (appendix 5). The questionnaire was based on two studies. The first study investigated substance abuse and knowledge thereof among elite South African athletes, which included questions on PES awareness, usage, attitudes, and patterns of PES use. [22] The other study investigated the knowledge and perceptions of elite South African athletes on doping and doping control from 1998 to 2002. [178] The questionnaire was formulated to elicit responses on PES and nutritional supplements used in order to improve performance. Further, participants' attitudes and perceptions about PES were solicited. The questionnaire underwent validity and reliability testing before being used as described in sections 3.3.2 and 3.3.3. The questionnaire was comprised of the following sections:

3.3.1.1. Section 1: Background information

In this section, information regarding the participants' demographic information was collected. Questions 1.1 to 1.5 inquired about participants' age, ethnic group, and their main school sport.

3.3.1.2. Section 2: General information

This section obtained information with regards to the general attitudes of the participants towards doping in sport. Information was also gathered about the sources of information on doping in sport.

3.3.1.3. Section 3: Use of performance enhancing substances

These questions solicited responses from participants regarding the usage of PES.

3.3.1.4. Section 4: Use of nutritional supplements

Section 4 questioned what nutritional supplements the participants were using regularly.

3.3.1.5. Section 5: Attitudes towards doping in sport

Section 5 determined what the participants' attitudes were towards doping.

3.3.1.6. Section 6: Suggestions to help address problem of doping

Those participants who believed that the use of PES in sport is a problem were required to suggest some ways to help solve the problem.

3.3.2. Validity and reliability

The content validity was established by consulting various professionals involved in the field of exercise science and sports medicine, including physiotherapists, university lecturers, personal trainers, sports medicine doctors, and private biokineticists. The suggestions expressed by the experts who reviewed the questionnaire were taken into account and the questionnaire was changed based on their input. The criteria used to classify these professionals as an expert included that they had to be qualified and working in the field of exercise science and sports medicine for four years or more, and had to have a relevant postgraduate qualification.

The reliability of the questionnaire was established by using the internal consistency method to ascertain reliability. A total of 10 male adolescent athletes from a randomly selected Johannesburg high school not involved in the study, were asked to volunteer to complete the questionnaire. [179,180] The questionnaires were administered a second time seven days after the initial administration to the same group of participants. It was decided to let seven days go by in order to reduce the influence and effect of memory by the time the questionnaire was completed the second time. The Cronbach's α statistical test was used to assess the reliability of the questionnaire. The scale reliability coefficient was determined to be 0.83 using the test scale of mean (standardized items). The average inter-item correlation was 0.2 with 20 items on the scale. Therefore, the questionnaire had a reliability value (83%) that was acceptable to use in the study. One that the Cronbach's α statistical test did not equal 1 was because multiple items were used in the analysis. This was done by averaging out measurement error by combining individual item scores to obtain a total score. Furthermore, it is very unlikely that a single item could have represented the questionnaire.

Therefore, the results of the Cronbach's α statistical test (0.83) show that measurement error would probably not have affected the outcome of the results in this study.

3.4. Procedure

Permission to conduct this study was obtained from the Department of Education (appendix 6). Consent was received from high schools that volunteered to participate in the study. Arrangements were made to conduct the study on a date and time that was convenient for the high schools that gave consent to participate.

3.4.1. Pilot Study

3.4.1.1. Objectives of the pilot study

A pilot study was carried out to:

1. Test the data collection procedure.
2. Examine the grammar and wording of the questionnaire.
3. Establish the reliability of the questionnaire.
4. Ascertain the length of time it took to complete the questionnaire.

3.4.1.2. Methodology of the pilot study

The reliability of the questionnaire was established by using the Crobach's alpha statistical method to ascertain the internal consistency of the research tool. A randomly selected Johannesburg high school, with a similar group of learners, was randomly selected to be involved in the study. The school's headmaster gave permission to carry out the study in the school. Ten male adolescent athletes from the high school were invited to volunteer to be involved in the study. [179,180] Verbal explanation was given on the significance of the study, what to anticipate from being involved, and information confidentiality. Furthermore, minor assent was given to participate in the study by these high school learners together with consent from their parents/guardians. The ten high school learners were asked to complete the questionnaire. The questionnaires were collected immediately after completion. The questionnaires were completed by the same group of participants seven days after the initial administration. [2,181] The questionnaires were coded by giving each completed questionnaire an unique numerical value on each occasion, thus ensuring that the author could not link individual results to a respondent. Also, the data was group analysed, further ensuring that confidentiality of the participants was not breeched.

3.4.1.3. Results of the pilot study

The participants that took part in the pilot study stated that the informed consent and minor assent forms were sufficient and well understood. The participants did not have any queries regarding the informed consent and minor assent forms. The data collection process was successful. The participants did not have a problem with comprehension of the grammar and the wording of the questionnaire. It took approximately ten minutes to explain the informed consent and minor assent forms. The participants took between fifteen and thirty minutes to complete the questionnaire. The reliability of the questionnaire was determined by using mean as the test scale. The questionnaire was established to be reliable (83%) based on results of the Cronbach's α statistical test (see 3.3.2. Validity and reliability).

3.4.2. Main study – data collection

Five out of the seven Johannesburg Boys' High Schools gave consent. One hundred participants in total volunteered to participate in the study. The response rate was therefore 81%. Each high school headmaster was contacted by telephone initially to gain permission, and then an email was sent to them with the study information and permission letter attached (appendix 4). A meeting was setup with the headmaster to discuss the study. This included talking about the aims and objectives, parent/guardian information sheet and consent (appendix 2), questionnaire (appendix 5), and minor assent form (appendix 3). It was conveyed to the headmasters that the normal school curriculum would not be disrupted in any way. The headmasters that gave consent to carry out the study in their high school highlighted a relevant contact person in order to liaise with. A convenient date and time was arranged to discuss the study with the potential participants. The purposes, aims and objectives of the study were discussed with the potential participants, ensuring them of their confidentiality. The potential participants were invited to volunteer to participate in the study.

To increase participation, the learners were reminded that all responses would remain anonymous and that the collected data would be group analyzed and not individually analyzed. Those participants that agreed to volunteer were then given parent/guardian information sheet and consent forms together with the minor assent forms (appendix 3). Only the learners that signed their assent forms as well as having consent from their parents/guardians were allowed to take part in the study. The minors' assent forms and parent/guardian information sheets and consent forms were collected by the previously highlighted contact person at each high school. A convenient date and time was arranged to administer the questionnaire. The participants were instructed on how to complete the questionnaire, and were assured that the information would remain confidential.

The questionnaire was completed under conditions where participants were not allowed to communicate with each other, thus ensuring the questionnaires were answered honestly. The participants were also given the opportunity to ask questions pertaining to its completion throughout. Questionnaires were handed in to the researcher immediately after completion. The collected information was then group analysed.

3.5. Ethical considerations

Ethical clearance was applied for and granted by the University of the Witwatersrand Human Research Ethics Committee (M060953) prior to commencement of the study (appendix 1). Permission was given by The Department of Education (appendix 6). The headmaster of each consenting high school gave permission to conduct the study (appendix 4). The participants were asked to volunteer to participate in the study. The parents/guardians of each child gave consent, allowing their child/ren to volunteer to participate in the study (appendix 2). Those who did volunteer to participate signed a minor assent form after their parents had given signed consent (appendix 3). To ensure confidentiality of the identity of the participants, numerical codes were used instead of names on all questionnaires. The participants that volunteered to participate were free to withdraw from the study at any time. The collected data was kept in a room that only the researcher had access to. The completed questionnaires were collected by the researcher immediately afterwards to ensure confidentiality. The collected information was group analysed collectively and not individually.

3.6. Data analysis

The Epi Info (TM) 3.5.1 and Statistica 9.0 statistical software packages were used in the analysis of the data from this study. Data were entered on an excel spreadsheet. Open-ended questions were clustered into themes of response. Categorical parameters were displayed in tables and figures using frequencies and percentages. The demographic variables like age, grade and the ethnic groups were displayed in a table using means and standard deviations. Categorical variables (rugby and other high school sport PES use) were compared using the Pearson's Chi Square test. The Fischer exact test was used to analyse these variables (rugby and other high school sport PES use) if cell frequencies were less than 5. The level of significance was set at the level of $p<0.05$.

CHAPTER FOUR: RESULTS

In this chapter, the results of the study are presented and commented on. The responses from the participants were coded and missing values were not included in the analysis because it was not possible to determine what the participants would have answered in cases where there was missing data. Some of the participants did not answer all questions and in most cases, multiple responses were given to certain questions where more than one option could be chosen. These multiple responses were taken into account when analysing the data, therefore in certain tables, the sum of the percentages do not add up to 100%.

4.1 Study population

One hundred out of an expected sample size of 123 invited participants volunteered to participate in the study, which gave a response rate of 81%. The rest of the potential participants had not given assent or their parents / guardians declined to sign the informed consent. Five out of the 7 high schools gave permission to conduct the study.

4.2 Demographic characteristics of the sample

Most of the participants (78%) were 17 to 18 years old, and these ages reflect the normal distribution of ages for the grades mentioned (Table 4.0). Sixty-seven percent of the participants were in Grade 11 which accounted for most of the high school sports participants. This result reflects the general distribution of 1st and 2nd sports teams at most Johannesburg boys' high schools.

Forty-two (42%) of the participants played rugby as their main high school sport, which shows that rugby is possibly the main sport played in these schools (Figure 4.0). Forty one percent of the participants indicated participation in common high school sports, including hockey (15%), athletics (4%), swimming (5%), water polo (6%), soccer (6%) and cricket (5%). One percent (1) of the participants did not respond to this section of the questionnaire.

Table 4.0 Participant characteristics (n=100)

Demographic characteristics	Mean±SD
Age: • **15 to 16 years (22%)** • **17 to 18 years (78%)**	16.95± 0.66
Grade: • **10 (11%)** • **11 (67%)** • **12 (22%)**	11.11± 0.57
Ethnic Group: • **White (85%)** • **Black (15%)**	White

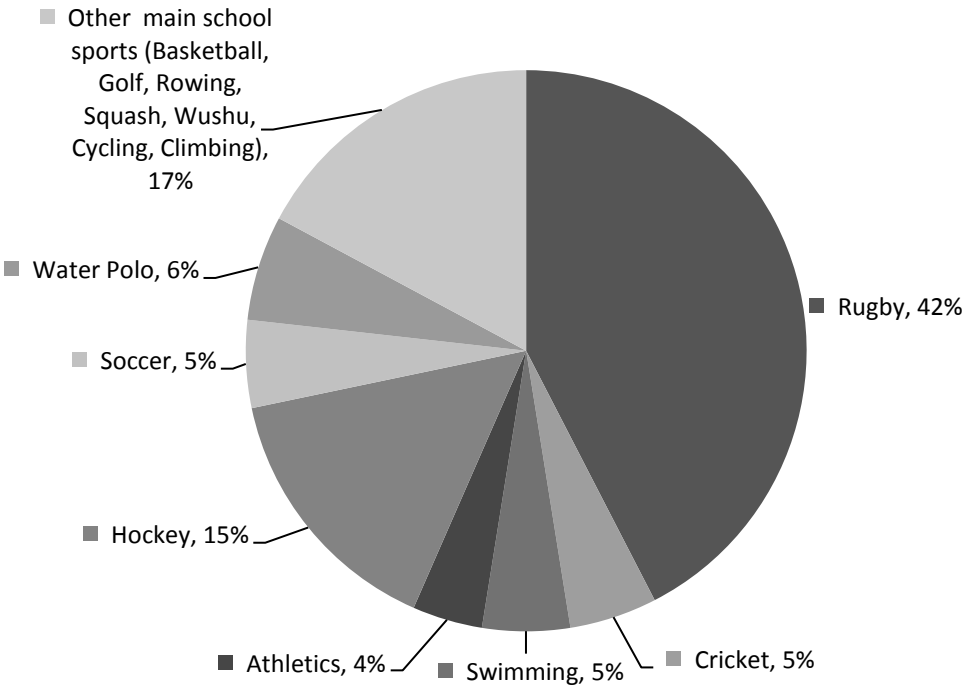

Figure 4.0 Distribution of main high school sport participation (n=99)

4.2 Sources of information on performance enhancing substance use

Table 4.1 displays where the learners obtained their information on PES for their usage. Multiple responses were given for this section, thus, the data was calculated by taking into account the number of individual responses per question.

The highest ranking source of information on PES usage was the internet (74%), followed by magazines (72%), from a friend (66%), the coaching staff (66%), and parents (40%). The internet was the main source of information (74%) on PES use in sport, possibly because the high schools in the study have access to this resource and its use as a means of finding out information is encouraged. Some of the other mentioned sources of information on PES use in sport were from personal trainers (33%), information brochures (31%), newspapers (31%), the pharmacist (24%), and 23% indicated that they attained information from the television and their school.

Table 4.1 Sources of information used by high school learners on PES use (n=100)

	Yes (%)	No (%)
Media, paper and electronic sources		
Magazines (n=88)	72	28
The internet (n=93)	74	26
Books (n=83)	16	84
Journals (n=80)	9	91
Television and School (n=65)	23	77
Information Brochures (n=80)	31	69
Newspapers (n=82)	29	71
Professional sources		
Biokineticist (n=87)	16	84
Coach (n=94)	40	60
Personal trainer (n=89)	33	67
Physician (n=87)	10	90
Pharmacist (n=89)	24	76
Other sources		
Sibling (n=85)	19	81
Parent (n=89)	33	67
Friend (n=96)	66	34

4.3 Patterns of performance enhancing substance use

Thirty (30%) of the participants indicated that they were using PES regularly, and 64 (64%) indicating that they did not use PES (Figure 4.1). Those participants that had indicated PES use in the last 12 months answered the remainder of the questions pertaining to PES use. The majority (83%) stated that they had started taking PES when they were over 15 years old (Figure 4.2). Figure 4.3 displays the awareness of the participants' coaches to their use of PES. The participants were questioned on whether their coaches were aware of their PES use. Thirty-seven percent of the participants indicated that their coaches were aware, which although low, may be suggestive of unethical behaviour.

The participants were questioned what their reasons were for using PES (Figure 4.4). Most of the participants (68%) reported that they felt it helps to improve their performance in sport. Other common reasons included assisting in coping with the stresses of sport (29 %), feeling afraid of being dropped from the team (21%), and having a better chance of making the team (28%). Ten percent (3) of these participants answered 'yes' to more than one question in figure 4.4. The types of PES used regularly were also considered (Table 4.2).

Four of the 30 participants (15%), indicated that they were using AAS, 19% indicated that they were using growth hormone, 8% indicated that they were using insulin as a performance enhancer, 15% indicated that they were using adrenaline /ephedrine to enhance performance. Two of the participants (6.75%) answered 'yes' to more than one substance in table 4.2. The responses of the substance caffeine (n=28) and other commercial products for PES (n=25) are reported under the section on nutritional substances used for enhancement.

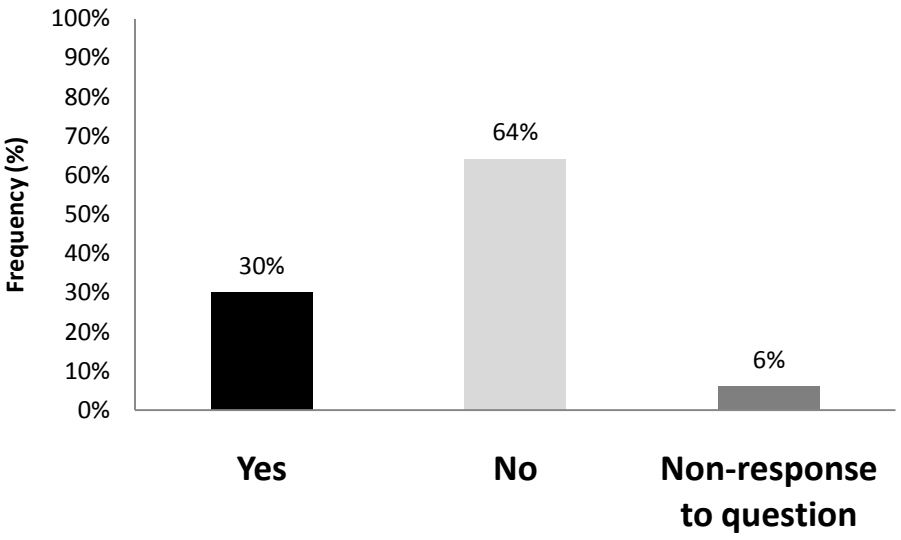

Figure 4.1 Prevalence of PES use (n=100)

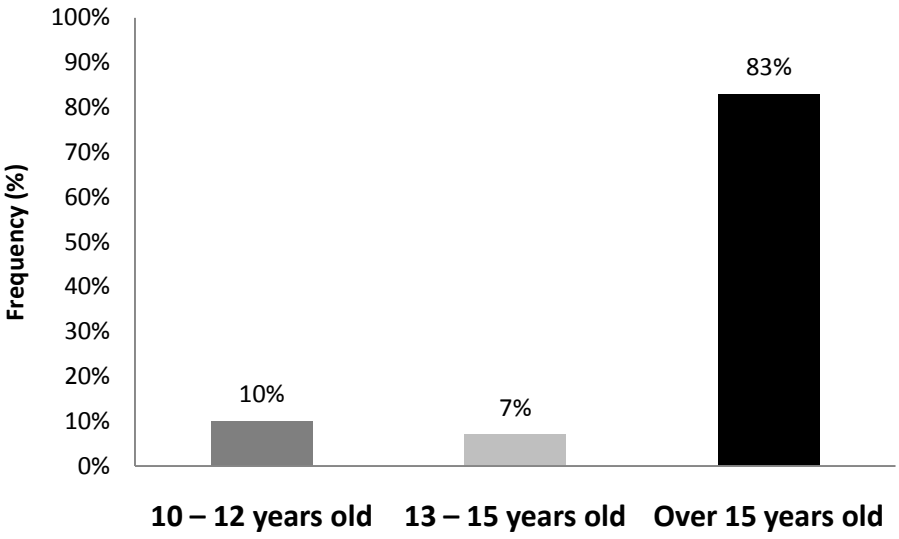

Figure 4.2 Age when PES use started (n=30)

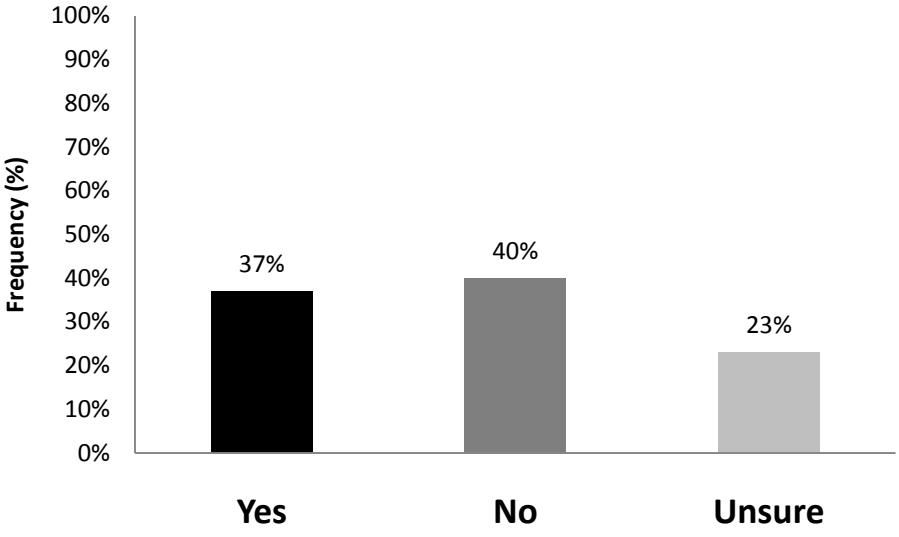

Figure 4.3 Awareness of coaches towards participants' use of PES (n=30)

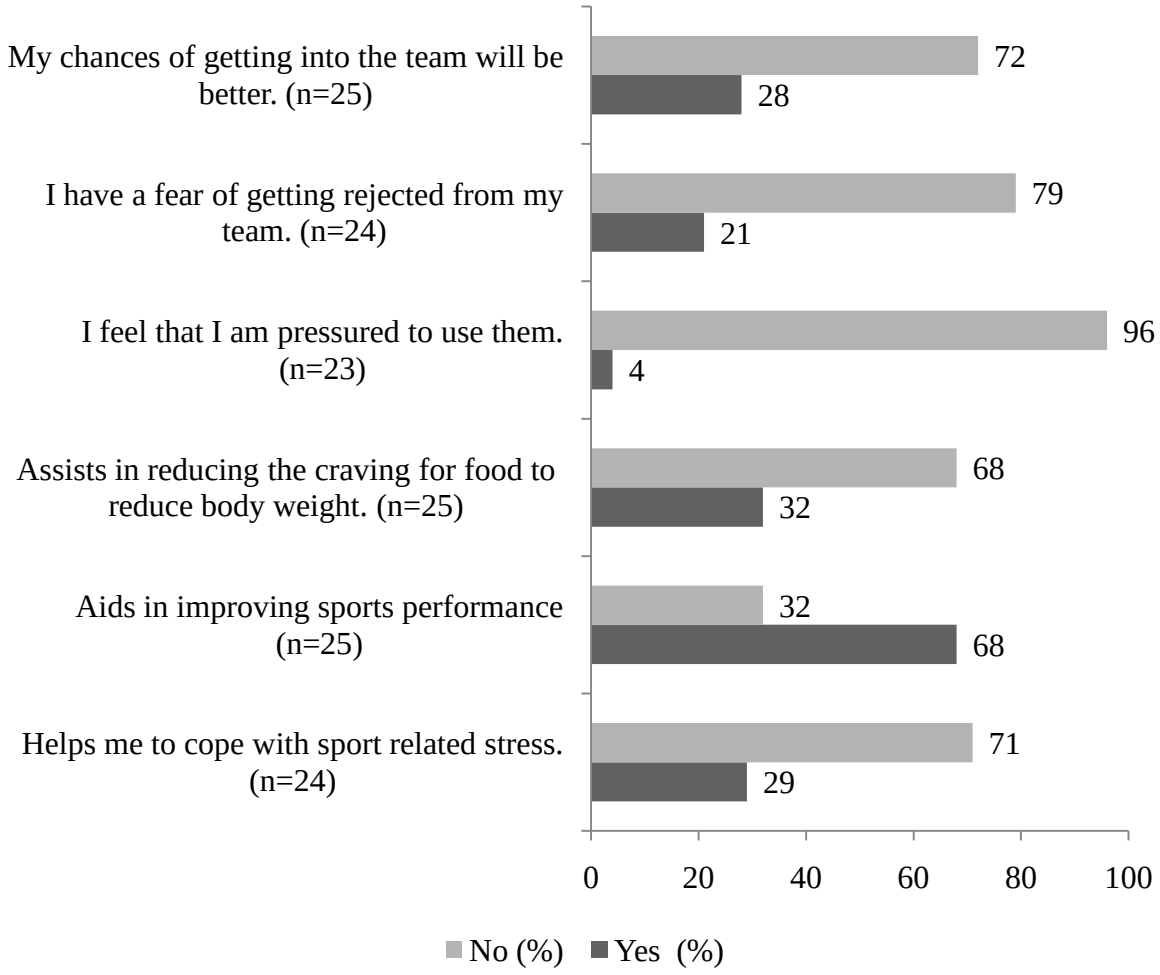

Figure 4.4 Reasons for using performance enhancing substances (n=30)

Table 4.2 Common prohibited PES used regularly (n=30)

	Yes (%)	No (%)
Anabolic-androgenic steroids (AAS) (n=26)	15	85
growth hormone (n=26)	19	81
Insulin (e.g. Apidra, Lantus) (n=25)	8	92
Adrenaline / Ephedrine (n=26)	15	85

4.4 Patterns of participants that do not use performance enhancing substances

The patterns of participants that do not use PES are presented in Table 4.3. Only those participants that did not use PES answered this question. There were multiple options available for the participants to fill in, and the results were thus analysed per statement. The section on 'other' was not reported as there was not any response for this from the participants. One participant answered 'yes' to more than one question in table 4.3.The majority of the participants that do not use PES (56%) reported that they were afraid of what it may do to their health.

Table 4.3 Main reasons for not using PES (n=64)

	Yes (%)	No (%)
I don't think it is necessary to take them (n=69)	70	30
I am afraid of what it may do to my health (n=64)	56	44
It goes against what I believe (n=63)	32	68
They're difficult to come by (n=61)	8	92
I am worried about what would happen if I got caught (n=61)	28	72
It is not allowed at my school (n=59)	29	71
I cannot afford it (n=62)	26	74
I am concerned about getting addicted to them (n=58)	15.5	84.5
I am afraid of becoming unable to compete (n=60)	25	75

4.5 Patterns of legal nutritional supplement use

Vitamins, protein and creatine supplements were common food supplements used by the participants, 61%, 61% and 32% respectively (Table 4.4). Sixty percent of the participants indicated that they used carbohydrate supplements for energy. Furthermore, 57% (16) indicated that they were using caffeine products, such as 'Redbull'. Although caffeine is found in coffee, a product commonly consumed by people worldwide, these participants indicated using it as a performance enhancer. One participant answered 'yes' to more than one substance in table 4.4. The majority of the participants (57%) indicated use of caffeine products, which are comparatively cheaper than the other common substances found in the study. These nutritional supplements used are legal and are easily available in pharmacies and most nutritional supplement outlets.

Table 4.4 Legal nutritional supplements used for performance enhancement (n=100)

	Yes (%)	No (%)
Caffeine supplementation (n=28)	57	43
Creatine supplementation (n=84)	32	68
Carbohydrates supplementation (n=90)	54	46
Protein supplementation (n=88)	61	39
Vitamin supplementation (n=88)	61	39
Other commercial products (Gakic, ripped hardcore and strong energys) used for PES (n=25)	14	11

4.6 Comparison of performance enhancing substance used by rugby and other high school sports

Table 4.5 and 4.6 show the comparison of PES use by rugby players and those involved in other high school sport.

In comparing the rugby athletes with those that were involved in other high school sports, there was statistical significance found between the two groups in terms of creatine, carbohydrate, and protein supplement usage ($p<0.05$). Thus, the rugby athletes were more likely to use these supplements for performance enhancement than those involved in other high school sports. The other PES substances used did not show statistically significant results between the two groups.

Table 4.5 Comparison of prohibited PES used by rugby versus other high school sports (n=30)

Prohibited substances (total number of responses)	Rugby Frequency (Percentage of 'Yes' responses to question)	Other high school sports Frequency (Percentage of 'Yes' responses to question)	P-value
Anabolic androgenic steroids (n=26)	2 (18%)	2 (13%)	p=1.00
Growth hormone (n=26)	3 (27%)	2 (13%)	p=0.62
Adrenaline (n=26)	3 (27%)	1 (6.67%)	p=0.28
Insulin (n=25)	1 (10%)	1 (6.67%)	p=1.00

Table 4.6 Comparison of legal nutritional PES used by rugby versus other high school sports (n=100)

Legal substances (total number of responses)	Rugby Frequency (Percentage of 'Yes' responses to question)	Other high school sports Frequency (Percentage of 'Yes' responses to question)	P-value
Creatine supplements (n=84)	19 (54%)	8 (16%)	p<0.001
Protein supplements (n=88)	24 (67%)	23 (44%)	p=0.038
Carbohydrate supplements (n=90)	27 (73%)	27 (51%)	p=0.036
Vitamin supplements (n=88)	23(66%)	31(59%)	p=0.5
Caffeine (e.g. Redbull) (n=28)	8 (62%)	8 (53%)	p=0.66

4.7 Attitudes and perceptions towards doping in sport

A large majority (91%) of the learners felt that PES usage in sport was on the increase (Table 4.7). Eighteen percent of the participants answered 'yes' to more than one question in table 4.7. Only

55% of them believed that testing for substance abuse would serve as a deterrent. More than half of the learners (53%) were aware of the punishment that would be metered out for substance abuse, and 72% of them acknowledged that they knew of substances that were banned by WADA. Figure 4.5 illustrates specific attitudes and perceptions towards doping in sport. The learners were asked to respond to twelve statements regarding their attitudes and perceptions towards the use of PES in sport. It seems that the use of PES in sport has increased over the last five years, as strongly agreed by 47% of the participants.

Forty-six percent strongly agreed that there should be more education programmes on the use and abuse of doping in sport, while 38% agreed that the media should take a stronger stand in the fight against doping. On the contrary, 45% of the participants disagreed that they would never think of using PES in sport, with 37% agreeing that they were occasionally enticed to. Over half of the participants (56%) strongly disagreed that if they did not use PES, they would not be capable of being successful because everybody else did.

Figure 4.6 shows the analysis of an open-ended question on suggestions to try aid in solving the problem of prohibited PES use in sport. The responses were grouped into categories of response.

The majority of the suggestions given by the participants (48%) indicated that more doping tests should be done. Nineteen percent of the participants suggested that education would provide a way to increase awareness of substances, their dangers, and laws concerning PES use in sport. A small number (3%) of the participants interestingly felt the doping in sport was not a problem.

Table 4.7 General attitudes and perceptions towards PES use in sport (n=100)

	Yes n (%)	**No n (%)**
Do you feel that the use of PES in sport is rising? (n=100)	91 (91)	9 (9)
Do you believe there is pressure placed on sportsmen to use substances in sport? (n=97)	81 (84)	16 (16)
Do you feel that doping tests will prevent the use of substances in sport? (n=95)	52 (55)	43 (45)
Are you aware of any substances that are prohibited by the World Anti-Doping Agency? (n=96)	69 (72)	27 (28)
Are you aware of the punishment for using prohibited substances in sport? (n=97)	51 (53)	46 (47)

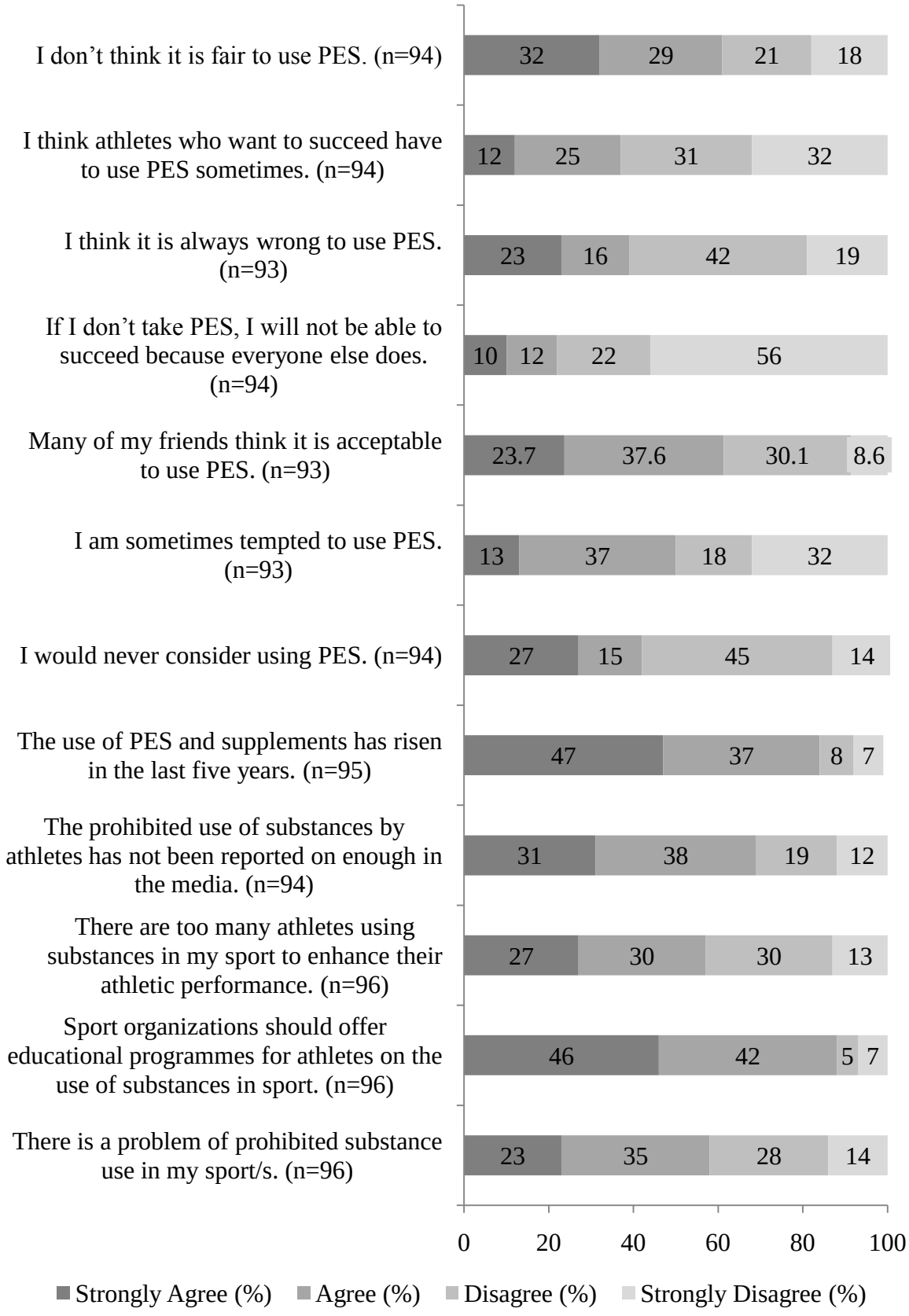

Figure 4.5 Specific attitudes and perceptions of high school learners towards doping in sport (n=100)

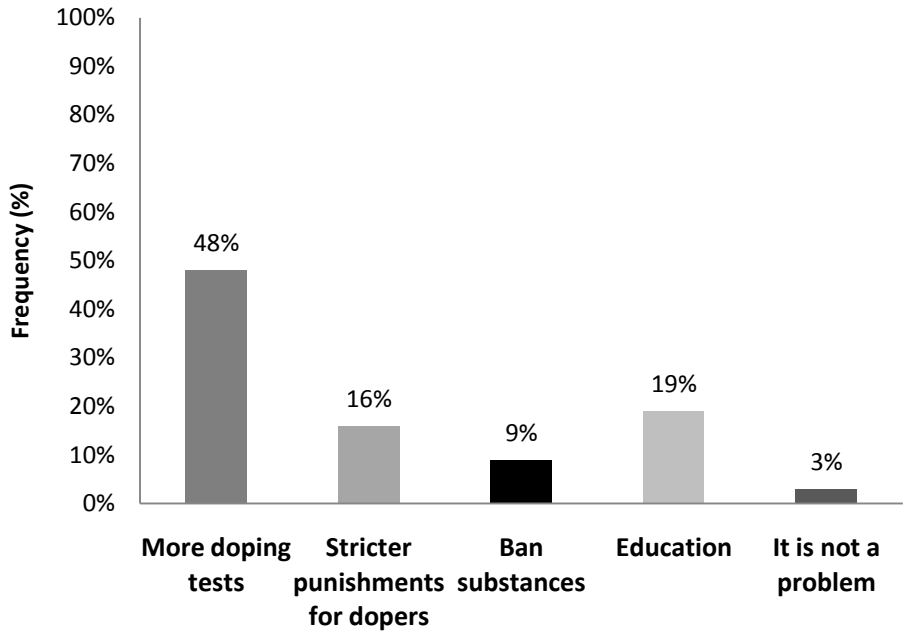

Figure 4.6 Learners suggestions to aid in addressing problem of PES use in sport (n=57)

4.8 Summary

In summary, the prevalence of PES use was 30%. The prohibited substances used to enhance performance were AAS (4%), growth hormone (5%), adrenaline/ephedrine (4%), and insulin (2%). It was evident that there were also nutritional supplement usage in the sample which included creatine supplementation (32%), protein supplementation (61%), carbohydrate supplementation (54%), caffeine PES use (57%) and vitamin (61%) supplementation. The majority of the participants (91%) felt that doping in sport is on the rise and more educational programmes are required with increased frequency of testing.

CHAPTER FIVE: DISCUSSION

The aim of this research was to establish the attitudes and perceptions towards and the prevalence of PES use by adolescent male athletes, in selected Johannesburg boys' high schools. These were examined based on prevalence of PES use, the common substances used and the attitudes towards PES use in sport.

5.1. Demographics

One hundred male adolescent high school athletes from the full squad of the first and second sports teams of selected Johannesburg boys' high schools volunteered to participate in the study, thus giving a response rate of 81%. The sample size had been based on a previous study by Lambert et al. (1998) [24] which found prevalence of AAS use (6.37%) in adolescent males who played first team sport. Two of the seven public and private Johannesburg high boys' schools did not give consent to carry out the research in their schools. Seventy-eight percent of the participants were 17 to 18 years old. The majority of the participants were white (85%), which could strongly be attributed to the assumption that these were previously whites' only boys' high schools. Also, most of the participants were in grade 11 (67%), which may be as a result of the 1st and 2nd sports teams normally being comprised of learners predominantly from this grade. The study also found rugby was the school sport played by most (42%) of the participants, which is currently one of the main sports played in South African high schools. The sport is well-liked throughout South Africa and the success of the national rugby team has helped to increase its popularity among adolescents.

5.2 Prevalence of substances used and common substances used for performance enhancement

The use of substances in sport is common and is a major concern currently facing authorities internationally. [13] The level of competition in South African adolescent sport has possibly become as competitive as that found in elite sport, however, many of these sports have unfolded doping scandals that have changed the public view of the athletic role models caught doping. [15,139] Adolescents need to have role models in sport that they can aspire to, but when these role models portray unethical and unfair practices in sport, their views may become distorted and they may also develop similar tendencies in sport. The problem of doping and use of prohibited PES in this study may perhaps be related to a much deeper social problem where they may also be using banned substances for recreational reasons. For example, an investigation by Madu and Matla (2003) [174] indicated that the use of prohibited substances by adolescents for social purposes was indicated (19.8%) in Pietersburg, Limpopo, South Africa.

Similarly, an investigation of high schools learners in rural KwaZulu-Natal showed that male adolescent learners regularly used alcohol (53%), cannabis (17%), cocaine (7%), and 13% reported smoking more than one cigarette a day. [175] Another study in KwaZulu-Natal, South Africa showed that adolescent use of marijuana (39%), ecstacy (3%) and prescription drugs (7%) was prevalent in grades 10, 11, and 12. [176] In the same way that the users of illegal recreational drugs put their health and well-being at risk to achieve a temporary sense of euphoria; those who indicated using prohibited PES in this study may be causing serious unwanted harm to their bodies, such as impaired hand-eye coordination, distorted sense of time, and the development of socially inappropriate aggressive behaviour. [13] Those adolescent athletes taking prohibited PES may possibly be more concerned with the short term effects that the substances potentially have than the long term harmful effects that could be detrimental to their health. Thus, adolescents who show a propensity for hazardous behaviour, such as using illegal drugs recreationally on a regular basis, might be more susceptible to using prohibited PES in sport. This notion is supported by a study on performance-enhancing drugs which showed that adolescent athletes are more inclined to reject their humanness and engage in risky behaviour that adults would generally not consider as safe. [18] The harmful psychosocial and physiological effects of using prohibited PES and doping may be avoided by ensuring training is well planned, competition is fair, following a nutritious eating plan, and that the adolescent athlete learns to lose as well as win.

An important part of an adolescent athlete's success in sport can come from having a well balanced diet and making sure that the optimal needed nutrients are ingested daily. [87,88] Often this cannot be possible for various reasons, such as having limited time to ensure proper nutrition and having a heavy training schooling schedule, thus, many adolescent athletes have decided to use dietary supplements to ensure that the recommended nutritional needs are met on a daily basis. [88] Athletes use nutritional supplements for a variety of reasons including improving performance, recovering quicker from exercise, influencing body composition and decreasing sickness and the risk of infection. [182] The assumption may be that these nutritional supplements do not have any banned substances included in them because they can be easily bought without a doctor's prescription and are sold legally. [91,172] However, Van Der Merwe and Grobbelaar (2004) [91] showed that 40% of nutritional supplements bought in Bloemfontein, South Africa, contained prohormones and stimulants that have been banned by WADA. [10,91] The findings of their study show that unintentional doping through the use of nutritional supplements is a reality for athletes in South Africa. [91] Studies done internationally have found similar results showing contamination of dietary supplements. [92-94] For instance, the study by Watson et al. (2009) [92] found that the intake of trace quantities of the

supplement 19-norandrostenedione may cause temporary increases in the concentrations of urinary metabolites 19-norandrosterone and 19-noretiocholanolone. The researchers found that adding as minute an amount as 2.5 µg of the metabolite 19-norandrosterone to a nutritional supplement seems enough to end up in a positive doping test in some athletes. [92] This seems to be a case of incorrect advertising or misinformation by the manufacturers of these products, which does appear to be unethical.

The exact reason for the contamination of these products was not known, but it does appear to be either intentional or indirectly related to poor manufacturing processes. Consequently, the adolescent athletes should therefore be aware that some nutritional supplements could potentially contain prohibited substances, such as AAS and ephedrine, which may not clearly be displayed on labels. Furthermore, the safety of using nutritional products cannot be guaranteed and there is no regulating organization for non-pharmaceutical products in South Africa.

Performance enhancing substances can be defined as "any substance taken in non-pharmacologic doses specifically for the purposes of improving sports performance". 4 The findings show that prohibited substances for the improvement of performance were prevalent in the sample, including growth hormone (5%), insulin (2%), adrenaline / ephedrine (4%), and AAS (4%). 10 In addition, the results showed that the use of legal substances for performance enhancement were also prevalent, including caffeine (57%), creatine (32%), vitamin (61%), protein (61%) and carbohydrate (54%) supplements. Many of these substances have potential benefits in sports performance such as increasing strength, power, speed, or endurance or by manipulating body composition. [4] A number of the prohibited substances have been banned because of the ill effects to health or unfair advantage, yet, the use of these still remains prevalent. [13] Some of the nutritional supplements may contain traces of prohibited substances that are on WADA's list [10,91], and there is still not enough evidence to show that there are any benefits in adolescent sports performance. [116,117] The substances indicated being used regularly by the participants of the current study is discussed under separate sub-headings.

5.2.1. Caffeine

Athletes use caffeine mostly for its stimulatory effects such as improvements in attention, reaction time, and focus. [95] Burke et al. (2006) [183] argued that athletes seem to have a perceived enhancement in effort and a perceived improvement of muscle use during times of caffeine

supplementation. It is consumed commonly throughout the world and can be found in small non-performance enhancing quantities in soft drinks, chocolate, tea, coffee and various types of remedies used to treat headaches and other ailments [13], however, some products available in South Africa have high doses of caffeine which promise stimulatory reactions. Results of the current study show that the prevalence of caffeine supplementation for performance enhancement was 57% (16) in those that indicated PES use. This finding is slightly more than the amount indicated by non-elite adolescent athletes (40%) in a Canadian investigation. [57] It appears that the prevalence (57%) of caffeine use in this sample is moderate, however, it is seems to be similar to what was found in Canada. This trend may be universal, but those adolescent athletes using caffeine supplementation need to be aware that there may be harmful side effects from overdose. Some the acute effects of caffeine overdose can include hypokalemia, raised blood glucose levels, tachycardia, and irritability.[100] Caffeine supplementation appears to give athletes a perceived improvement in performance, but high doses greater than 300mg should be avoided to prevent any adverse effects. [101] The athletes in the current study also should be aware that caffeine supplementation has yet to be proven to have performance enhancing properties. The athletes that indicated using this product in the current study should focus rather on improving their performances through well planned training regimens that allow them adequate time to recover from hard bouts of training. There is already consensus that this approach may be an alternative to PES use. [184]

5.2.2. Anabolic androgenic steroids

The findings show that the use of AAS reported by the participants (4%) was similar to the current literature, [54-62] which indicated a prevalence of AAS use from 0.7% up to 12%. Results by Faigenbaum et al. (1998) [54] showed that there was a prevalence (2.7%) of AAS use in USA high school learners, whilst investigations conducted in Sweden showed that there was also an incidence (2.8 to 3.6%) of AAS use in adolescent males aged 16 to 17 years. [62] In South Africa investigation done by Lambert et al. (1998) [24] found a similar finding this study (6.37%). It appears that the use of AAS for the improvement of body composition and sport performance is prevalent worldwide. Although, its use has been shown to increase muscle mass, decrease fat mass, and an increase the total amount of strength [64-66], the adverse effects, such as increase aggression and liver damage, associated with its use should be a major reason deterring adolescents and adults from using it. [12,13,68-73,75] Although only a small percentage of learners indicated AAS use (4%), it was startling to note that learners in high schools are using this harmful substance. It is more worrying that 37% of the coaches were aware that their students were using prohibited PES.

5.3.3. Growth hormone

Growth hormone seems like an attractive substance for athletes because it has the potential to improve muscle strength and mass through aiding in the production of protein and helping with lipolysis. [76] In addition, growth hormone has been shown to reduce fat mass and thus decrease an athlete's total body weight. [77,78] The prevalence of growth hormone in the current study was found to be 5% of the total sample of participants. This prevalence is low, but is similar to the trend of prevalence found which ranged from 0.4 to 5% in similar population groups. [55,57,81] The findings of the current study and of the other studies show that the use of growth hormone is still found in adolescent athletes even though it has been banned by WADA. It seems that the few potential benefits that growth hormone appears to offer adolescent athletes should be far overshadowed by the many adverse effects. Some of these include include acromegaly in adults and gigantism in adolescents. [74,79,82] The thought of having increased height and body size in sport may seem advantageous to adolescent athletes, however, individuals with acromegaly can experience ergolytic symptoms such as weakness, shortness of breath, myopathy, and a decreased tolerance for exercise. [81-83] Furthermore, attaining human growth hormone extraction unlawfully, increases the danger of infectious diseases because a 'pure' product cannot always be guaranteed. [84]

The ergolytic effects of growth hormone use in adolescent sport appear to far outweigh the potential ergogenic effects mentioned. The researcher believes that the learners who had indicated growth hormone use in the current study may not be aware of the adverse effects or even if it has an ergogenic effect on performance. An argument against using growth hormone may lie in the fact that the body is already producing growth hormone naturally in these athletes, and an increase in the amount of this hormone may result in a negative feedback mechanism whereby the endogenous production of growth hormone may be reduced.

As a result of this, there may not be any tangible ergogenic effect for the adolescent athletes using growth hormone. This is reality is vital for the adolescent athletes in the current study using growth hormone to comprehend. Their success in sport may be very important for them, and they may be employing every possible means available to always excel in competition. Furthermore, they may see the use of this substance as a necessity to achieve excellence in sport, but there are legal means of doing this without the expense of psychosocial and physiological drawbacks.

5.2.4. Adrenaline / ephedrine

International investigations have found that when combined with caffeine, adrenaline can increase the duration of endurance training in addition to improving performance during anaerobic activity. [46-48] Further potential benefits offered by using these substances including giving the athlete a sense of decreased tiredness, increased aggressiveness and hostility, suppression of the appetite, increased loss of fat mass, an increased amount of energy, and heightened reaction time. [49,50] The current study found a prevalence of 4% adrenaline/ephedrine use in the sample, but the specific form or type used was not known. This finding is similar to the literature which indicated a low prevalence (2-2.3%) in adolescent athletes and amongst South African elite athletes. [22,44] This low prevalence found in these studies and in the current study could be indicative of a reality that this substance is not widely used as much as other doping products. On the other hand, a much higher prevalence of ephedrine use (13.3%) was indicated in professional American collegiate athletes during routine drug testing. [45]

The higher prevalence found in this professional group of athletes might be the result of greater external pressure to perform or might be as a result of easier access to this substance. Even though this may be the case in the professional group, it might be of concern to the adolescent athletes in the current study who indicated regular adrenaline /ephedrine use. However, using this substance could prove to be harmful to their health. For instance, a number of side effects have been noted from using this substance regularly including arrhythmias, myocardial infarctions, stroke, unexpected fatality and seizures. [51] It is also of concern that the adolescent athletes using ephedrine in the current study might already have developed a dependency on it. [52,53] This behaviour could lead to further psychosocial problems, such as progressing onto using illegal recreational drugs or other criminal behaviours. Holding on to this trend could prove harmful to those in contact with the athletes, such as parents or siblings and it may even be disruptive to family and high school life. Stimulants such as ephedrine have to potential to reduce fatigue, but like the other prohibited products, their side effects outweigh the benefits. Thus, it would be beneficial for the adolescent athletes in the current study using it to research safer and legal alternatives to using this product with the aim of improving performance.

5.2.5 Insulin

Insulin seems attractive as a probable performance enhancer mostly because of its anabolic nature. [1] This hormone has the potential to cause cellular growth, increase the rate of glycogen production, and escalate protein production. [6,13] Moreover, it delays the liver's output of glucose, thus increasing

liver glycogen storage, and improving lipogenesis. [6,13,85] The current study found a 2% prevalence of insulin use for enhancement of performance. This is a low prevalence, which is the reason for speculating that this finding could very possibly be a representation of the adolescent athletes that use it for therapeutic purposes rather than for performance enhancement for a number of reasons as this was not clarified on the questionnaire. Firstly, the use of insulin in sport is debatable because although insulin may be anabolic in nature, it has been shown to increase fat mass and decrease performance, in sports such as sprinting and high jump. [13,85] Secondly, hypoglycaemia is a key possible hazard of using insulin in sport because it can possibly lead to neurological problems or even death if not recognised and managed properly in acute cases. [13] Thirdly, insulin is only available by prescription from a medical practitioner for therapeutic use to ensure that normoglycaemia is attained in diabetic patients. Having considered these three assumptions, it seems impractical and illogical for the adolescent athletes in the current study to choose this substance as a preferred performance enhancer when there are less expensive and more practical legal alternatives available. Two realistic alternatives could be having a well-balanced diet and a periodized exercise training programme. Based on the assumptions discussed, the author believes that the prevalence of insulin found in the current study was probably for therapeutic reasons and not for the deliberate enhancement of sport performance. However, this was not clearly established by the study and perhaps future research in the area of doping in adolescent athletes should make this clear in the research instrument.

5.**2.6. Carbohydrate supplementation**

Carbohydrate supplementation is generally acceptable in sport and has a number of benefits for the adolescent athletes using it. For example, CHO has also been shown to be an important source of energy for optimal performance. [123,125] The findings of the current study showed that 54% of the participants indicated using CHO supplements to improve performance. With slightly over of the adolescent athletes in this study using this form of supplementation, it is comforting to note that they are using legal methods to improve performance in sport. The remaining 46% of the sample may not be using CHO supplementation for a variety of reasons, however, individual choice and preference may be a key factor. The author feels that additional education is required in order to assist the adolescent athletes with better health choices. This may be important as the full comprehension of CHO supplementation on the physiology of adolescent athletes during the developmental period is not fully known. [81] However, CHO supplementation has nonetheless been proven as an important energy source for endurance activity in adults and thus may enable adolescent athletes to perform at their peak during South Africa's hot seasons for longer periods.

[129,130] Noakes (2004) [130] showed that carbohydrate-loading is proven method of increasing CHO stores in the body, giving the adolescent an advantage of having an increased threshold to fatigue. Thus, the adolescent athletes using CHO supplements in the current study may benefit by achieving a well-balanced diet. Moreover, the others in the study could benefit from using this substance as an indirect way of enhancing performance.

5.2.7. Protein supplementation

Protein supplementation, when taken in moderation, may be an essential part of the adolescent athletes' diet. [119] Proteins have various important functions in the development of an adolescent athlete including the ability to maintain, build, and successfully repair tissue in the body; function as hormones, enzymes, immunoproteins, and aid in transportation around the body. [120] Findings of this study showed the prevalence of protein supplement use to be 61%. This result is much higher than the literature (12-35%) [169,170] which may be indicative of the current trend favouring protein as a desirable supplement to aid in performance enhancement. The higher prevalence of protein found in the current study could also possibly be related to better marketing of products to the users of this product in this study. On the other hand, the participants in the current study suing protein supplements may perhaps accept it as a performance enhancer more openly than the literature. The majority of the participants (61%) in the current study using protein supplementation may be attaining the goal of well balanced diet, however, further education on nutrition may be warranted. For example, the participants using this substance need to be educated on the side effects of using excess amounts of protein, such as dehydration, muscle cramps, and kidney damage. [119] The participants using protein supplements in the current study can learn about the safety of using this product and how to ensure that RDA is not exceeded.

5.2.8. Vitamin supplementation

The use of vitamins, in addition to using other nutritional supplements may be essential for adolescent athletes. [135,136] Also, the careful use of vitamins on a regular basis may aid in ensuring a well balanced diet is attained. [131-134] The use of vitamin supplementation during times of heavy training may help to lower the effects of fatigue from exercise in adolescent athletes participating in demanding habitual exercise. [131-134]

Results of the current study indicate that vitamin supplementation was prevalent (61%). This finding is in keeping with the trend found in the literature (35-61%). [164-168] The adolescent athletes in the

current study may be using vitamins for a number of reasons including, as a result of advice from parents or coaches, advertising, prevention during times of stress, or because RDA is not being met. Nevertheless, there has not been enough research in adolescent use of vitamins; [88] therefore, adolescents using them for supplementation must adhere to within 100% RDA to avoid any medical complications from overuse. The use of vitamin supplementation in the current study seems to be common, and this may be another case of successful advertising. The cost of vitamins are affordable and available to a wider group of people than other commercially sold products. As a results, it's popular and helps to ensure that RDA is met and is regarded as safe. However, as with all supplements, excess quantities can lead to severe problems with health and upper limits of tolerance have been instituted for several vitamins. [137] For instance, excess quantities of niacin can result in damage to the liver. [137]

5.2.9. Creatine supplementation

Supplementation with synthetically produced creatine has been demonstrated to raise the total skeletal muscle creatine level by 30% and that of phosphocreatine by 20%.[106-109,114] Harris (2005) [2] showed that creatine supplementation also has the potential to increase phosphocreatine availability, increase phosphocreatine resynthesis, reduce muscle acidity, aid in oxidative metabolism, enhance training and increase muscle mass.

The current study found a prevalence of 32% creatine supplement use. This result is comparatively less than half (75%) the prevalence found in an investigation that examined the use of oral creatine as an ergogenic aid for increased sports performance. [117] The lower prevalence in the current study could be as a result of the reduced popularity of the product, however, this may not be the case where the product is openly encouraged by coaches and other authorities. For instance, the product may be used because of sponsorship by a company, advice given by coaching staff, encouraged to do so by peers, or due to personal belief system in creatine's ability to enhance performance. In contrast to these findings, a study, Smith et al. (2001) [118] found an even lower prevalence (8.2%) in high school athletes. This could be the result of poor marketing of the product or a belief that creatine has not effect on performance enhancement. In fact, more research is required to provide evidence of the effects of creatine supplementation in adolescent athletes. [114,115,118] Furthermore, the harmful side effects of creatine supplementation indicated in adult use, such as altered renal function and increased gastro-intestinal pain are well-known and presumably affect adolescents as well. [2] Moreover, the author feels that the use of creatine in learners younger than 18 years is not safe until proven otherwise. [116]

5.3 Attitudes and perceptions towards performance enhancing substance use

The Olympic Charter's virtues of 'friendship, solidarity and fair play' [14] still need to become a reality and perhaps should become a core pillar in the fight against doping in adolescent sport. The issue of doping is affecting sport internationally and in South Africa. Doping in sport is unethical and unfortunately the youth using banned substances may have adverse effects on their well being and development. The findings of this study indicate that 84% of the participants felt that there was pressure placed on them to use PES in sport. This finding is of concern as it appears that the pressure to achieve and succeed may be great for these adolescent athletes. This is the reason why the fight against doping in this group should be taken seriously.

Doping in sport can be regarded as a form of cheating where athletes take substances to aid them in achieving success over competition. [13] . Thirty-two percent of the participants strongly agreed that prohibited PES use in sport was unfair. This finding is smaller than a survey investigating the prevalence of AAS in Canadian students, which found that 74% of the participants indicated that they thought doping in sport was dishonest. [154] Ideally, a greater amount of the participants of the current study should have agreed to the use of prohibited substances in sport being unethical. However, an atmosphere of extraordinary pressure may be giving a distorted view of sport participation, whereby doing what it takes to get ahead may be encouraged.

It seems that the environment of 1st and 2nd high school sports teams are ones where increased pressure may be placed on the athletes to be successful and give maximum effort in performance throughout the whole season. The athletes in this study felt that there was pressure placed on them to perform but believe that the practice of doping is one of cheating. Albeit, parents, coaching staff, and sometimes their friends may place unrealistic demands on them and thus could indirectly tempt or even encourage the use of PES in sport. Interestingly, 37% of the PES users indicated that their coaches were conscious that they were taking PES and some of these were illegal, which is in itself unethical. Perhaps those involved in high school sport including parents / guardians, coaching staff, teachers, and adolescent athletes should be taught that losing or coming second or third place is fine. This would allow them to learn that fair game play and honest interaction with opponents is essential.

Adolescent sport could turn into a win-at-all-costs competitive environment, as was reflected by a study investigating steroid use amongst high school girls, [17] which found that doing whatever it takes to excel in competition, and occasionally placing health and well-being in danger, had become

routine practice. The harmful effects of many of the common prohibited substances are well-known, although most of these adverse effects are reversible on cessation. However, with the evolution of new products being engineered and sold on the black market, the adolescents using them could be bearing the burden of utilizing unknown substances which may have harmful and irreversible side effects. Some of these harmful effects could result in poor health and poor performance in the long term. The adolescent athletes using them seem to assume that these substances are necessary for optimal performance. This assumption is reflected by the finding that 68% of the prohibited PES users take substances to help them perform better in sport and 29% indicated that it aids them in coping with the stresses of sport participation. Optimal performance in sport is vital for success, but this could be accomplished by legitimate means. For example, adolescent athletes may be educated on the harmful effects of doping on health and well being, which could act as a deterrent to prohibited PES use in sport. Peak performance can also be achieved through the use of science in exercise and use of psychological resources to improve an athlete's self image.

Physical image is perhaps one of the most important and influential issues facing adolescents during the transitional period from childhood to becoming an adult. A number of the participants (32%) indicated that that they used performance enhancers because they were concerned about their body weight. The AAP document on PES use in adolescent argued that adolescents are tremendously concerned about their body image. [4] An athlete's mental image of themselves is possibly one of the pivotal features in determining whether they will be successful or not in competition. For example, Lance Armstrong, the famous multiple-winner of the Tour de France, expressed the importance of having a healthy self image and submersing oneself into hard training and exercise to succeed and be ahead of the rest in competition. [139] The thought of finding an easier way to success by avoiding hard training could be very attractive to athletes, however, the repercussions of being caught, the numerous adverse health effects, and the possibility of facing a shameful prison sentence should be enough to deter any temptation of doping. De Merode (1999), [20] former chairman of the Olympic Committee, argued that the problem of doping in sport could perhaps be the result of the alluring attractiveness of riches and fame. This may be true, however, these are usually short-lived and the price of having to suffer with the consequences of poor health for the remainder of life is probably worse than the temporary riches and fame. More time should therefore be given on educating adolescent athletes on the use of doping in sport so that they would be able to make a mature decision to dope or not, having fully known the cost.

The vehicle of education is one of the ways that could aid in discouraging the use of doping and prohibited PES in sport. [140,161,162] The findings of the current study show that 88% expressed a need for education about doping. This result is similar to that of research done by the Carnegie Research Institute at Leeds Metropolitan University which found that elite athletes generally have negative attitudes towards doping in sport and believe that doping tests should remain in sport. [146] The majority of the participants from this study indicated that more educational drives were needed to allow for them to be better equipped with information regarding doping in sport. A number of the athletes in the current study possibly cannot comprehend the gravity of using prohibited PES. Doping may essentially tear down what is decent and good regarding adolescent sport. It may even corrode societal confidence and endanger the adolescent athletic population. The participants in the current study may be using the internet to obtain information on doping, but this information may be limited as it is not always reliable. Hence the reason for a need for education resources of a dependable quality.

These high quality educational drives must go beyond the professional athlete involved in competition and focus on those involved in adolescent and recreational sports, where drug testing is not commonly seen. [159] International (WADA) and local (SAIDS) agencies have the ability and strength to provide consistency in anti-doping laws, uniformity in applying sanctions on the diffusion of relevant information and the improvement of educational policies. [160] It would be useful to include those involved in anti-doping programmes to aid and inform adolescent athletes on the use and abuse of drugs in sport, what factors lead to doping, and how to deal with these. [141] It seems that a holistic and multidisciplinary approach to education could provide a way of restoring moral values in sport, and also gives adolescent athletes and uninformed coaches and parents the opportunity to learn more about doping. The South African Department of Education may be able to play a pivotal role together with SAIDS to ensure that the educational needs of these learners are met. Furthermore, these two bodies can work together in providing random drug tests in high school sports teams, which would help to deter adolescents from using prohibited PES.

Public opinion conveys a message that doping and prohibited PES use is essentially against the core pillar of sport and exercise, [151] however, the reality is that its use is common in sport. [152,153] In reality a number of participants (35%) in the current study agreed that there was a problem of prohibited substance use in their sport. Although this is not the view of the majority (65%) of the participants, this perception must be taken into account by the local anti-doping authorities and those involved with the adolescents at the Johannesburg boys' high schools. A well driven educational drive in

concert with stricter punishments for dopers and more doping tests may possibly provide a better deterrent for those athletes considering using prohibited PES in sport.

5.4 Limitations of the study

Even though this study offers some input on adolescent PES use, it is not devoid of limitations. It is possible that some of the participants gave false responses, thus underreporting their PES usage, even though self reports were completed under conditions that stressed strict confidentiality.

The researcher assumed that the participants answered truthfully. Nevertheless, self-reporting questionnaires examining the use of prohibited substances usually show limitations in acquiring legitimate responses. Even so, the literature investigating the validity of responses to questions asking about the personal usage of prohibited substances concluded that the self reported questionnaire is a reliable instrument for collecting data. [185,186] Further, the questionnaire was limited as it was not known whether insulin was used for therapeutic reasons or not. All of the questions were not answered by every participant as was expected in certain areas, however, in other areas where response was expected, there was none. This was however, taken into account when analysing the data. More questions could have been added into the questionnaire, such as whether the substances used were banned or legal, whether they were prescribed by a doctor, what the frequency of the substance use was the reasons for using or not using nutritional supplements, and evaluating whether the PES users were conscious of the harmful effects of the substances. Moreover, the section on nutritional substance use could have included some of the substances available locally. Weight loss products, which are widely available, could also be included in the section on nutritional substances. Also, with regards to sample size, the approach of using previously published studies has the risk of being inadequate. For example, if the prevalence had changed, the sample size would be inadequate. However, the researcher took this into account when calculating sample size and inflated the required sample size to allow for any changes in the trend.

Despite these limitations, the results provide evidence on the use PES in male adolescents in Gauteng, South Africa.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Founded on the results of this study, it could be legitimate to assume that there is a prevalence of PES use in male adolescent athletes in Johannesburg boys' high schools. Nutritional supplements and ergogenic substances were found to be commonly used in this population. In addition, the attitudes and perceptions towards PES use in sport showed that most of the adolescent athletes felt pressured to use substances to perform better. The issue of doping in adolescent sport appeared to be influencing adolescent athletes in general and this problem has been evidently confirmed among male adolescent athletes in Johannesburg boys' high schools.

The evident eagerness of male adolescent athletes to utilize nutritional supplements and substances to accomplish their objectives in sport, albeit these objectives might be achieved at the cost of their wellbeing and result in reduced health, emphasizes the needed requirement for an improvement of contribution from high schools, coaching staff, parents/guardians, SAIDS and medical practitioners to provide more education regarding the potential benefits and adverse effects of substances and nutritional supplements used in adolescent sport. Furthermore, additional interventions such as efforts to improve the anti-doping attitude of adolescents may be important in addressing the problem of doping in sport. More investigations are important in acquiring a complete picture of the reasons and causes that influence the incidence of doping, nutritional supplements and substance abuse in adolescent sport.

6.1 Recommendations for intervention

The researcher recommends that a plan be implemented to discourage the use of PES in male adolescents. Adolescents' attitudes and perceptions towards PES use should be investigated further. A significant programme of intervention should be implemented at the pre-adolescent stage in an attempt to provide meaningful education to coaches, school learners, parents/guardians and teaching staff on the effects and side effects of using PES. This programme should include relevant literature about PES and be complemented with journal clubs, forums and talks on scientific means on enhancing performance in sport. More focus should be given to finding out what the cause and scale of demand there is on adolescents to excel in sport in order that a plan to reduce this stress can be devised.

The sale of PES products via the internet should be regulated and screened to decrease the likelihood of any athlete purchasing products that may have traces of banned substances. The

optimisation of performance in sport can be enhanced by improved training methods, nutrition, psychology, and performance monitoring. The internet could also be used as a means of communication to actively engage in educating adolescents on doping. The media and magazines may help to increase an anti-doping attitude, which is similar to South Africa's all-out drive to reduce HIV/AIDS numbers. Organisations such and SAIDS may aid in introducing a nationwide programme to monitor and follow any trends in the pattern of knowledge, attitude and behaviour with regards to PES.

Future studies may include some investigation into the prevalence of traditional South African medicinal use for performance enhancement in youth sport. Similar studies could be done in other parts of the country to obtain an indication of the general trend of PES use by male and female South African adolescent athletes. Moreover, future studies might benefit from including comparison between variables such as age, socioeconomic status and gender.

Intervention studies should be done to investigate the impact of educational strategies to improve anti-doping attitude in adolescent athletes.

REFERENCES

1. Editors of The American heritage® dictionaries. The American heritage® dictionary of the english language, fourth edition <http://www.thefreedictionary.com/adolescent>. Accessed 2009 March 15. Houghton Mifflin Company, Boston, 2009.
2. Harris L. Creatine supplementation: It's association with muscle injury in young rugby players. Johannesburg: University of the Witwatersrand, 2005.
3. Eichner ER. Ergolytic drugs in medicine and sports. The American Journal of Medicine. 1993;94:205 -11.
4. American Academy of Pediatrics. Use of performance-enhancing substances. Pediatrics. 2005;115(4):1103 -6.
5. Decision News Media SAS. AFSSA calls for creatine ban <http://www.foodnavigator.com/content/view/print/106292>. Accessed 2009 May 19. Decision News Media SAS, 2001.
6. Tortora GJ, Grabowski SR. Principles of anatomy and physiology, 10th Edition. New York: John Wiley & Sons, Inc.; 2003.
7. World Anti- Doping Agency. World Anti- Doping Code. Montreal: World Anti-Doping Agency; 2009.
8. World Anti- Doping Agency. The Code <http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=250>. Accessed 2009 March 30. World Anti-Doping Agency, Montreal.
9. World Anti- Doping Agency. Mission & Priorities <http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=255>. Accessed 2009 March 30. World Anti-Doping Agency, Montreal.
10. World Anti- Doping Agency. The Prohibited List 2009. Montreal: World Anti-Doping Agency; 2008.
11. World Anti- Doping Agency. Q&A: 2009 Prohibited List. Montreal: World Anti-Doping Agency; 2008.
12. World Anti-Doping Agency. A Brief History of Anti-Doping <http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=312>. Accessed 2009 March 23. World Anti-Doping Agency, Montreal.
13. Clisby L. Drugs and the athlete. In: Brukner P, Khan K (eds). Clinical Sports Medicine 2nd Edition. Sydney: McGraw-Hill, 2005.

14. International Olympic Committee. Olympic Charter <http://multimedia.olympic.org/pdf/en_report_122.pdf>. Accessed 2009 March 16. DidWeDo S.à.r.l., Lausanne, Switzerland, 2007.
15. Noakes T. Tainted glory — doping and athletic performance. Campus Sport, UCT October, 2006:24 - 5.
16. Fahey J. Forging ahead on firm footing and with fresh resolve. Play true magazine - an official publication of the World Anti-Doping Agency 2008.
17. White KA. Steroid use among high school girls on rise, study says. Education Week 1998;17(18):10.
18. Mayo Clinic Staff. Performance-enhancing drugs and your teen athlete <http://www.mayoclinic.com:80/health/performance-enhancing-drugs/SM00045>. Accessed 2009 March 16. Mayo Foundation for Medical Education and Research, 2009.
19. Powers ST, Howley ET. Exercise physiology: Theory and application to fitness and performance. 5th Edition. Boston: McGraw-Hill; 2004.
20. de Merode PA, Schamasch P. Harmonisation of methods and measures in the fight against doping in sport. <http://ec.europa.eu/research/smt/hardop-en.pdf>. Accessed 2009 March 16. Office for Official Publications of the European Communities, Luxembourg, 1999.
21. Van der Burgh C. Drugs and South African youth. Pretoria: Institute for Manpower Research and Human Sciences Research Council, 1975.
22. Coopoo Y, Jakoet I. Substance abuse and knowledge thereof among elite South African athletes. South African Journal of Sport Medicine. 2000;7(3):10-3.
23. Schwellnus MP, Lambert MI, Todd MP, Juritz JM. Androgenic anabolic steroid use in matric pupils. A survey of prevalence of use in the western Cape. The South African Medical Journal. 1992;82:154 - 8.
24. Lambert MI, Titlestad SD, Schwellnus MP. Prevalence of androgenic-anabolic steroid use in adolescents in two regions of South Africa. The South African Medical Journal. 1998;88(7):316 - 30.
25. Skowno J. Drug survey among first-team schoolboy rugby players. South African Medical Journal. 1992;82(3):204.
26. Tanner SM, Miller DW, Alongi C. Anabolic steroid use by adolescents: prevalence, motives, and knowledge of risks. Clinical Journal of Sport Medicine. 1995;5:108 - 15.
27. Swedan NG. Women's sports medicine and rehabilitation. Philadelphia: Lippincott Williams & Wilkins; 2001.

28. Connolly G. Je performe sans drogue – Guide de l ' e n t r a îneur. Québec: Sports-Québec, 2004.
29. Hoberman J. The early development of sports medicine in Germany. In: Berryman J, Park R (eds). Sport and exercise science: Essays in the history of sports medicine. Champaign, Illinois: University of Illinois Press, 1992.
30. Yesalis CE. History of doping in sport. In: Bahrke M, Yesalis C (eds). Performance enhancing substances in sport and exercise. Champaign: Human Kinetics, 2002:1 - 20.
31. Lovgren S. Ancient olympics mixed naked sports, pagan partying <http://news.nationalgeographic.com/news/2004/08/0809_040809_nakedolympics.html>. Accessed 2009 March 23. National Geographic News, 2004.
32. Strauss RH, Curry TJ. Magic, science and drugs. In: Strauss RH (ed). Drugs and performance in sports. Philadelphia: Saunders, 1987.
33. Fourcroy J. Designer steroids: past, present and future. Current Opinion in Endocrinology & Diabetes. 2006;13(3):306-9.
34. Boje O. Doping bulletin of the health organisation of the League of Nations. Personnel. 1939;3:26 -8.
35. World Health Organization Programme on Substance Abuse. Drug use and sport: Current issues and implications for public health. Geneva: WHO, 1993.
36. International Olympic Committee. Olympic Games Fonds <http://www.olympic.org/common/asp/download_report.asp?file=en_report_1364.pdf&id=1364>. Accessed 2009. International Olympic Committee, Lausanne, 2007.
37. Verroken M. Drug use and abuse in sport. In: Mottram DR (ed). Drugs and sport, 2nd Edition. London: E&FN Spon, 1996.
38. Wallechinsky D. The complete book of the Olympics. Boston: Little, Brown & Company; 1992.
39. BBC News. Doping scandal reaches court. <http://news.bbc.co.uk/2/hi/europe/733155.stm>. Accessed 2009 March 24. BBC News, London, 2000.
40. Franke WW, Berendonk B. Hormonal doping and androgenization of athletes: a secret program of the German Democratic Republic. Clinical Chemistry. 1997;43:1262 - 79.
41. Gillies H, Derman WE, Noakes TD, Smith P, Evans A, Gabriels G. Pseudoephedrine is without ergogenic effects during prolonged exercise. Journal of Applied Physiology. 1996;81(6):2611 - 7.

42. Swain RA, Harsha DM, Baenziger J, Saywell RM, Jr. Do pseudoephedrine or phenylpropanolamine improve maximum oxygen uptake and time to exhaustion? Clinical Journal of Sport Medicine. 1997;7:168 - 73.

43. Clemons JM, Crosby SL. Cardiopulmonary and subjective effects of a 60 mg dose of pseudoephedrine on graded treadmill exercise. Journal of Sports Medicine and Physical Fitness. 1993;33:405 - 12.

44. Schaefer MP, Smith J, Dahm DL, Sorenson MC. Ephedra use in a select group of adolescent athletes. Journal of Sports Science and Medicine. 2006;5:407 - 14.

45. National Collegiate Athletic Assocation News Staff. Latest drug-testing results indicate concern for ephedrine use <http://www.ncaa.org/wps/portal>. Accessed 2009 March 12. National Collegiate Athletic Assocation News, 1999.

46. Bell DG, Jacobs I, Zamecnik J. Effects of caffeine, ephedrine and their combination on time to exhaustion during high intensity exercise. European Journal of Applied Physiology. 1998;77:427 - 33.

47. Bell DG, Jacobs I. Combined caffeine and ephedrine ingestion improves run times of Canadian Forces warrior test. Aviation, Space, and Environmental Medicine. 1999;70:325 - 9.

48. Bell DG, Jacobs I, Ellerington K. Effect of caffeine and ephedrine ingestion on anaerobic exercise performance. Medicine and Science in Sports and Exercise. 2001;33:1399 - 403.

49. Voy J. Drugs, sport, and politics. Leeds: Human Kinetics Publishers (UK) Ltd.; 1991.

50. Boyce EG. Use and effectiveness of performance-enhancing substances. Journal of Pharmacy Practice. 2003;16:22 - 36.

51. Haller CA, Benowitz NL. Adverse cardiovascular and central nervous system events associated with dietary supplements containing ephedra alkaloids. New England Journal of Medicine. 2000;343:1833 - 8.

52. Gruber AJ, Pope HG. Ephedrine abuse among 36 female weight lifters. American Journal on Addictions. 1998;7:256 - 61.

53. Gill A. Faster, higher stronger: confessions of an ephedrine junkie. The Globe and Mail 2002 March 9:L3.

54. Faigenbaum AD, Zaichowsky LD, Gardner DE, Micheli LJ. Anabolic steroid use by male and female middle school students. Pediatrics. 1998;6:101 - 5.

55. Wanjek B, Rosendahl J, Strauss B, Gabriel H. Doping, drugs and drug abuse among adolescents in the state of Thuringia (Germany): Prevalence, knowledge and attitudes. International Journal of Sports Medicine. 2007;28:346 - 53.

56. Goral M. Evaluation of acth, steroids, barbiturates, benzodiazpines, beta blockers, caffeine, cannabis and cocaine dopings in sportsmen. Research Journal of Biological Sciences. 2008;3(8):830 - 6.

57. Buist A, Goulet C, Valois P, Cote M. Étude de l'éthique, du dopage et de certaines habitudes de vie chez des sportifs québécois. Québec: Secrétariat au loisir et au sport, 2002.

58. Elliot D, Goldberger L. Intervention and prevention of steroid use in adolescents. American Journal of Sports Medicine. 1996;20:1552-63.

59. Goldberger L, Elliot D, Clark GN, et al. Effect of a multidimensional anabolic steroid prevention intervention. The adolescent training and learning to avoid steroids (ATLAS) program. Journal of American Medical Association. 1996;24(6):46 - 50.

60. Yesalis CE, Bahrke MS. Doping among adolescent athletes. Bailliere's Best Practice & Research. Clinical Endocrinology & Metabolism. 2000;14(1):25 - 35.

61. Dawson RT. Drugs in sport - the role of the physician. Journal of Endocrinology. 2001;170(1):55 - 61.

62. Nilsson S, Baigi A, Marklund B, Fridlund B. The prevalence of the use of androgenic anabolic steroids by adolescents in a county of Sweden. European Journal of Public Health 2001;11(2):195 - 7.

63. American College of Sports Medicine. Position statement: Senate hearing on the abuse of anabolic steroids and their precursors by adolescent athlete: American College of Sports Medicine; 2006.

64. Hartgens F, Lichtenbelt WDVM, Ebbing S, Vollard N, Rietjens GJWM, Kuipers H. Androgenic-anabolic steroid-induced body changes in strength athletes. The Physician and Sportsmedicine. 2001;29:49 - 66.

65. Forbes GB, Porta CR, Herr BE, Griggs RC. Sequence of changes in body composition induced by testosterone and reversal of changes after drug is stopped. The Journal of the American Medical Association. 1992;267:397 - 9.

66. Bhasin S, Storer TW, Berman N, et al., et al. The effects of supraphysiologic doses of testosterone on muscle size and strength in normal men. The New England Journal of Medicine. 1996;335:1 - 7.

67. Kadi F, Eriksson A, Holmner S, Thornell LE. Effects of anabolic steroids on the muscle cells of strength-trained athletes. Medicine and Science in Sports and Exercise. 1999;31:1528 - 34.

68. Colby HD, Longhurst PA. Fate of anabolic steroids in the body. In: Thomas JA (ed). Drugs, athletes, and physical performance. New York: Plenum Publishing Corporation, 1988.

69. Fox SI. Human Physiology, 7th Edition. New York: McGraw-Hill; 2002.

70. Frohlich J, Kullmer T, Urhausen A, Bergmann R, Kindermann W. Lipid profile of body builders with and without self-administration of anabolic steroids. European Journal of Applied Physiology. 1989;59:98 - 103.

71. Hartgens F, Kuipers H. Effects of androgenic-anabolic steroids in athletes. Sports Medicine. 2004;34(8):513 - 54.

72. Friedl K. Effects of anabolic steroids on physical health. In: Yesalis CE (ed). Anabolic steroids in sport and exercise. Champaign, Illinois: Human Kinetics Publishers, 1993:107 - 50.

73. National Institute on Drug Abuse. Anabolic steroid abuse. Bethesda: National Institute on Drug Abuse, 2006.

74. George A. The anabolic steroids and peptide hormones. In: Mottram DR (ed). Drugs and sport, 2nd Edition. London: E&FN Spon, 1996.

75. Drugs.com. Anabolic Steroids (Systemic) <http://www.drugs.com/cons/anabolic-steroids.html>. Accessed 2009 April 7. Drugs.com, 2004.

76. Ambrose PJ. Drug use in sports: a veritable arena for pharmacists. Journal of the American Pharmacists Association. 2004;44:501 - 16.

77. Cuneo RC, Salomon F, Wiles CM, Hesp R, Sonksen PH. Growth hormone treatment in growth hormone-deficient adults. II. Effects on exercise performance. Journal of Applied Physiology 1991;70(2):695 - 700.

78. Cuneo RC, Salomon F, Wiles CM, Hesp R, Sonksen PH. Growth hormone treatment in growth hormone-deficient adults. I. Effects on muscle mass and strength. Journal of Applied Physiology 1991;70(2):688 -94.

79. Laos C, Metzl JD. Performance-enhancing drug use in young athletes. Archives of Pediatrics & Adolescent Medicine. 2006;17:719 - 31.

80. Segal D. Guidelines for using growth hormone in paediatric patients in South Africa: Treatment of growth hormone deficiency and other growth disorders. South African Medical Journal. 2009(99):185 - 95.

81. Calfee R, Fadale P. Popular ergogenic drugs and supplements in young athletes. Pediatrics. 2006;117:e577 - 89.

82. Wadler GI, Hainline B. Drugs and the athlete. Philadelphia: F.A. Davis Company; 1989.

83. Khandwala HM. Acromegaly <http://www.emedicinehealth.com/acromegaly/article_em.htm>. Accessed 2009 April, 16. WebMD, Inc.

84. Bidlingmaier M, Wu Z, Strasburger CJ. Side effects of doping with growth hormone. Munich: Ludwig Maximilians University, 2002.

85. George A. Peptide and glycoprotein hormones and sport. In: Mottram DR (ed). Drugs and sport, 3rd Edition. New York: Routledge, 2003.
86. Green GA. Insulin as an anabolic drug of abuse in sport? Diabetes Technology & Therapeutics. 2004;6(3):387 - 8.
87. American Dietetic Association. Position of the American dietetic association, dietitians of Canada, and the American college of sports medicine: nutrition and athletic performance. Journal of the American Dietetic Association. 2000;100(12):1543 -56.
88. Maughan RJ, King DS, Lea T. Dietary supplements. Journal of Sports Sciences. 2004;22:95 - 113.
89. Burke L, Castell LM, Stear SJ. BJSM reviews: A-Z of supplements: dietary supplements, sports nutrition foods and ergogenic aids for health and performance Part 1. British Journal of Sports Medicine. 2009;43(10):728-9.
90. Cohen PA. American roulette — contaminated dietary supplements. The New England Journal of Medicine. 2009;361(16):1523-5.
91. Van Der Merwe PJ, Grobbelaar E. Inadvertent doping through nutritional supplements is a reality. South African Journal of Sport Medicine. 2004;16(2):3 - 7.
92. Watson P, Judkins C, Houghton E, Russell C, Maughan R. Urinary nandrolone metabolite detection after ingestion of a nandrolone precursor. Medicine and Science in Sports and Exercise. 2009;41(4):766-72.
93. Geyer H, Parr MK, Mareck U, Reinhart U, Schrader Y, Schanzer W. Analysis of non-hormonal nutritional supplements for anabolic-androgenic steroids-results of an international study. International Journal of Sports Medicine. 2004;25:124-9.
94. Maughan R. Contamination of dietary supplements and positive drugs tests in sport. Journal of Sports Sciences. 2005;23:883-9.
95. British Medical Association. Drugs in sport: The pressure to perform. London: BMJ Books; 2002.
96. Avois L, Robinson N, Saudan C, Baume N, Mangin P, Saugy M. Central nervous system stimulants and sport practice. British Journal of Sports Medicine. 2006;40:i16 - 20.
97. Doherty M, Smith PM. Effects of caffeine ingestion on rating of perceived exertion during and after exercise: A meta-analysis. Scandinavian Journal of Medicine and Science in Sports. 2005;15(2):69 - 78.
98. Munnoo S. The use of drugs in sport at tertiary institutions in South Africa. Durban: University of Kwa-Zulu Natal, 2004.

99. Meltzer S, Kohler R, Jakoet I, Noakes T. A practical guide to the use of nutritional supplements in South Africa. Continuing Medical Education. 2004;22(3):143 - 4.

100. Leson CL, McGuigan MA, Bryson SM. Caffeine overdose in an adolescent male. Journal of Toxicology: Clinical Toxicology 1988;26:407 - 15.

101. International Food Information Council Foundation. Caffeine & health: Clarifying the controversies. Washington, DC: International Food Information Council Foundation; 2009.

102. Folin O, Denis W. Protein metabolism from the standpoint of blood and tissue analysis. Third paper, Further absorption experiments with especial reference to the behavior of creatine and creatinine and to the formation of urea. Journal of Biological Chemistry. 1912;12(1):141 -61.

103. Rubinstein M, Federman D. Sports supplements. Can dietary additives boost athletic performance and potential? . Postgraduate Medicine. 2000;108:103 - 6, 9 - 12.

104. Balsom PD, Soderlund K, Ekblom B. Creatine in humans with special reference to creatine supplementation. Sports Medicine. 1994;18(4):268 -80.

105. Harris R, Soderlund K, Hultman E. Elevation of creatine in resting and exercised muscle of normal subjects by creatine supplementation. Clinical Science. 1992;83:367 - 74.

106. Hultman E, Soderlund K, Timmons JA, Cederblad G, Greenhaff PL. Muscle creatine loading in men. Journal of Applied Physiology. 1996;81:232-7.

107. Branch JD. Effect of creatine supplementation on body composition and performance: a meta-analysis. International Journal of Sport Nutrition and Exercise Metabolism. 2003;13:198-226.

108. Kreider RB. Effects of creatine supplementation on performance and training adaptations. Molecular and Cellular Biology. 2003;244(1-2):89-94.

109. Burke LM. Sports supplements debate: a risky practice that produces expensive urine or legitimate performance boosts that can be found in a packet or bottle? In: Taylor NAS, Groeller H (eds). Physiological bases of human performance during work and exercise. New York: Churchill Livingstone, 2008.

110. Kraemer WJ, Volek JS. Creatine supplementation - Its Role in Human Performance. Clinics in Sports Medicine 1999;18(3):651 - 66.

111. Branch JD. Effect of creatine supplementation on body composition and performance: a meta-analysis. International Journal of Sports Nutrition and Exercise Metabolism. 2003;13:198 - 226.

112. Dempsey RL, Mazzone MF, Meurer LN. Does oral creatine supplementation improve strength? A meta-analysis. The Journal of Family Practice. 2002;51:945 - 51.

113. Stockler S, Schultz PW, Salomons GS. Cerebral creatine deficiency syndromes: Clinical aspects, treatment and pathophysiology. In: Salomons GS, Wyss M (eds). Creatine and creatine kinase in health and disease. Volume 46: Springer, 2007:149 - 66.

114. Kreider RB, Ferreira M, Wilson M, et al. Effects of creatine supplementation on body composition, strength, and sprint performance. Medicine and Science in Sports and Exercise. 1998;30:73 -82.

115. Birch R, Noble D, Greenhaff PL. The influence of dietary creatine supplementation on performance during repeated bouts of submaximal exercise. European Journal of Applied Physiology. 1996;69:268 - 70.

116. Metzl JD. Strength training and nutritional supplement use in adolescents. Current Opinion in Pediatrics. 1999;11:292 - 6.

117. Ray TR, Eck JC, Covington LA, Murphy RB, Williams R, Knudtson J. Use of oral creatine as an ergogenic aid for increased sports performance: perceptions of adolescent athletes. South African Medical Journal. 2001;94(6):608 - 12.

118. Smith J, Dahm DL. Creatine use among a select population of high school athletes. Mayo Clinic Proceedings. 2000;75(12):1257 - 63.

119. Mottram DR. What is a drug? In: Mottram DR (ed). Drugs and sport, 2nd Edition. London: E&FN Spon, 1996.

120. Groff JL, Gropper SS. Advanced nutrition and human metabolism, 3rd ed. Belmont, Calif: Wadsworth Thompson Learning; 2000.

121. Lambert MI, Hefer JA, Millar RP, MacFarlane P. Failure of commercial oral amino acid supplements to increase serum growth hormone concentrations in male body-builders. International Journal of Sport Nutrition. 1993;3(3):298 - 305.

122. Nelson-Steen S, Bernhardt DT. Nutrition and weight control. In: Sullivan JA, Anderson SJ (eds). Care of the young athlete. Rosemount, IL: American Academy of Pediatrics and American Academy of Orthopaedic Surgeons, 2000.

123. Baechle TR, Earle RW. Essentials of strength training and conditioing, 2nd Edition / National Strength and Conditioning. Champaign, Illinois: Human Kinetics; 2000.

124. Petrie HJ, Stover EA, Horswill CA. Nutritional concerns for the child and adolescent competitor. Journal of Nutrition. 2004;20:620 - 31.

125. McArdle WD, Katch FI, Katch VI. Exercise Physiology: energy, nutrition, and human performance. 4th Edition. Philadelphia: Williams & Wilkins; 1996.

126. Micheli LJ. Overuse injuries in children's sports: the growth factor. Orthopedic Clinics of North America. 1983;14(2):337 - 60.

127. Timmons BW, Bar-Or O, Riddell MC. Influence of age and pubertal status on substrate utilization during exercise with and without carbohydrate intake in healthy boys. Applied Physiology, Nutrition, and Metabolism. 2007;32:416 - 25.
128. Fahlstrom M, Fahlstrom PG, Lorentzon R, Henriksson-Larsen K. Positive short-term subjective effect of sports drink supplementation during recovery. Journal of Sports Medicine and Physical Fitness. 2006;46:578 - 84.
129. Ivy JL, Lee MC, Brozinick JT, Jr., Reed MJ. Muscle glycogen storage after different amounts of carbohydrate ingestion Journal of Applied Physiology. 1988;65(5):2018-23.
130. Noakes T. Lore of running, 4th edition. Europe: Human Kinetics; 2004.
131. National Academy of Sciences. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. Washington, DC: National Academy Press; 1999.
132. National Academy of Sciences. Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline. Washington, DC: National Academy Press; 2000.
133. National Academy of Sciences. Dietary reference intakes for vitamin C, vitamin E, selenium and carotenoids. Washington, DC: National Academy Press; 2000.
134. National Academy of Sciences. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, DC: National Academy Press; 2002.
135. Fairfield K, Fletcher R. Vitamins for chronic disease prevention in adults: Scientific review. Journal of American Medical Association. 2002;287:3116 - 26.
136. Fletcher R, Fairfield K. Vitamins for chronic disease prevention in adults: Clinical applications. Journal of American Medical Association. 2002;287:3127 - 9.
137. McDowall JA. Supplement use by young athletes. Journal of Sports Science and Medicine. 2007;6:337 - 42.
138. Dubin CL. Commission of inquiry into the use of drugs and banned practices intended to increase athletic performance. Ottawa: Canadian Government Publishing Center; 1990.
139. Armstrong L. Every second counts. New York: Broadway Books; 2003.
140. Kalusha B. Doping Control in countries with limited health resources. 3rd International Football Medicine Conference. Sun City, South Africa, 2010.
141. Verroken M, Mottram DR. Doping control in sport. In: Mottram DR (ed). Drugs and sport, 2nd Edition. London: E&FN Spon, 1996.

142. Todd J, Todd T. Significant events in the history of drug testing and the Olympic Movement: 1960- 1999. In: Wilson W, Derse E (eds). Doping in elite sport: the politics of drugs in the Olympic movement. Champaign, Illinois: Human Kinetics Publishers, Inc., 2001.

143. Wikipedia - the free encyclopedia. List of doping cases in cycling <http://en.wikipedia.org/wiki/List_of_doping_cases_in_cycling>. Accessed 2009 March 25. Wikimedia Foundation, Inc., 2009.

144. Fahey J. Keynote Address. The Anzsla Conference. Melbourne: World Anti-Doping Agency, 2008.

145. The South African Institute for Drug-Free Sport. The athlete's guide to drug-free sport, 6th Edition. Cape Town: The South African Institute for Drug-Free Sport; 2007.

146. Carnegie Research Institute: Leeds Metropolitan University. Social science research fund: international literature review: attitudes, behaviours, knowledge and education – Drugs in sport: past, present and future. Montreal: WADA International Review of Literature; 2007.

147. Alaranta A, Alaranta H, Holmila J, Palmu P, Pietilä K, Helenius I. Self-reported attitudes of elite athletes toward doping: differences between type of sport. International Journal of Sports Medicine. 2006;27:842 -6.

148. Hoberman J. How Drug testing fails: The politics of doping control. In: Wilson W, Derse E (eds). Doping in elite sport. Champaign, Illnois: Human Kinetics, 2001:241 - 74.

149. Schwerin MJ, K.J. C. What do people think of male steroid users? An experimental investigation. Journal of Applied Social Psychology. 1992;22:833-40.

150. Grove JR, Paccagnella M. Tall poppies in sport: Attitudes and ascribed personality traits. Australian Psychologist. 1995;30:88 - 91.

151. Todd T. A history of the use of anabolic steroids in sport. In: Berryman JW, Park RJ (eds). Sport and Exercise Science Essays in the History of Sports Medicine. Urbana-Chicago: University of Illinois Press, 1992.

152. Koyser S, Mauren A, Miah A. Viewpoint legalization of performance enhancing drugs. Lancet. 2005;366:21.

153. Savulescu J, Faddy B, Clayton M. Why we should allow performance enhancing drugs in sport. British Journal of Sports Medicine. 2004;38:666 -70.

154. Melia P, Pipe A, Greenberg L. The use of anabolic androgenic steroids by Canadian students. Clinical Journal of Sport Medicine. 1996;6:9 - 14.

155. Laure P, Lecerf T, Friser A, Binsinger C. Drugs, recreational drug use and attitudes towards doping of high school athletes. International Journal of Sports Medicine. 2004;25:133 - 8.

156. Tangen JO. "Competitors influence each others drug use!" A heuristic use of discriminant analysis to predict drug abuse among Norvegian athletes. Corpus, Psyche et Societas. 1999;6:1 -20.

157. English G. A theoretical explanation of why athletes choose to use steroids, and the role of the coach in influencing behaviour. National Strength and Conditioning Association Journal. 1987;9:53 -6.

158. Reilly T, Mottram DR, Chester N, et al. Review of research into drug misuse in sport. London: UK Sports Council; 1996.

159. Hoppeler HH, Kamber MF, Melia PS. Doping and prevention of doping. International co-operation. Clinical Journal of Sport Medicine. 1995;5:79-81.

160. Verroken M, Mottram DR. Doping control in sport. In: Mottram DR (ed). Drugs and sport, 2nd Edition. New York: Routledge, 2003.

161. Radebe L. The player - victim, scapegoat or sinner? 3rd International Football Medicine Conference. Sun City, South Africa, 2010.

162. Singh G. Doping Control in countries with limited health resources. 3rd International Football Medicine Conference. Sun City, South Africa, 2010.

163. Sobal J, Muncie HL. Vitamin/mineral supplement use among adolescents. Journal of Nutrition Education. 1988;20(6):314 - 8.

164. Kim SH, Keen CL. Patterns of vitamin/mineral supplement usage by adolescents attending athletic high schools in Korea. International Journal of Sport Nutrition. 1999;9:391 - 405.

165. O'Dea JA. Consumption of nutritional supplements among adolescents: usage and perceived benefits. Health Education Research Journal of Biological Sciences. 2003;18(1):98 -107.

166. Bell A, Dorsch KD, McCreary DR, Hovey R. A look at nutritional supplement use in adolescents. Journal of Adolescent Health Education Research. 2004;34:508 - 16.

167. Ziegler PJ, Nelson JA, Jonnalagadda SS. Use of dietary supplements by elite figure skaters. International Journal of Sport Nutrition and Exercise Metabolism. 2003;13:266 - 76.

168. Nieper A. Nutritional supplement practices in UK junior national track and field athletes. British Journal of Sports Medicine. 2005;39:645 - 9.

169. Herbold NH, Visconti BK, Frates S, L. B. Traditional and non-traditional supplement use by collegiate female varsity athletes. International Journal of Sport Nutrition and Exercise Metabolism. 2004;14:586 - 93.

170. Hoffman JR, Faigenbaum AD, Ratamess NA, Ross R, Kang J, Tenenbaum G. Nutritional supplementation and anabolic steroid use in adolescents. Medicine and Science in Sports and Exercise. 2008;40(1):15 - 24.

171. Kayton S, Cullen RW, Memken JA, Rutter R. Supplement and ergogenic aid use by competitive male and female high school athletes. Medicine and Science in Sports and Exercise. 2002;35:S193.

172. Cohen PA. American roulette — contaminated dietary supplements. The New England Journal of Medicine. 2009;16(361):1523-5.

173. Dvorak J. Beyond sample collection... 3rd International Football Medicine Conference. Sun City, South Africa, 2010.

174. Madu SN, Matla MQ. Illicit drug use, cigarette smoking and alcohol drinking behaviour among a sample of high school adolescents in the Pietersburg area of the Northern Province. South African Journal of Adolescence. 2003;26(1):121 - 36.

175. Taylor M, Jinabhai CC, Naidoo K, Kleinschmidt I, Dlamini SB. An epidemiological perspective of substance use among high school pupils in rural KwaZulu-Natal. South African Medical Journal. 2003;93(2):135 -40.

176. Rottcher WH. A study of the leisure pursuits of leaners in grades 10, 11, and 12 in KwaZulu-Natal. Durban: University of KwaZulu-Natal, 2005.

177. Sports Information and Science Agency. Drug related issues in sport and awareness survey. Pretoria: National Department of Sport and Recreation, 1999.

178. Coopoo Y, Manjra SI. Knowledge and perceptions of elite South African athletes on doping and doping control, 1998 v. 2002. South African Journal of Sport Medicine. 2004;16(3):14 - 8.

179. Hertzog M. Considerations in determining sample size for pilot studies. Research in Nursing & Health. 2008;31:180-91.

180. Nieswiadomy RM. Foundations of nursing research (4th ed.). Upper Saddle River, NJ: Pearson Education; 2002.

181. Piccinelli M. Test-retest reliability of the Social Problem Questionnaire in primary care in Italy. Social Psychiatry and Psychiatric Epidemiology. 1997;32(2):57-62.

182. Maughan R. The scope of nutritional supplement use in sport. Health and doping risks of nutritional and social drugs. Germany: International Symposium, 2002.

183. Burke L CM, Cox G, Crawford R, Desbrow B, Farthing L, Minehan M, Shaw N & Warnes O. Supplements and sports foods. In: Burke L, Deakin V (eds). Clinical Sports Nutrition, 3rd ed. Australia: McGraw-Hill, 2006.

184. Lambert M. Performance enhancement by allowed means. 3rd International Football Medicine Conference. Sun City, South Africa, 2010.

185. O'Farrel T, Fals-Stewart W, Murphy M. Concurrent validity of a brief self-report drug use frequency measure. Addictive Behaviors 2003;28:327 - 37.

186. Secades-Villa R, Fernandez-Hermida J. The validity of self-reports in a follow-up study with drug addicts. Addictive Behaviors. 2003;28:1175-82.

APPENDICES

Appendix 1: Ethical clearance

e
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Constantinou

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M060953**
PROJECT	The Use of Performance Enhancing Substances & Supplements in SA High Schools Sport
INVESTIGATORS	Dr D Constantinou
DEPARTMENT	Exercise Science & Sports Med
DATE CONSIDERED	06.09.29
DECISION OF THE COMMITTEE*	APPROVED UNCONDITIONALLY

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

DATE 07.05.15 **CHAIRPERSON** .....
(Professors PE Cleaton-Jones, A Dhai, M Vorster, C Feldman, A Woodiwiss)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor :

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 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 2: Parent / guardian information sheet and consent form

University
of the Witwatersrand,
Johannesburg
Centre for Exercise Science and Sports Medicine

Room 46, Wits Education Campus, St Andrews Rd, Parktown, South Africa
Telephone: +27 11 717-3372/1 | Fax: +27 11 717-3379
Postal address: Wits Centre for Exercise Science & Sports Medicine, Wits Medical School, Wits, 2050, South Africa

PARENT / GUARDIAN INFORMATION SHEET and CONSENT FORM

Title of the study: The use of performance enhancing substances by adolescent males in selected Johannesburg boys' high schools.

Dear Parent / Guardian,

This is a letter asking you for permission to request participation of your son in a survey investigating the use of performance enhancing substances in selected high schools in Gauteng.

The questionnaire will take about 10 to 15 minutes to fill in. Participants' normal school curriculum will not be interrupted. The confidentiality of your son will be maintained continuously and they will be encouraged not to reveal their identity on the questionnaire. Kindly sign this consent form in the provided space below together with your response. Any questions or concerns will be answered by the researchers. Contact numbers are available below.

Kindly return this form by requesting your son to give the completed form to their coach / person in charge of school sport. The researchers will make sure that confidentiality is adhered to and will keep all collected data in a locked environment. The data will be group analyzed and will be reported on as presentations and / or made available for publication in the scientific and medical literature.

Thank you for your participation in this significant research.

Mr. Philippe Gradidge	Dr. Demitri Constantinou	Prof. Yoga Coopoo
072 620 4575	083 255 7721	083 415 7466

I have read and comprehended the information on the research that is being done on the use of performance enhancing substances in selected Johannesburg boys' high schools and

(1): consent to giving my son permission to participate in this study.

Signature of parent / guardian: _____

Date: _____

Or

(2): I do not give consent to my son permission to participate in this study.

Signature of parent / guardian: _____

Date: _____

Appendix 3: Minors' assent form

University
of the Witwatersrand,
Johannesburg
Centre for Exercise Science and Sports Medicine

Room 46, Wits Education Campus, St Andrews Rd, Parktown, South Africa
Telephone: +27 11 717-3372/1 | Fax: +27 11 717-3379
Postal address: Wits Centre for Exercise Science & Sports Medicine, Wits Medical School, Wits, 2050, South Africa

MINORS' ASSENT FORM

Title of the study: The use of performance enhancing substances by adolescent males in selected Johannesburg boys' high schools.

Researchers at The University of Witwatersrand, Johannesburg are trying to learn more about what performance enhancing substances selected Johannesburg boys' high schools are using in the hope of improving their athletic performance.

This is what will happen during this study:

You will be given a questionnaire by the researchers. This questionnaire will not require any personal information and will take about 10 to 15 minutes to complete. You may stop completing the questionnaire at anytime if you feel you need to. The information gathered in this study will help identify what, if any, performance enhancing substances are being used in selected Johannesburg boys' high schools. The study will also identify the attitudes of those participating with regards to the use of these substances in sport. Although you do not have to be in this study if you do not want to, you are encouraged to discuss this with your parents before making your decision. Participation in the study is voluntary and you may withdraw at any time. Please ask as many questions as you need to make sure you understand the nature and extent of the study before you sign this form.

Thank you for your participation in this significant research.

Mr. Philippe Gradidge	Dr. Demitri Constantinou	Prof. Yoga Coopoo
072 620 4575	083 255 7721	083 415 7466

I have read and understood the information on the research that is being done on the use of performance enhancing substances in selected Johannesburg boys' high schools and

(1): consent to volunteering to participate in this study.

Signature of student: _____

Date: _____

Or

(2): I do not consent to volunteering to participate in this study.

Reason (optional): _____

_____

_____

Signature of student: _____

Date: _____

Appendix 4: Principal information letter and permission form

University
of the Witwatersrand,
Johannesburg
Centre for Exercise Science and Sports Medicine

Room 46, Wits Education Campus, St Andrews Rd, Parktown, South Africa
Telephone: +27 11 717-3372/1 | Fax: +27 11 717-3379
Postal address: Wits Centre for Exercise Science & Sports Medicine, Wits Medical School, Wits, 2050, South Africa

PRINCIPAL INFORMATION LETTER and PERMISSION FORM

Title of the study: The use of performance enhancing substances by adolescent males in selected Johannesburg boys' high schools.

Dear Principal Name,

I thank you for the opportunity of asking your school to take part in this study.

The main aim of this investigation is to identify what, if any, performance enhancing substances are being used in selected Johannesburg boys' high schools. Ethical clearance has been granted by the University of Witwatersrand Ethics Committee (M060953) and permission has been obtained from the Department of Education to carry out this study.

A questionnaire has been formulated to elicit responses on performance enhancing substances used in order to improve performance. Further, the participants' attitudes regarding performance enhancing substance use will also be solicited.

The use of your school will be greatly appreciated to conduct this survey and every effort will be made to ensure that the participants' normal school curriculum will not be disrupted. Confidentiality of participants will be guaranteed. All collected data will be group analyzed to make certain of this. The results will be reported on as presentations and / or publications in the scientific and medical literature.

Any questions or concerns regarding this study will be answered by the researchers.

Thank you for your school's participation in this significant research.

Mr. Philippe Gradidge	Dr. Demitri Constantinou	Prof. Yoga Coopoo
072 620 4575	083 255 7721	083 415 7466

I have read and comprehended the information on the research that is being done on the use of performance enhancing substances in selected Johannesburg boys' high schools and

(1): give the researchers permission to conduct this study at "School Name".

Signature of principal or nominee: _____

Date: _____

Or

(2): I do not give the researchers permission to conduct this study at "School Name".

Signature of principal or nominee: _____

Date: _____

Appendix 5: Questionnaire

JOHANNESBURG BOYS' HIGH SCHOOL PERFORMANCE ENHANCING SUBSTANCE SURVEY

The questions below have been put together to investigate the use of performance enhancing substances in high school sport. Your involvement in this survey is voluntary and you may withdraw at any time. Your name must not appear on the questionnaire to ensure confidentiality.

Read the questions carefully and answer by placing an 'X' in the blocks provided, and where asked, please write in your answer appropriately. Make sure that you do not communicate with fellow participants when filling in the questionnaire and do not hesitate to ask any questions. Thank you kindly for your participation in this study.

SECTION 1: BACKGROUND INFORMATION

The questions following will ask background information about you.

1.1 What is your age? _____ Years old

1.2 What grade are you in?

8	
9	
10	
11	
12	

1.3 What ethnic group are you?

White	
Black (Indian, Coloured, African)	

1.4 What is the main school sport you participate in regularly? (Please mark one.)

Rugby	
Cricket	
Swimming	
Athletics	
Hockey	
Rowing	
Soccer	
Other (Please specify)	

1.5 Which <u>other</u> sports do you participate in regularly?

	Yes	No
Rugby		
Cricket		
Swimming		
Athletics		
Hockey		
Rowing		
Soccer		
Other (Please specify)		

SECTION 2: GENERAL INFORMATION

2.1 Read the questions carefully and answer suitably.

		Yes	No
2.1.1	Do you feel that the use of performance enhancing substances in sport is rising?		
2.1.2	Do you believe there is pressure placed on sportsmen to use substances in sport?		
2.1.3	Do you feel that doping tests will prevent the use of substances in sport?		
2.1.4	Are you aware of any substances that are prohibited by the World Anti-Doping Agency?		
2.1.5	Are you aware of the punishment for using prohibited substances in sport?		

2.2 Have you received information on the use of performance enhancing substances from anyone?

	Yes	No
Pharmacist		
Personal Trainer		
Coaches		
Friend		
Physician		
Biokineticist		
Sibling		
Parent		
I have not received information		
Other (please specify)		

2.3 Where do you receive your information about substances use in sport?

	Yes	No
Magazines		
Information Brochures		
Books		
Newspapers		
Journals		
The internet		
Other (please specify)		

SECTION 3: USE OF PERFORMANCE ENHANCING SUBSTANCES

3.1 In the past year (12 months), have you used performance enhancing substances?

Yes → Proceed to question 3.2	
No → Proceed to question 3.6	

3.2 When did you begin using performance enhancing substances?

10 – 12 years old	
13 – 15 years	
Over 15 years old	

3.3 Are your coaches aware that you are using performance enhancing substances?

Yes	
No	
Unsure	

3.4 What are your reasons for using performance enhancing substances?

	Yes	No
Assists me in coping with the stresses of sport.		
Helps to improve the way I perform in sport.		
Helps to reduce food craving in order to decrease my body weight.		
I feel pressured to.		
I feel afraid of being dropped from the team.		
I will have a better chance of making the team.		
Other (please specify)		

3.5 Do you use any of the following performance enhancing substances regularly?

	Yes	No
Anabolic-androgenic steroids		
Growth Hormone (hGH)		
Insulin (e.g. Apidra, Lantus)		
Adrenaline		
Caffeine (e.g. Redbull, Guarana)		
Other (please specify)		

3.6 If you DO NOT USE performance enhancing substances, what are the main MOTIVATING FACTORS why?

	Yes	No
I don't think it is not necessary to take them		
I am afraid of what it may do to my health		
It goes against what I believe		
They're difficult to come by		
I am worried about what would happen if I got caught		
It is not allowed at my school		
I cannot afford it		
I am concerned about getting addicted to them		
I am afraid of becoming unable to compete		
Other (please specify)		

SECTION 4: USE OF NUTRITIONAL SUPPLEMENTS

What nutritional supplements do you use regularly?

	Yes	No
Creatine supplements (e.g. Creatine Monohydrate)		
Protein supplements (e.g. Whey protein)		
Carbohydrate supplements (e.g. Energade, Powerade)		
Vitamins (please specify)		
Other (please specify)		

SECTION 5: ATTITUDES TOWARDS DOPING IN SPORT

Kindly rate the degree to which you agree or disagree with the following sport related statements.
1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly disagree (Please circle one number.)

(5.1) There is a problem of banned substance use in my sport/s.	1	2	3	4
(5.2) Sport organizations should offer educational programmes for athletes on the use of substances in sport.	1	2	3	4
(5.3) There are too many athletes using substances in my sport to enhance their athletic performance.	1	2	3	4
(5.4) The illegal use of substances by athletes has not been reported on enough in the media.	1	2	3	4
(5.5) The use of performance enhancing substances and supplements has risen in the last five years.	1	2	3	4
(5.6) I would never consider using performance enhancing substances.	1	2	3	4
(5.7) I am sometimes tempted to use performance enhancing substances.	1	2	3	4
(5.8) Many of my friends think it is acceptable to use performance enhancing substances.	1	2	3	4
(5.9) If I don't take performance enhancing substances, I will not be able to succeed because everyone else does.	1	2	3	4
(5.10) I think it is always wrong to use performance enhancing substances.	1	2	3	4
(5.11) I think athletes who want to succeed have to use performance enhancing substances sometimes.	1	2	3	4
(5.12) I don't think it is fair to use performance enhancing substances.	1	2	3	4

SECTION 6:

If you believe that the use of performance enhancing substances in sport is a problem, can you suggest some ways to help solve the problem?

Thank you for participating in this study!

Appendix 6: Permission letter from Department of Education

UMnyango WezeMfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Date:	21 May 2007
Name of Researcher:	Constantinou Demitri
Address of Researcher:	3 Tipuana Place
	Bedfordview
	2008
Telephone Number:	0117173372
Fax Number:	0117173379
Research Topic:	The Use of Performance Enhancing Substances and Supplements in South African High School Report
Number and type of schools:	20 Secondary Schools
District/s/HO	All Districts

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

Permission has been granted to proceed with the above study subject to the conditions listed below being met, and may be withdrawn should any of these conditions be flouted:

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*

4. *A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Senior Manager (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher must supply the Senior Manager: Strategic Policy Development, Management & Research Coordination with one Hard Cover bound and one Ring bound copy of the final, approved research report. The researcher would also provide the said manager with an electronic copy of the research abstract/summary and/or annotation.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Senior Manager concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

ACTING CHIEF DIRECTOR: OFSTED

The contents of this letter has been read and understood by the researcher.	
Signature of Researcher:	
Date:	