

**Current perceptions and usage practices of nutritional supplements
amongst adolescent rugby-playing school boys from the Kwazulu
Natal region**

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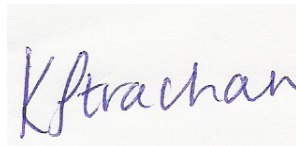
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ABSTRACT

The aim of the study was to investigate current perceived role of nutritional supplements in adolescent (16-18 years) male rugby players and establish usage practices within Kwazulu Natal (KZN) schools.

Methods The nutritional supplementation practices of **68** rugby players from 7 KZN secondary schools were surveyed using an anonymous paper-based questionnaire. The boys were asked to identify from a list (with "Other" as a selection) which supplement they used, the frequency of use, sources of supplement information and advice they base their choices on, where products were bought from, reasons for use, average monthly spend on buying these supplements, whether dietary changes were made in conjunction with taking a supplement and what was their understanding of the role of supplementation in achieving their performance goals.

Results Sixty eight out of 236 invited participants completed the questionnaire. This translated into a response rate of 29%. Fifty four percent of participants admitted to using nutritional supplements, protein and creatine being the most popular products listed (43% and 22% of supplement users, respectively). Thirty five percent of supplement users supplemented daily and 24% supplemented 3-4 times per week. Friends were the most popular source of advice and information regarding nutritional supplements 32% (n=12), with supplement company representatives the next most commonly used source 22% (n=8). Seventy percent (n=26) of supplements are bought from a pharmacy, with an average monthly cost of R250, but ranging from R30 to as much as R1500 per month. Seventy percent (n=26) indicated that they also made dietary changes in addition to taking the nutritional supplement. These dietary changes included making healthier food choices 81% (n=21), increasing intake of protein foods 65% (n=17), planned snacks around exercise 35% (n=9), increasing carbohydrate-rich foods 62% (n=16), increasing fruit and vegetable intake 50% (n=13), and including snacks between meals 35% (n=9). The study participants rated practice sessions and weight training as most important

in terms of helping them achieve their goals; diet, rest and supplements were similarly ranked as being between fairly to very important. Twenty two percent admitted that they would consider taking an illegal supplement if it would assist them in achieving their goals.

Conclusions

This study indicates that at least half of rugby-playing school boys (age 16-18 yrs) are making use of some form of supplementation, with protein and creatine supplementation being the most popular. The data indicate that rugby-playing school boys see their peers as a good source of information, and are willing to spend a large amount of money obtaining it (about R250 per month on average). This is concerning as peer pressure combined with lack of knowledge on nutritional supplement usage (and nutrition) can lead to widespread misuse of supplements, and potential detrimental side-effects in this young study population. However it highlights the value that school-level educational programmes (age and sport specific) can have in improving supplement usage practices and creating sound nutritional practices amongst this population, better equipping them at making informed decisions. In addition, educational programmes should be extended to other influential sources of information such as school coaches, teachers and parents.

OPSOMMING

Die doel van die studie was om die huidige persepsie oor die waarde van voedingssupplemente en die gebruikspraktyke daarvan in 16 -18 jarige adolessente manlike atlete in Kwazulu Natal (KZN) skole te bepaal.

Uitkomstes van die studie was om die voorkoms en tipe supplemente wat gebruik word, redes aangevoer vir die gebruik daarvan, kennis oor die rol van supplemente asook die bron van inligting te bepaal.

Metodes Die voedingssupplementasie praktyke van 68 rugby spelers uit 7 KZN sekondêre skole is ondersoek deur gebruik te maak van 'n anonieme vraelys (papier basis). Die seuns is gevra om van 'n lys (die opsie "ander" was ingesluit) te identifiseer watter supplement hulle gebruik, die frekwensie van gebruik, die bronne van inligting en raadgewing ontvang, waar die produk aangekoop is, redes vir gebruik, gemiddelde maandelikse kostes aangegaan en of dieetveranderinge tesame met die supplementasie aangegaan is. Kennis rondom die rol van supplementasie in prestasie doelwitte is getoets.

Resultate: Agt-en-sestig uit 'n totaal van 236 deelnemers wat uitgenooi is om deel te neem aan die studie, het die vraelys voltooi. Dus het 29% van die studie-deelnemers het dus op die vraelys gereageer. Vier en vyftig persent van die deelnemers het erken dat hulle supplemente gebruik waarvan kreatien en proteïen gelys is as die mees gewildste produkte (onderskeidelik 43% en 22%). Vyf en dertig persent het daagliks supplemente gebruik en 24% het 3-4 keer per week supplemente gebruik. Vriende was die mees gewildste bron van raad en inligting (32%), gevolg deur supplement maatskappy verteenwoordigers (22%). Sewentig persent van supplemente word gekoop by 'n apteek en 'n gemiddelde maandelikse bedrag van R250 word gespandeer, maar dit wissel van R30 tot soveel as R1 500 per maand. Sewentig persent het erken dat hulle dieet veranderinge in hul dieet tesame met die supplementasie aanbring. Hierdie veranderinge het die volgende ingesluit: die keuse van gesonder voedselsoorte (81%); 'n verhoogde inname

van proteïenryke voedselsoorte (65%); beplanning van peuselhappies rondom oefening (65%); verhoogde inname van koolhidraatryke voedsel (62%); meer vrugte en groente (50%) en die neem van peuselhappies tussen maaltye (35%). Die deelnemers het oefening met gewigte en oefensessies as die mees belangrike faktore geag om hul doelwitte te bereik. Dieet, rus en suplemente is daarnaas gelyk geag as redelik belangrik en 22% het erken dat hulle 'n verbode middel sal gebruik indien dit hulle sal help om hulle doelwitte te bereik.

Gevolgtrekkings

Die studie wys dat ten minste die helfte van skoolseuns wat rugby speel (16-18 jr) een of ander vorm van suplementasie gebruik, waarvan proteïen en kreatien die mees gewildste is. Die data dui daarop dat skoolseuns wat rugby speel hul tydgenote ag as 'n goeie bron van inligting oor supplement gebruik en dat hulle bereid is om groot bedrae geld te spandeer om die suplemente te bekom (gemiddeld R250,00 per maand). Dit is kommerwekkend aangesien groepsdruk tesame met 'n gebrek aan kennis oor suplementasie (en voeding) kan lei tot algemene misbruik van suplemente en moontlike nuwe effekte in hierdie jong studie populasie. Dit beklemtoon egter ook die waarde wat skool – gebaseerde opvoedingsprogramme kan hê om die bewustheid en kennis oor supplement gebruik in hierdie populasie te verbeter om hul in staat te stel om ingeligte besluite te neem. Dit moet ouderdom -en sportspesifieke voedingsonderrig insluit. Opvoedingsprogramme moet ook uitgebrei word na ander partye wat invloedryke bronne van inligting is soos skool afrigters, onderwysers en ouers.

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LIST OF ABBREVIATIONS

AAS	Androgenic anabolic steroid
CHO	Carbohydrate
DHEA	Dehydroepiandrosterone
FDA	Food and Drug Administration
GABA	Gamma-aminobutyric acid
GH	Growth hormone
HHG	Hypothalamic-hypophyseal-gonadal
HMB	Beta-hydroxy-beta-methylbutyrate
IGF-I	Insulin-like growth factor
KZN	Kwazulu Natal
n	Number of participants
SA	South Africa
SD	Standard deviation

CHAPTER 1: LITERATURE REVIEW

1.1 Introduction

Pressure to perform at school-level sports is great with a “win-at-all-costs” mentality emerging. Training schedules are highly structured often starting months before the season starts and many young athletes train several times a week, often for more than one sport, and some even train more than once a day. More and more athletes train extensively at an earlier age in the hope of being awarded a high school or university scholarship or being recognised for a professional career. This, plus the concern that dietary intake may already be inadequate, particularly in terms of total energy, protein, calcium, iron and other vitamins and minerals, could have long-term consequences on linear growth, bone mineral density and sexual maturation.^{1, 2,}

3

1.2 Effect of physical exercise and nutrition on the growth and maturation process

After 5 weeks of monitoring a group of adolescent males involved in sport, a significant decrease in growth factors were seen compared to a sedentary control group⁴. As noted in the review by Bertelloni et al.³ this decrease resembled that seen in children with under-nutrition and stunted growth due to coeliac disease, and those suffering from nutritional deficiencies due to anorexia nervosa³. Despite these results, it remains inconclusive as to whether there is a level of training that is considered excessive and able to cause long-term detrimental effects.³ However, as the number of young athletes engaging in high levels of sports training is increasing, it is vital that longitudinal studies are done to explore this further, and in the meanwhile health professionals involved with adolescent athletes must be aware of the potential effects and should provide necessary advice regarding training methods and dietary regimens³.

Nutritional inadequacy could also be to blame for, in the short-term, a greater risk of underperformance, injury and slower recovery.^{1, 2} It is understandable that young athletes and their parents are concerned about meeting nutritional requirements, and seek advice from

available sources. Due to their lack of knowledge relating to the nutritional content and adequacy of their dietary intake, nutritional supplementation is often viewed as a “safety net”,^{5,6} rather than focusing on achieving an optimal background diet which would be more beneficial to short- and longer-term health and development.^{7,8}

1.3 Growth of the nutritional supplement market

Nutritional supplements have become increasingly popular in recent years and two factors are thought to have played a role in this. The first being the Dietary Supplement Health and Education Act of 1994 which removed control of natural supplements from the jurisdiction of the Food and Drug Administration (FDA).⁹ This allowed rapid expansion and greater availability of many substances seen to be so-called “natural”. The second factor being an increasingly common mindset that “natural” is “good”.⁹ A huge concern when considering the use of these products in adolescence is that none of these products have undergone testing in this age group and so no long term effects of these products are known.⁹

The sources of supplement information are many (athletic trainers,¹⁰ parents,⁵ friends, doctors,¹¹ television (TV), magazines,¹² supermarkets and sport stores), but most are not trained or equipped with appropriate nutritional knowledge to provide scientific evidence-based advice,¹⁰ and unfortunately a dietitian is not commonly listed as a source of such advice.

A review by Rosenfield¹³ indicated a couple of elements that make adolescents vulnerable to the use of supplements / ergogenic aids. This includes factors such as peer pressure - adolescents are found to overestimate steroid use in their peers, and tend to use steroids to become well-liked.¹³ Adolescents also typically live in the present and disregard future health risks, in addition they generally lack knowledge of healthy alternatives and look for “quick fixes” to improve their performance, and this may lead to poor decision-making.¹³ They are also

particularly vulnerable to the aggressive marketing strategies and are easily influenced by successful elite athletes, trying to model their behaviours.¹³

Another major challenge when dealing with this age group is their incomplete prefrontal cortex which makes it difficult for them to plan, organise and strategize. Adolescents need to develop skills to think more critically prior to taking part in risky behaviour,¹³ such as making decisions over taking illegal performance-enhancing drugs.

Regarding the taking of supplements to enhance sporting performance there are two issues to consider further, the first is the risk of damage to the athlete's health due to the nature of substance taken, the dose and possibly combination of products, and secondly the ethical concern of providing an unfair advantage of improved performance due to using a particular product rather than through training alone.^{14, 15}

1.4 Supplement usage practices amongst young athletes

1.4.1 Global surveys

Several international studies (France,¹⁴ USA¹⁶ and Canada¹⁷) conducted at school level and amongst adolescents have indicated that supplements are commonly used,^{16, 14, 17} particularly by athletes who do weight training as part of the training preparation for their sport,¹⁶ with figures ranging from 3% to as much as 62% depending on the study.^{16, 14, 17, 11, 18, 19} A similar study conducted in the United Kingdom amongst 32 national track and field athletes competing at the 2004 World Junior Championships used a questionnaire survey and reported that 62% of participants were using supplements.¹¹ Another questionnaire-based study conducted in Canada using 333 adolescent athletes found that the most commonly used supplement was multivitamins (used by almost half of the study population), but 13.5% indicated that they used additional protein supplementation and 5.3% used creatine supplementation.¹⁷

Nine hundred-and-two football and volleyball athletes (males and females) from high schools in Iowa (USA) completed an anonymous survey investigating the use of nutritional supplements and it was revealed that the use of supplements is “widespread” ranging from creatine, androstenedione, Beta-hydroxy-beta-methylbutyrate (HMB), amino acids, Dehydroepiandrosterone (DHEA), phosphagen, weight gainer 1850, Tribulus, multivitamins, calcium and Gamma-aminobutyric acid (GABA).¹⁸ Supplements were being used despite lacking evidence of long-term safety, and without assessment of dietary intake to determine whether there was a need for supplementation.¹⁸

Other studies found that adolescents use a wide variety of supplements ranging from banned anabolic steroids^{20, 21} and amphetamines to caffeine, multivitamin and mineral supplements, creatine,^{17, 15, 21, 18} HMB,¹⁸ androstenedione,^{17, 18} protein supplements,¹⁷ and energy/sports drinks.⁵

The promotion of supplements is intense, despite the limited scientific evidence to support the claims.⁶ The marketing is very effective creating the impression of safe and effective products providing only positive aspects of the products.¹⁴ Lack of knowledge and misleading claims make the adolescent athletes and their parents particularly susceptible to the influences of this marketing.¹⁷

1.4.2 Surveys within South Africa

Data on nutritional supplement usage amongst the youth in South Africa is lacking. Studies need to be conducted to investigate sources of information leading to the purchase of a wide range of supplements, the specific types of products being used and the youth athletes’

understanding of the role of supplements in health and sports performance versus the all-encompassing role of balanced dietary intake.

A study that investigated the prevalence of androgenic anabolic steroid (AAS) use among school children from two separate geographical areas in South Africa found that the overall prevalence was 14.4 children per 1000, but that there was a significant difference between the two areas.²¹ Region A included matriculants from 41 schools of the Cape Education Authority, and region B included matriculants attending schools of the Johannesburg school boards in Gauteng Province.²¹ Prevalence of use was higher in sport participants, particularly high-achievers in sport, supporting the positive association between substance / supplement use and the pressure to perform in sport.²¹ If this is the case for performance-enhancing drugs such as steroids, then it is likely that the case is similar for nutritional supplements. Gyms were the most common source of supply of supplements in this study with gym friends supplying 25%, and gym instructors or owners supplying 22.5%.²¹ Other sources were team friends (20%), school friends (20%), veterinary surgeons (15%), coaches (15%), family doctors (7.5%), pharmacists (7.5%), and parents (2.5%).²¹

Research involving adolescents and the use of nutritional supplements is limited, probably due to the fact that they are minors and therefore require the consent of their parents prior to them being able to agree to participation. Also little is known about the physiological and psychological effects of supplementation in the under 18 year age group,⁷ and any beneficial or adverse effects are likely to manifest only much later in life.

1.5 Reasons for nutritional supplement use in sport

The high prevalence of nutritional supplement use in all sports exists despite limited scientifically proven benefits^{17, 7, 10} and uncertainty of the ability of products to enhance

performance,⁷ and although clearly aware of the claimed benefits, young people seem to be unaware of, or not interested in the potential risks associated with nutritional supplementation.⁵

21, 7

In 1994 Goldman conducted a survey among aspiring Olympians asking them two questions - The first was, "If you were offered a banned performance-enhancing substance that guaranteed that you would win an Olympic medal and you could not be caught, would you take it?"²² Out of the 198 athletes participating in the survey, 195 said that they would take it regardless.²² The second question was "Would you take a banned performance-enhancing drug with a guarantee that you will not be caught, you will win every competition for the next 5 years, but will then die from adverse effects of the substance?". More than 50% of the athletes answered "yes" to this question.²² This supports the emerging "win-at-all-costs" mentality.

Since the introduction by the International Olympic Committee of formal drug testing it has become clear that banned drugs are often used by athletes in achieving record-breaking performances, and this may be sending a message that these substances are required in order to achieve such performances. Additionally, these athletes receive fame and respect which gives the impression that these drugs are accepted.²²

The reasons most commonly given for taking nutritional supplements are short-term in nature, for example, to boost energy levels and prevent illness, improve performance,^{5, 15, 23, 7} for improved speed and endurance,¹⁵ to improve physical appearance¹⁵ and promote healthy growth⁶ and weight gain.¹⁷ From a sample of 10 000 adolescents living throughout the USA it was found that boys reading men's, teen, fashion or health and fitness magazines were twice as likely as their peers, who do not read these magazines, to use products that were perceived to enhance appearance, muscle mass or strength.¹⁶ Thus the marketing and advertising of these

products contribute significantly to the perceived benefits, particularly when using popular iconic athletes to promote the product. Often in these advertisements anecdotal evidence is used to promote the benefits of using the product rather than basing this advertising on scientific-evidence based results. This same study revealed that about 30% of the boys and girls reported wanting more defined muscles, therefore concern with body dissatisfaction may also be associated with the use of potentially unhealthy products to achieve the desired results.¹⁶

Nutritional supplements are also often taken as “health insurance” to make up for recognised poor dietary intakes or due to uncertainty about the adequacy of dietary intakes.^{5,24} Vitamins and minerals in one study conducted amongst university students in the USA (n=236) were thought to provide immediate energy (65%) and some thought that it would increase muscle strength (14.7%). However although vitamin and mineral supplementation has a role to play in improving deficient diets, there is no scientific evidence suggesting that general use would improve athletic performance.¹⁰

Supplements are not always used in ways consistent with the known relationship between nutrition and athletic performance.¹⁰ Blanket distribution of supplements is not appropriate, just because one product works well for one athlete it does not mean that another athlete will benefit in the same way. Increased knowledge is required so that athletes understand the role of diet in improved sports performance and the importance of assessing one’s diet prior to deciding what supplements are necessary.

1.6 Nutritional supplement usage and related safety concerns

The concern among health professionals is that the supplement industry in South Africa (SA) is currently not regulated sufficiently.^{25, 8} These products are categorised as nutritional supplements and thereby do not need to undergo rigorous testing (e.g. FDA or Medicines

Control Council (MCC)) to confirm safety and efficacy. In South Africa a survey in 2004 detected that 12 (40%) out of 30 over-the-counter nutritional supplements contained banned substances, such as ephedrine.²³ For this reason nutritional supplements and sports foods cannot be regarded as “safe” or harmless to health.²³ Even when these nutritional supplements are labelled as “safe”, illegal substances prohibited by the International Olympic Committee (IOC) and World Anti-Doping Agency (WADA) may still be found in varying amounts.⁷ In most cases the contamination of nutritional supplements with banned substances may be due to poor manufacturing procedures, but there is evidence that it could be deliberate by manufacturers to increase sales by ensuring noticeable results following taking their products.^{24, 7} Therefore, the safety of many well-advertised nutritional supplements is unknown,^{25, 8} let alone whether they are safe for use in adolescents.⁹

Athletes (youth in particular) are for the most part unaware of the above-mentioned safety concerns and are relying on information provided on the supplement labels. A survey among UK track and field athletes found that of the 32 athletes only one was concerned about the purity and safety of nutritional supplements, and 71% of those using supplements believed that there was a risk of a positive doping test.¹⁹

1.6.1 Protein supplementation

Inappropriate use of general macro-nutrient supplements such as protein supplements is a concern. Though research indicates that athletes may have greater protein requirements than the sedentary population, protein needs are generally easily met via the diet and ingesting more than is required to maintain a positive nitrogen balance will not offer further benefit.²⁶ The potential increased need for dietary protein does not necessitate additional protein supplementation in most cases, provided a well balanced varied diet containing complete protein foods, such as meat, chicken, fish, low fat dairy products, is taken regularly.²⁷

Growing (and highly active) adolescents could be at a greater risk of sub-optimal dietary protein intake because of their raised needs due to growth and development, but studies show that generally athletes increase their food intake to meet energy requirements which automatically meets their protein needs.¹ Hence, before it can be determined whether supplementation is required, individual assessment must occur to assess whether deficiencies in the dietary intake exist. Should dietary deficiencies exist, effort should first be made to correct the dietary intake, as this is a more sustainable, healthier and cheaper option than supplementation.

The National diet and nutrition survey conducted in the United Kingdom in 2003 found that the average protein intakes for all adults between the ages of 19 to 64 years were well above the UK Reference Nutrient Intake (RNI) for protein, with a mean daily intake at least 130% of the RNI.²⁸ Similarly, in South Africa the mean total protein intake for age groups 1-9 years in all provinces was found to be greater than the Recommended Daily Allowance (RDA), urban children having a significantly greater mean dietary protein intake than rural children ($p=0.0001$), but in two provinces (Northern Cape and free State) there was the highest percentage of children with protein intakes less than half of the RDA.²⁹ Despite this data being of a different age group to that being studied in this survey, it is the only national data available and may thus potentially illustrate a similar problem in adolescents.

Studies in adult populations indicate that excessive protein intake ($>2\text{g} / \text{kg}$ body weight / day) in the long-term may contribute to overweight and calcium losses which, if calcium intake is inadequate, may lead to osteoporosis in the long term.²⁶ Protein foods that also contribute fat and cholesterol should be restricted to avoid detriment to heart health⁸ and other diseases of lifestyle.

Most of the research conducted has focused on the prevalence of steroid usage, but because the use of protein powders, creatine and amino acids is much more common, the significance of the adverse effects of these products is potentially much greater²² and warrants more research.

1.6.2 Creatine supplementation

Creatine monohydrate (or commonly referred to as 'creatine' in short) is a very popular supplement used by athletes¹⁵ and has been well-researched in adult populations. There is little evidence of side effects when used at levels matching average daily creatine turnover (~2-3 g / day), thus giving a high level of confidence to the safety of this supplement in healthy adult populations.³⁴

Creatine is naturally present in dietary sources such as fish, and meat. Creatine is also formed from glycine, arginine and methionine and produced by the liver, kidneys and pancreas. It is then transported to muscle, heart and brain tissues, 95% of which remains in the muscle.²² Creatine is purported to offer benefit in anaerobic, short duration, maximal-intensity exercise,⁶ allowing faster muscle ATP recovery between maximal effort bouts and greater ATP energy availability to perform repeated bouts of exercise (for example repeated sprints, pushing weights), and overall may help a person to train harder during each session (hence also the ability to increase muscle size and endurance).^{8, 19} Indications are that it may also buffer lactic acid production during exercise which delays muscle fatigue during high-intensity exercise.⁸ For these reasons it is seen to potentially add value to a rugby player's training and performance ability.

Typically there are athletes who respond to creatine supplementation and those that do not (possibly due to high baseline creatine intake and levels and muscle fibre type / composition).²²

Some side effects which need consideration include the effect of causing water retention during the initial stages amounting to about 1-2 kg in the first week, for some athletes this could be detrimental to their performance,⁶ particularly speed-reliant athletes.²² Additionally, increased muscle cramping, muscle tears and electrolyte dilution, GI upset and dehydration may also occur,⁶ although these adverse effects are not uniformly seen.⁸ There is no data suggesting that creatine is a health risk, but this should not be interpreted as an assurance of safety.¹⁹

However, to our knowledge there is no data available looking at the effects of usage in under 18 year old populations. As such, there is consensus in the literature that it is not recommended for use in people under the age of 18 years.^{15, 22, 13} Despite this caution in scientific circles, creatine is used by adolescents, as demonstrated by a study of 1103 New York City adolescents, where 44% of the 12th grade scholars participating the study admitted to using creatine supplementation.¹⁵ Reasons could include the aggressive marketing of this legal supplement, to which adolescents are likely to be particularly vulnerable. These young athletes may be trying to copy successful famous athletes, and the pressure to win from coaches, parents, peers may be great enough to entice such practices.¹⁵

1.6.3 Other popular nutritional supplements marketed towards increased muscle strength and size improvement

Beta-hydroxy-beta-methylbutyrate (HMB) and amino acids are commonly used by adult athletes,^{6, 8} both are considered legal.³¹ HMB is a metabolite of leucine (an essential branched chain amino acid) purported to decrease protein catabolism,^{6, 19} hence promoting a net anabolic effect.¹⁹ HMB used in the early stages of training may reduce the degree of exercise related muscle damage, and may contribute to a small reduction in body fat percentage with a small increase in muscle mass gain.^{26, 31} Studies to date have focused on the effects on organ function (renal and liver) and haematological parameters.¹⁹ At this stage there are no

recognised side effects,^{6, 31} but results from long terms studies are still required,³¹ research in the use and safety of HMB is still in the very early stages.¹⁹ Furthermore no studies exist in adolescents; therefore HMB-use should be discouraged in adolescent athletes.¹⁹

Branched-chain amino acids (BCAA) are included in group B of the classification system of nutritional supplements used in South Africa (SA) which implies that conclusive evidence is lacking of its beneficial effects.^{25, 31} Group A of this classification system includes supplements and sports foods that provide a performance benefit or a timely source of nutrients (e.g. HMB, creatine, sports drinks), and group C includes supplements that are prohibited for use by the International Olympic Committee (IOC) and World Anti-Doping Agency (WADA) (e.g. testosterone precursors and ephedrine). However, the potential indication for BCAA supplementation is during prolonged aerobic endurance events through their purported effects of competitive inhibition of dietary tryptophan transport across the blood-brain barrier, potentially reducing serotonin production thus delaying mental and physical fatigue.⁶ Single large doses of BCAA (about 300mg/kg body weight) have been found to increase ammonia production during exercise, and therefore it is recommended to ingest multiple smaller doses before or during exercise.²⁶ Further research is needed in this area to clearly define the effects of taking BCAA during exercise, its effects on endurance performance and the dosage needed to establish the benefit thereof.²⁶

Glutamine is also classified in group B, and further research is needed to confirm the benefit of supplementation,²⁶ however, it is hypothesized that supplemental glutamine will spare intramuscular glutamine, and therefore may have an anabolic effect. It is commonly used amongst athletes to enhance immune system function, but this too needs to be confirmed through further scientific research.²⁶ None of the references used listed any known side-effects of glutamine supplementation.

1.6.4 Popular supplements marketed towards decreasing body fat

The main active ingredient in so-called “fat burners” is ephedrine, or pseudoephedrine, both closely related to amphetamine.²² Ephedrine is derived from ephedra herbs (ma huang) and it possesses adrenergic agonistic effects, enhances the release of norepinephrine, and stimulates the central nervous system.²² It is marketed to decrease appetite and increase energy, metabolism and performance.²² Ephedrine is commonly combined with caffeine and in 1998 seventeen deaths had been linked to its use in this form.⁸ Traditionally ephedrine is used by athletes for quick energy and to aid with fat loss, and this, despite the majority of studies available showing no change in sports performance with ephedrine use. Adverse effects associated with its use include hypertension, arrhythmias, anxiety, tremors, insomnia, seizures, cerebra vascular accident, myocardial infarction and death.^{22, 19} The use of ephedrine products is banned by the IOC.^{31, 22, 8} Given this, and the lack of supportive data and safety concerns, the use thereof should be discouraged in adolescent athletes.¹⁹

None of the above supplements have been investigated for efficacy or side-effects in young athletes. However, based on the fact that further research is needed in most cases even in the adult athletic population, the use of these supplements in an adolescent population (< 18 years) would be of major concern.

Safety measures need to be implemented within this market to safe-guard young athletes, but such measures must be sensitive to different age groups too. A large component of these safety measures need to include education and raising awareness of the specific roles of supplements and appropriate use depending on the sport and the individual athlete’s goals.

1.7 Sources of supplement and nutritional information and advice

A questionnaire survey conducted in Nebraska among 139 high school students found that the most common source of information pertaining to supplements was the coach (38.1%), with fitness clubs second (24.5%) and health store clerks and books and magazines third and fourth with 10.8% and 10.1% respectively. An important question is what the coaches' knowledge is and where *they* get the information from. A previous study by Scofield et al.¹² found that coaches score poorly on knowledge of general nutrition of adolescent athletes. In this same study¹² 56.8% of the students who participated were willing to attend a nutrition talk on dietary supplements provided by a health professional, which indicates they recognise a need for further information on this topic.¹²

In a study conducted with South African (n=2772) school children investigating the prevalence of androgenic-anabolic steroid use, the most common sources of advice included gymnasium friends (25%), gymnasium owner or instructors (22.5%), team friends (20%) and school friends (20%).²¹ A study conducted in France amongst 6 402 adolescent athletes competing at regional level during the 2001-2002 school year investigated the demand and supply of drugs to improve performance, and found that mostly products were obtained from a friend, their parents or a family doctor, others mentioned a drug-dealer, a pharmacist, their trainer, sports teacher, or physiotherapist.¹⁴

A survey was conducted among students from 8 universities in USA to investigate whether nutritional supplements were used, the perceived efficacy of the supplements, availability of a registered dietitian, use of nutrition services, and perceptions of athletic trainers' knowledge of nutrition.¹⁰ It was found that although dietitians were available at half of the universities, only 14% of respondents listed a dietitian as their primary source of nutrition information and the

athletic trainer remained the most frequent source of nutrition information.¹⁰ Similarly a questionnaire-based survey done amongst 32 national UK track and field athletes competing at the 2004 World Junior Championships also found that 75% of the athletes had access to a dietitian specializing in sport nutrition, but despite this the service was infrequently used. Coaches had the greatest influence on the athletes' supplement practices, with doctors and dietitians being less influential.¹¹

The United Kingdom's position statement on supplement use in sport states "Diet, lifestyle and training should all be optimized before considering supplements and athletes should assess the need for supplements by always consulting an accredited sports dietician and/or registered nutritionist with expertise in sports nutrition and a sports and exercise medicine doctor before taking supplements." They also stress that it is the responsibility of the athlete if they are found to have banned substances in their system.³² The position statement from the Sports Nutrition Advisory Committee of Coaching Association Canada on supplement use states that supplements are not a shortcut to optimal performance and that attention needs to be paid to a well-designed training and nutrition programme, and then hard work is required to be better than the competition.³³ It is the recommendation of the Sports Science Institute of South Africa that "no persons under the age of 18 should take any sport-specific supplement without the advice of a sports physician or dietitian".²⁵

Before any effective program can be implemented to control the advice given regarding supplement use there needs to be a clear understanding of the most commonly used sources of this information. These individual sources can then be targeted to ensure appropriate advice is given, or at least that the athlete is referred to an adequately knowledgeable person.

1.8 Future Research

Many IOC and WADA banned substances have been tested and found to have adverse health effects in the adult population, and other substances, for example creatine, and caffeine have been found to have no adverse long term health effects but may contribute a small but important effect in improving sports performance in adults.³⁴ Larger studies need to be conducted to establish what the current supplement usage practices amongst athletes are, what the influences of such trends are and where the supplements are sourced in order to target programmes effectively to change poor practices.

The purpose of this survey was to explore the prevalence of supplement usage in 16-18 year old rugby players, and determine where they get their information on these products from, what their perceived roles and benefits of these products is, whether they perceive diet to play a role and how other factors contribute to their performance ability. It is also intended to provide practical suggestions on how to prevent inappropriate supplement usage in this age group.

CHAPTER 2: METHODS

2.1 Aim

To investigate the prevalence of nutritional supplements usage amongst adolescent male rugby players (16-18 yrs) from KZN schools.

2.2 Objectives

The specific objectives of the study are:

1. to investigate the prevalence of usage of nutritional supplements;
2. to investigate the reasons for use;
3. to investigate knowledge of the role of supplements;
4. to determine which sources of information are relied upon;
5. to determine whether dietary intake changes were made by supplement users

2.3 Study Design

An observational descriptive study was conducted amongst 7 KZN schools. Each school was contacted and informed of the intentions of the study and invited to participate, all schools volunteered their participation. A list of all boys playing rugby within the specified age group was requested from each school. From this list 35 boys were randomly selected (the investigator selected each name whilst closing her eyes and using a pen to pick out a name from the list of randomly arranged names) and were invited to participate in the study. A meeting was called with these groups of selected boys at each school and an outline of the study and its aims were given, and they were then invited to participate. Those that accepted were given a blank consent form to take home to allow their parents or legal guardian to read more detailed information on the study and if they were in agreement they were required to complete the form. Once consent forms had been signed and returned to the school, a further meeting was called with these boys and a paper-based questionnaire (appendix 1) was distributed for completion. Only those boys who returned a completed consent form were permitted to participate in the

survey. The investigator personally distributed the consent forms and administered the questionnaire at each school. Neither names of the boys nor the schools were recorded on the questionnaire in order to maintain anonymity. At one school there was a nil return of consent forms. No attempt was made to follow-up non-responders. The study was approved by the Ethics committee of Stellenbosch University.

2.4 Study Population

Seven schools from Kwazulu Natal were invited to participate. The schools were selected for having at least one boys' rugby team that represented the school. The participants were boys aged between 16 and 18 years old. No ethnic group was excluded, and there were participants from more than 1 ethnic group included in the study. Two hundred and forty five boys from 7 KZN schools' rugby teams were randomly selected and invited to participate in the survey. Of these, 236 boys took consent forms home, of which 68 boys returned completed consent forms and agreed to complete the questionnaire.

2.5 Questionnaire

2.5.1 Pilot Study

A group of 5 rugby players (16-18 yrs) from one of the schools were asked to give feedback on the language and content of the questionnaire prior to administering to the selected groups. They were asked to independently complete the questionnaire, and were then asked to provide feedback on the questionnaire during an open-forum discussion session. There appeared to be no ambiguity or other problems so no changes were made to the original questionnaire. The only issue raised was the need to highlight to participants that only one option could be selected in question 2, 4 and 11, as it was felt that this was not made sufficiently clear on the questionnaire. These boys were excluded from the study.

2.5.2 The Questionnaire Design

The questionnaire was designed to obtain information on the prevalence of usage of nutritional supplements that are currently on the market and popular amongst sports participants based on the investigators professional experience of working with athletes. They were asked to indicate from this list (with “other” as a selection), which one they use most frequently. Participants were asked if they use sports or nutritional supplements, and if they did, then how often they took them. Eight popular supplements^{5, 6, 9, 10, 15,16, 17, 18, 19, 22} were listed from which they were required to indicate which they were using; if they were using more than one then they were required to select the one they considered to be most important. Additionally the supplement name was requested, how often they take the supplement, how long they had been using the supplement for, and whether they had experienced any adverse effects since taking it. They were also asked how / where they found out about the product (with a list of potential sources given to select from^{5, 6, 10, 11, 12, 13,16, 17}), what benefits they expected to get from using the product^{5, 11, 14, 18} and whether they had achieved these results. Participants were asked to indicate how much is spent monthly on buying their supplements. A list of 7 purchase points was given^{13, 14, 21} and participants were asked to indicate where they obtain their product from. Participants were asked if they had made any change to their diet to assist in achieving their goals, and if they had, they were requested to select those changes from a list of possible changes. In determining the perceived value of team practice, supplements, dietary intake, rest and weight training a scale consisting of 1 to 5 was used. Finally participants were asked whether they would consider taking an illegal supplement to achieve their goals.

The questionnaire contained 15 questions, most of these were closed questions, some with either a “yes” or “no” response required, and others with a multiple choice option. In 3 cases an “other” option was provided in the event that the multiple choice did not offer an appropriate alternative. One open-ended question was included for the participant to list any adverse

effects from taking their choice supplement. The questionnaire took anything from about 1 minute to complete (in the case that no supplements were taken) up to about 10 minutes.

2.6 Statistical Methods

Analysis of results was completed using Statistica 8 and Microsoft Excel XP. Due to the descriptive and informative nature of the study, mostly descriptive statistics in the form of mean and standard deviation (SD) for nominal data and percentages of the total population for ordinal data was calculated to determine the central tendency.

CHAPTER 3: RESULTS

3.1 Demographic Information

The total number of boys invited to participate in this study was 245 (35 at each of 7 schools), not all those invited attended the initial session where informed consent forms were distributed, only 236 took these forms home. Although 77 provided completed consent forms (table 3.1), only 68 attended the meeting to complete the questionnaire. This was a response rate of 28.8%, 68 out of a total of 236 selected subjects. The mean age of the study population was 16.5 [Standard Deviation (SD) 0.6-0.8] years.

Table 3.1: Average age of participants per school

School	No. of consent forms returned	Age (years)
SCHOOL A	10	16.9 ± 0.7
SCHOOL B	13	17.2 ± 0.6
SCHOOL C	23	16.7 ± 0.6
SCHOOL D	7	16.9 ± 0.7
SCHOOL E	8	16.5 ± 0.8
SCHOOL F	16	16.8 ± 0.7

Age data presented as means ± SD

3.2 Prevalence and frequency of supplement use

Question 1 asked whether the participants used sports or nutritional supplements. Fifty four percent (n=37) of those who completed the questionnaire admitted to using supplements (figure 3.1). Of those, 100% (n=6) of participants from school D admitted to using supplements, 64% (n=14) of school C, 57% (n=7) from school F, 36% (n=4) from school A and B and 33% (n=2) from school E (see table 3.2).

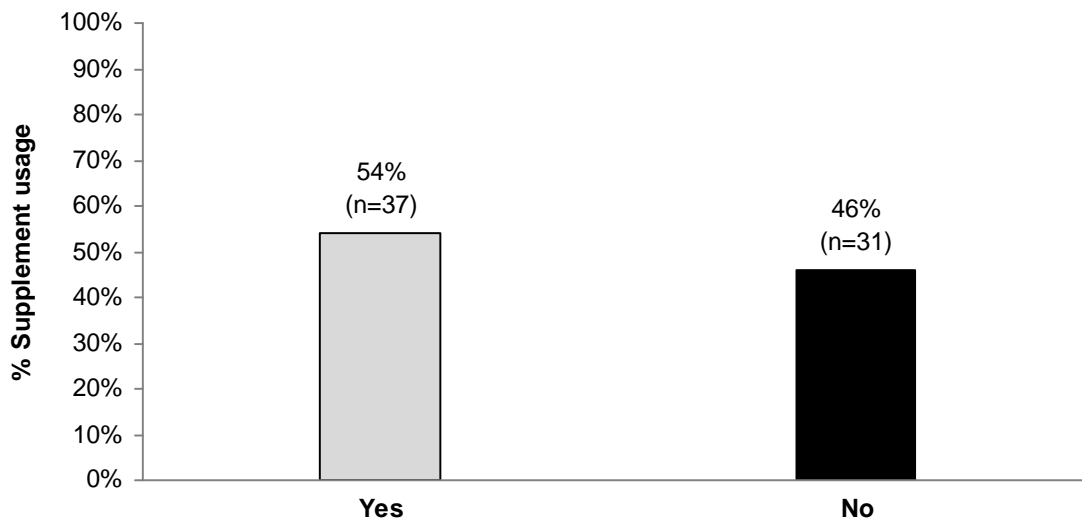


Figure 3.1: Results of the whole study group showing the total prevalence of supplement use within the surveyed schools

Table 3.2: Results showing the proportion of supplement users and non-users within each school surveyed.

SCHOOL	SUPPLEMENT USERS		SUPPLEMENT NON-USERS	
	%	# subjects	%	# subjects
A	36.4%	4	63.6%	7
B	36.4%	4	63.6%	7
C	63.6%	14	36.4%	8
D	100%	6	0%	0
E	33.3%	2	66.7%	4
F	58.3%	7	41.7%	5
TOTAL		37		31

Of the positive responses (i.e. subjects answering “yes”) to question 1, 14 participants were from school C and school E had the lowest positive response to this question with only two participants using supplements (see table 3.2). However, school C also had the greatest response rate in that they completed the greatest number of questionnaires (32%, n=22) and school E was one with the lowest response rate (9%, n=6) (see figure 3.2). School C on the other hand had the greatest number of participants and therefore it is more likely that they would have a greater response to this question again by virtue that there were so many more participants from that school. Schools C, D and F had more positive responses than negative responses ((n=14), (n=6), (n=7), respectively). Schools A, B and E had more negative responses ((n=7), (n=7) and (n=4), respectively (table 3.2).

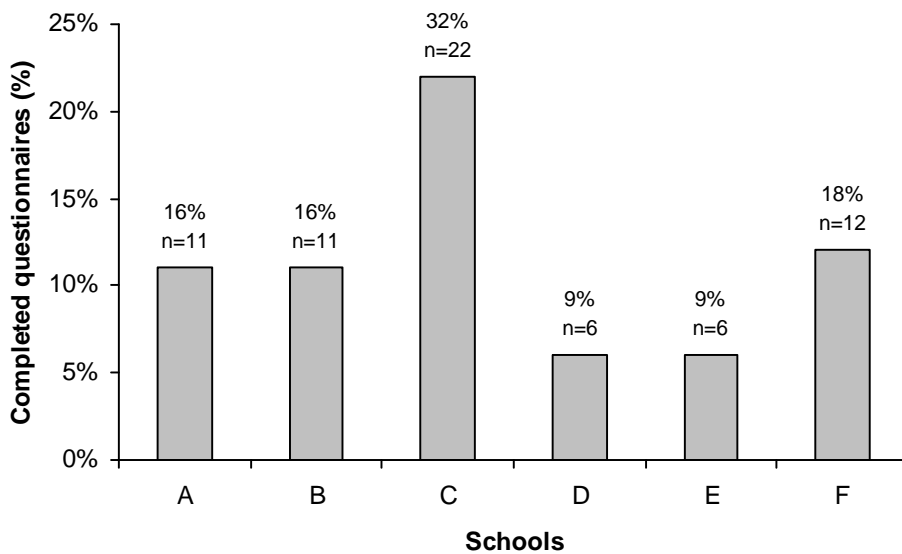


Figure 3.2: Results showing the response rate of returned questionnaires of each school of the total 68 completed questionnaires received

The second part of question 1 asked participants who admitted to using supplements to indicate how often they used it. Thirty five percent (n=13) of boys using supplements do so daily, with

24% (n=9) using it 3-4 times per week, 16% (n=6) using 1-2 per week, 11% (n=4) using it only once a week and 14% (n=5) less than weekly (see figure 3.3).

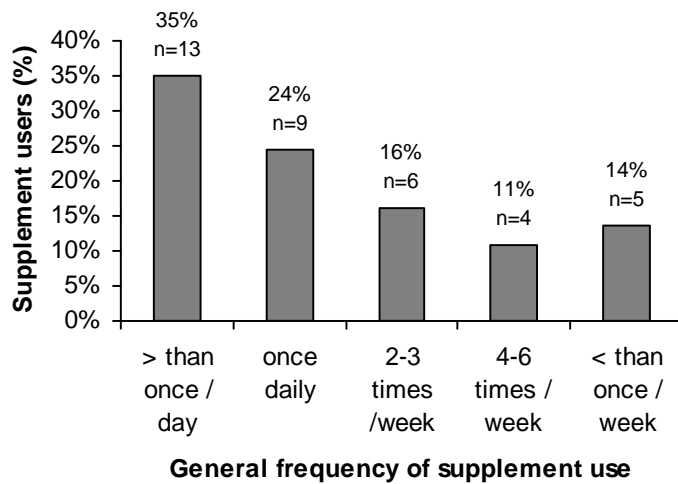


Figure 3.3: Frequency of supplement use

3.3 Type of products used

Question 2 asked participants to indicate the product that they use, and if they use more than one product to indicate the one they use most frequently. Eight examples of products were listed with the option of “other” to provide them the opportunity to list a product not included. Product names were also requested. Protein and Creatine were most commonly used, 43% (n=16) and 22% (n=8), respectively. Mass builders are used by 14% (n=5) of the participants. All other products are used by less than 10% (n<3) of the sample group (figure 3.4). Other products investigated included fat burners, amino acids, HMB, energy drinks and meal replacements. A further 6% (n=2) indicate “other” products of which “nitric oxide” and a “strength booster” were listed (See figure 3.4).

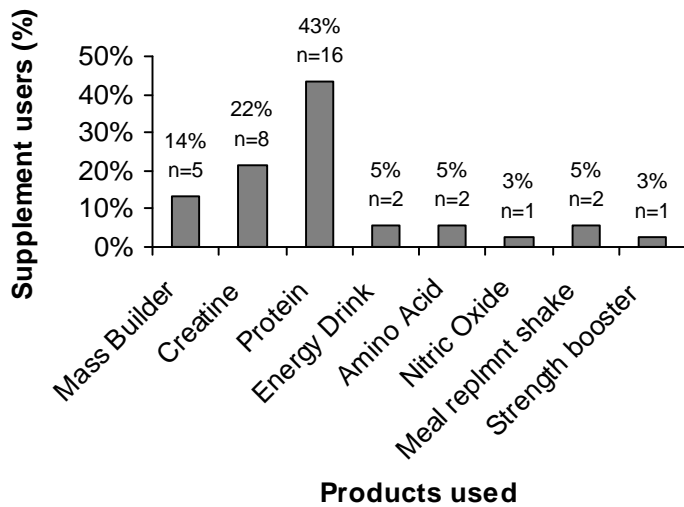


Figure 3.4: The products most commonly used by participants

Table 3.3 shows the breakdown of supplements used at each school. From this table it is clear that protein supplements are used at all schools, and creatine is used at all but one school, indicating the popularity of these supplements. Energy drinks and meal replacements were relatively unpopular among this group.

Table 3.3: Breakdown of types of supplements used at each school

Supplements used by participants at each school % (n)									Total no. supplements used at each school
School	Mass		Protein	Energy Drink	Amino Acid	Nitric oxide	Meal replacement	Strength Booster	
	Builder	Creatine							
A	1	1	2	0	0	0	0	0	4
B	0	1	1	1	1	0	0	0	4
C	2	4	7	0	0	1	0	0	14
D	0	1	1	1	1	0	2	0	6
E	0	0	1	0	0	0	0	1	2
F	2	1	4	0	0	0	0	0	7

As shown in Table 3.4, “Mass builders” were used by 5 participants either once a day, 4-6 times per week or less than weekly. Creatine was used by 8 participants, 50% of these used it once a day, with 1 participant using it more than once a day. Protein supplements were used by 16 participants, 6 of which used it 2-3 times per week, 4 used it more than once a day, 3 used it less than once a week, 2 used it 4-6 times per week and 1 used it once a day. Energy drinks, amino acid supplements, nitric oxide, and meal replacements were used by 2 or less participants each (see table 3.4)

Table 3.4: Frequency of use of each of the supplements being used at the schools

Products Used	Frequency with which each product is used by participants % (n)					Total no. participants using each product
	> than 1/day	1/day	2-3x /wk	4-6x /wk	<1/wk	
Mass builder	0	1	0	3	1	5
Creatine	1	4	2	0	1	8
Protein	4	1	6	2	3	16
Energy drink	0	0	1	0	1	2
Amino Acid	1	0	1	0	0	2
Nitric Oxide	0	0	0	0	1	1
Meal replacement	2	0	0	0	0	2

3.4 Source of information

Question 4 asked the participants where they found out about the product they are using, 6 choices were given to be selected from (sport magazine, gym, coach, friends, Television (TV) commercials, and supplement industry / representative). Information on these products was obtained from friends (32%, n=12), a supplement company representative (22%, n=8), the gym (19%, n=7), sports magazines (19%, n=7), coaches (5%, n=2) and TV (3%, n=1) (figure 3.5).

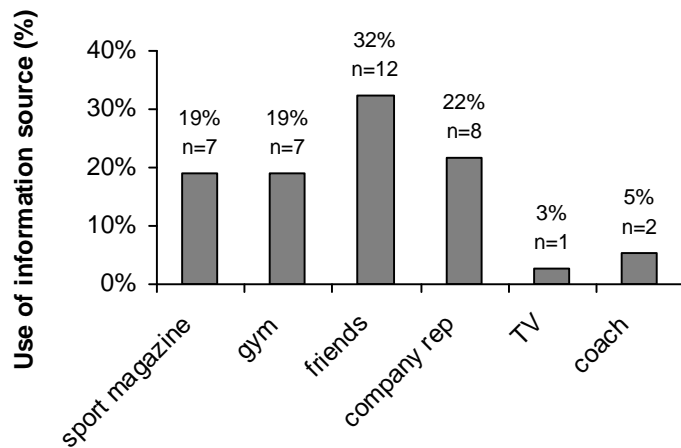


Figure 3.5: The sources used by the participants to get advice and information about the products that they use

At school B and C friends were the most common source of information (3 of 4 and 7 of 14 supplement users, respectively). At school A, 3 of the 4 supplement users obtained information from sports magazines. School D was the only school where the coach was listed as an important source of this information (n=2). At school E it was an even divide between friends and the company representative (n=1), and at school F the company representative was the most common source of information (n=4) (table 3.5).

Table 3.5: The sources of information most commonly used at each school

School	Sources of information used by each school					
	Sports Mag	Gym	Friends	Company rep	TV	Coach
A	3	1	0	0	0	0
B	1	0	3	0	0	0
C	2	3	7	2	0	0
D	1	1	0	1	1	2
E	0	0	1	1	0	0
F	0	2	1	4	0	0
Total no. using each source	7	7	12	8	1	2

The investigators also determined whether the source of information and advice on supplementation influenced the type of supplement purchased. There was no relationship between the source of information and the type of supplement used ($p=0.8$).

3.5 Reasons for use

Question 5 asked participants to indicate by selecting from a list of eight benefits (and “other” as a selection), which results they expected to experience by taking the supplement. They were able to select as many benefits as applied to them. Protein and Creatine are the most commonly used supplements and the reasons given for their use was investigated in order to assess their knowledge regarding these products. Both creatine (88%, $n=7$) and protein (56%, $n=9$) were thought to increase strength (table 3.3). Neither were thought to increase endurance (88% ($n=7$) and 81% ($n=13$) for creatine and protein, respectively) (table 3.6). In terms of allowing the athlete to train harder it was thought by 50% ($n=4$) that creatine would allow one to train harder, and only 25% ($n=4$) thought protein would facilitate harder training (table 3.6). Both creatine and protein were thought by 63% ($n=5$ and $n=10$, respectively) to promote weight (muscle mass) gain (table 3.6). A majority did not feel that either creatine or protein would increase energy levels (75% ($n=6$) and 81% ($n=13$), respectively) (table 3.6). Fifty percent ($n=4$)

thought that creatine would aid recovery while 56% (n= 9) thought that protein would aid recovery (table 3.6). Other products listed were only used by between 1-3 subjects and so results for these products are not discussed in further detail.

Table 3.6: Participants' expectations of potential beneficial effects from taking either protein or creatine supplementation

Expected benefit	Protein supplement users % (n)		Creatine supplement users % (n)	
	Expecting a benefit	Do not expect a benefit	Expecting a benefit	Do not expect a benefit
Increased strength	56 (9)	44 (7)	88 (7)	12 (1)
Greater endurance	19 (3)	81 (13)	13 (1)	87 (7)
Ability to train harder	25 (4)	75 (12)	50 (4)	50 (4)
Weight (muscle) gain	63 (10)	38 (6)	63 (5)	38 (3)
Greater energy levels	19 (3)	81 (13)	25 (2)	75 (6)
Better recovery	56 (9)	44 (7)	50 (4)	50 (4)

Question 6 asked participants whether they had achieved the results that they expected. Ninety two percent (n=34) of supplement users felt that they were getting the results that they expected from taking the product (figure 3.7).

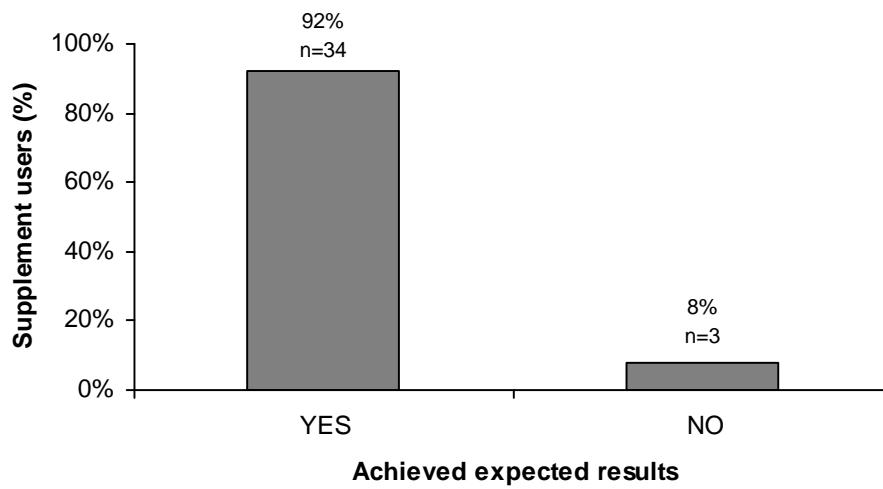


Figure 3.7: Supplement users who achieved expected results through supplementation

The relationship between the type of supplement used and whether expected results were achieved was investigated and it was found that of the 3 participants that did not achieve the results that they expected, 2 were using a protein supplement and 1 was using a mass builder (table 3.7). All other participants 92%, (n=34) achieved the results that they expected.

Table 3.7: The relationship between the type of supplement used and whether expected results were achieved

Supplement used	Where expected results achieved? % (n)	
	Yes	No
Mass builder	80 (4)	20 (1)
Creatine	100 (8)	0
Protein	88 (14)	13 (2)
Energy drink	100 (2)	0
Amino acid	100 (2)	0
Nitric oxide	100 (1)	0
Meal Replacement Shake	100 (2)	0
Strength Booster	100 (1)	0

Question 7 asked participants to say how long they had been taking the product for, they had to select from four options; less than one month, about one month, more than one month, more than 3 months. Thirty five percent (n=13) had been taking their product for about one month, 22% (n=8) for more than one month, and 32% (n=12) for more than three months (Figure 3.8).

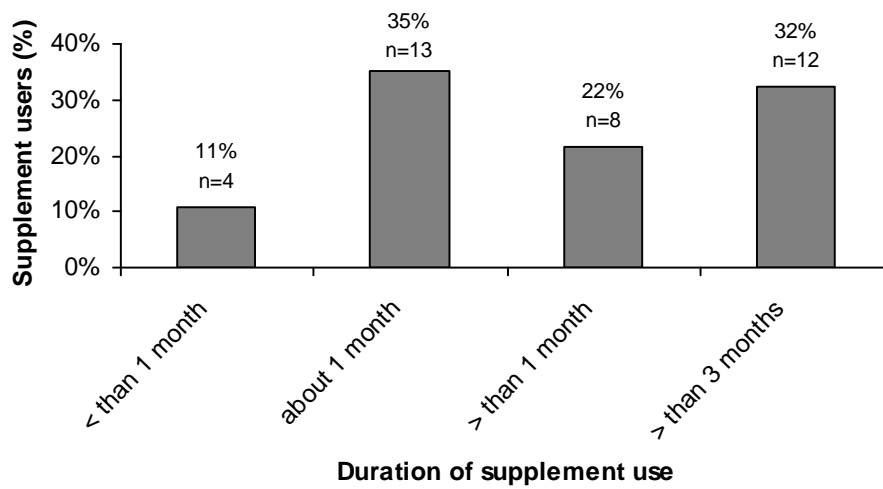


Figure 3.8: Duration for which participants had been using their products at the time of the study

Question 8 asked whether any adverse effects had been experienced. Ninety seven percent (n=36) had reportedly not experienced any adverse effect(s) since taking the product (figure 3.9). The relationship between those that experienced adverse effects and the type of supplement used was explored. There was only one participant who reported adverse effects and he was taking a protein supplement, he reportedly experienced weight loss, which was not the effect he desired.

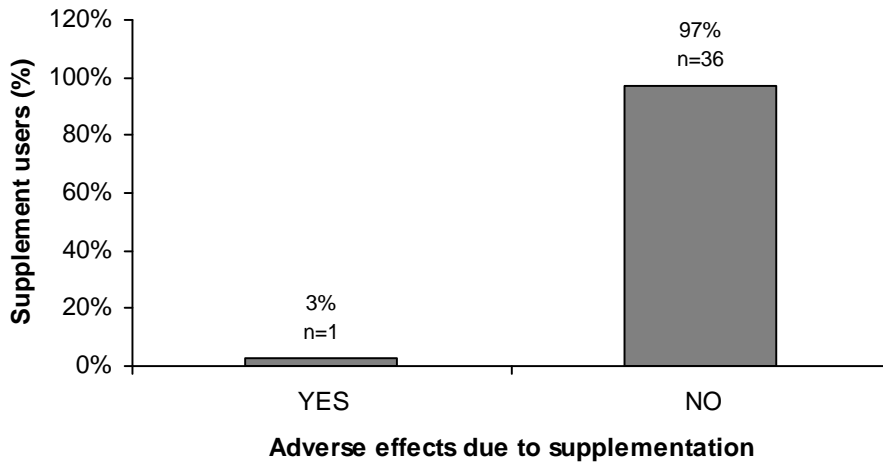


Figure 3.9: Percentage of participants who experienced adverse effects from supplementation

3.6 Average cost per month

Study participants were asked to give an estimate of what the cost of their product is per month. Eighty one percent of this study population indicated spending between R200 and R400 per month on their nutritional supplements, while up to R1500 per month was spent by 1 study participant (figure 3.10). The least spent monthly was R30 (n=1) and the most was R1500 (figure 3.11).

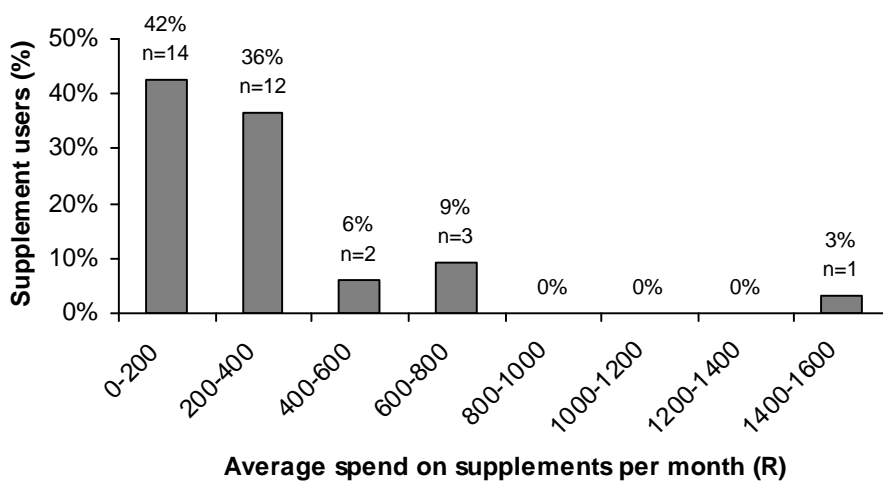


Figure 3.10: Average monthly spend on supplements

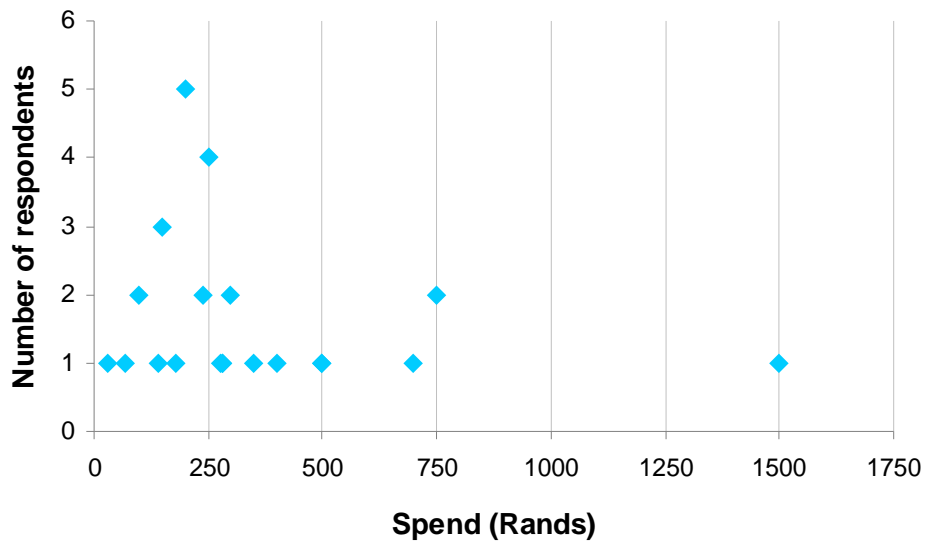


Figure 3.11: Scatter plot showing the range of average monthly costs across the study participants

Seventy percent (n=26) buy their products from a pharmacy, 11% (n=4) from a supermarket, 5% (n=2) each from a sports store or directly from the manufacturer, and 5% (n=2) through sponsorship, and only 3% (n=1) got their products from a friend (figure 3.12).

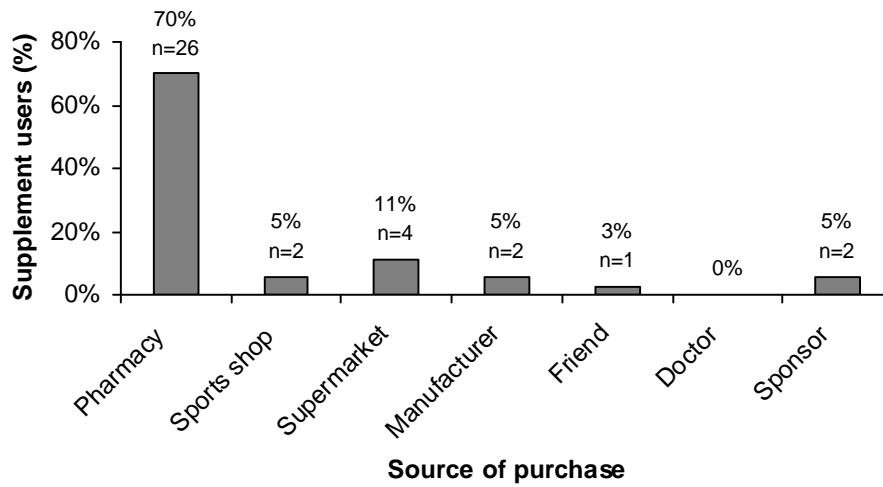


Figure 3.12: Most commonly used source of purchase of supplements

3.7 Dietary changes

Study participants were asked whether they had made any dietary changes in order to help them achieve their goals and were asked to select from a list the specific changes they had made. They were able to select as many dietary changes as were relevant to them. Seventy percent (n=26) of those subjects using supplements indicated that they had made dietary changes (figure 3.13), of these 81% (n=21) selected making more healthy food choices, 65% (n=17) increased their protein intake, 62% (n=16) increased carbohydrate content of the diet, 50% (n=13) increased their fruit and vegetable intake, 35% (n=9) planned snacks between meals, or around exercise, 15% (n=4) decreased portions of carbohydrate foods and 4% (n=1) cut out snacks between meals. None of the participants selected decreasing portions of protein foods (table 3.8).

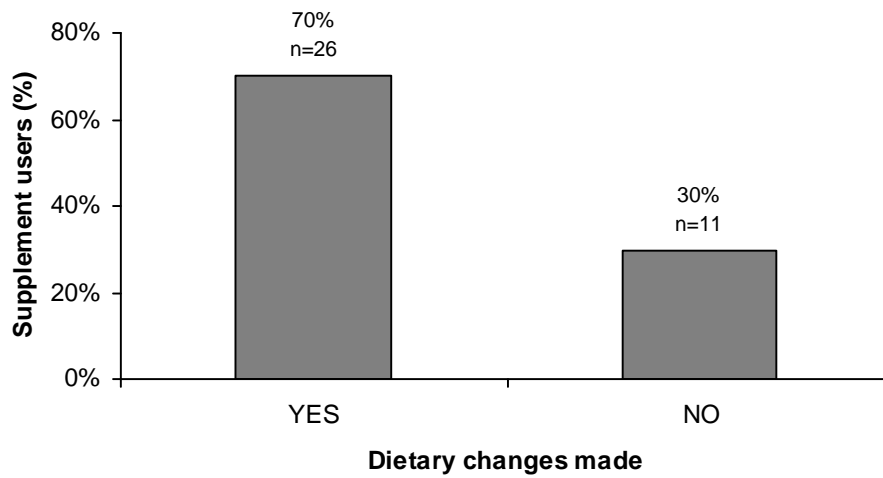


Figure 3.13: Percentage of supplement users who made dietary changes

Table 3.8: Dietary changes made by the participants who admitted to using supplements

Dietary changes	% of participants who made dietary changes (n)
Increase portions of carbohydrate foods	62 (16)
Decrease portions of carbohydrate foods	15 (4)
Included snacks between meals	35 (9)
Planned snacks around exercise	35 (9)
Cut out snacking between meals	4 (1)
Healthier food choices, no junk food	81 (21)
More vegetables and fruit	50 (13)
Increased portions of protein foods	65 (17)
Decreased portions of protein foods	0

Chi-square test was used to investigate whether making dietary changes in addition to taking a supplement had an influence on whether expected results were achieved versus those supplement users who did not make dietary changes ($p=0.00486$). Of those participants who made dietary changes, 76% ($n=26$) also achieved expected results from the supplementation (figure 3.14). Figure 3.14 only includes those supplement users who achieved expected results, figure 3.7 shows that 34 supplement users achieved expected results and 3 did not.

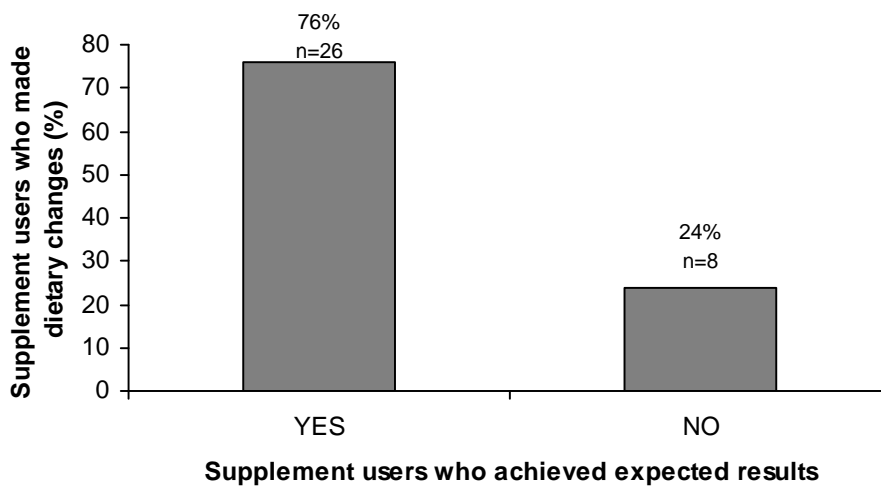


Figure 3.14: Results showing the relationship between whether participants who made dietary changes experienced expected results or not.

The relationship between whether the source of purchase had any influence on whether any dietary changes were made was investigated and no correlation was found (table 3.9). Eight of the participants that did not make any dietary changes got their supplements from a pharmacy (i.e. 31% of all pharmacy purchases) and 2 bought their supplement from a supermarket, and 1 obtained their supplement from a sponsor.

Table 3.9: Relationship between the source of purchase of supplements and whether dietary changes were made

Source of purchase	Were dietary changes made? % (n)	
	Yes	No
Pharmacy	69 (18)	31 (8)
Sports Store	100 (2)	0
Supermarket	50 (2)	50 (2)
Manufacturer	100 (2)	0
Friend	100 (1)	0
Sponsor	50 (1)	50 (1)

3.8 Factors important in achieving goals

Question 14 asked the subjects to rank the following in terms of their importance in helping them achieve their sporting goals: practice sessions/ exercise, weight training, diet, rest, and supplements. The ranking scale was a number from 1 to 5 with 1 = not important, 2= helps a little, 3= fairly important, 4=very important and 5 = critical, can't achieve without it.

Practice or the exercise itself was ranked by 51% (n=19) as being critical, and by 35% (n=13) as very important (figure 3.15). Thirty eight percent (n=14) ranked weight training as very important, 30% (n=11) as critical and 24% (n=9) as fairly important (figure 3.16). Thirty five percent (n=13) and 38% (n=14) ranked diet as fairly important and very important, respectively (figure 3.17). Thirty percent (n=11) and 38% (n=14) ranked rest as fairly important and very important respectively (figure 3.18). Thirty eight percent (n=14) and 32% (n=12) ranked

supplements as fairly important and very important respectively and 8% (n=3) ranked supplements as critical (figure 3.19).

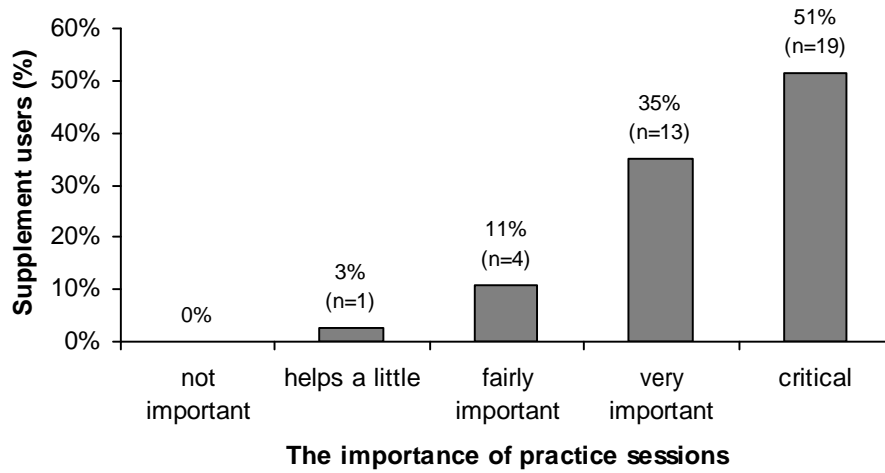


Figure 3.15: The participants' ranking of the importance of practice sessions

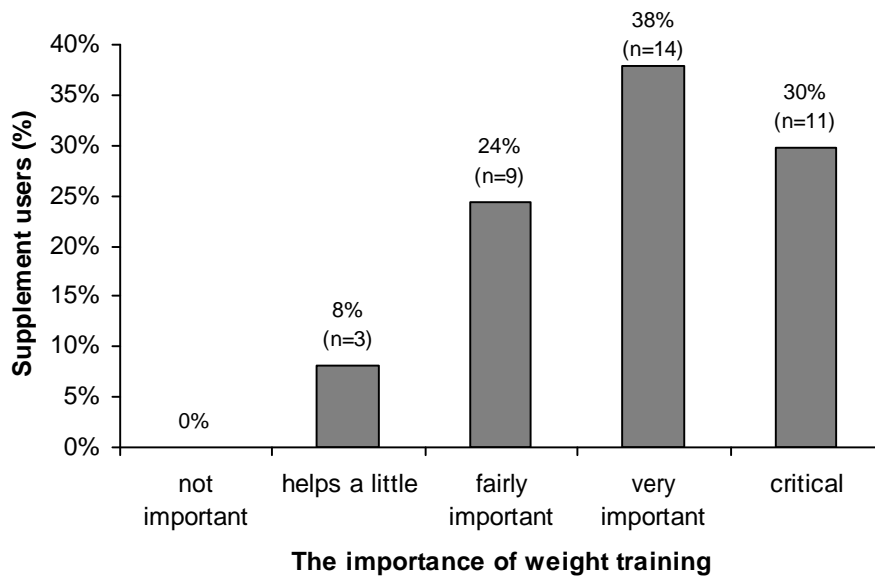


Figure 3.16: The participants' ranking of the importance of weight training

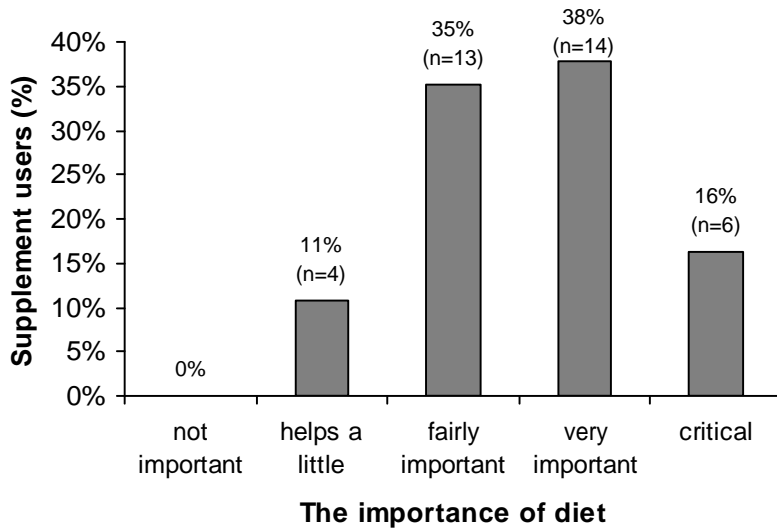


Figure 3.17: The participants' ranking of the importance of diet

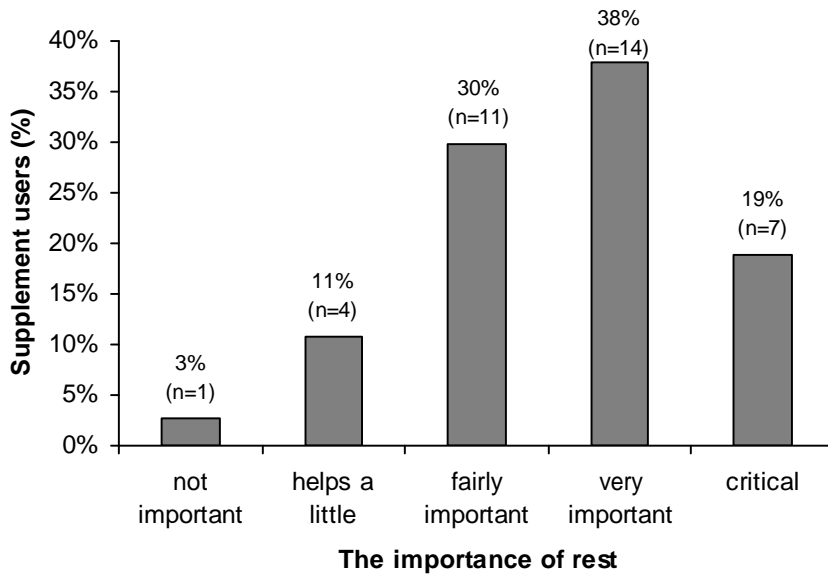


Figure 3.18: The participants' ranking of the importance of rest

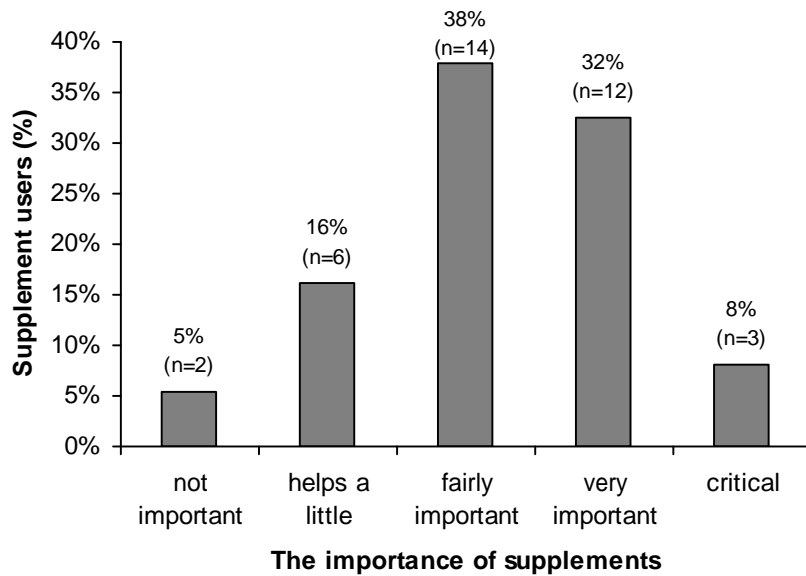


Figure 3.19: The participants' ranking of the importance of nutritional supplementation

3.9 Illegal supplementation

Study participants were asked if they would consider taking an illegal supplement if it would improve their sporting performance or help them to achieve their goals. An illegal supplement was defined as one that may get them banned from participating in sport and or have negative side effects in terms of their health. Twenty two percent (n=8) admitted that they would be willing to try an illegal supplement (figure 3.20).

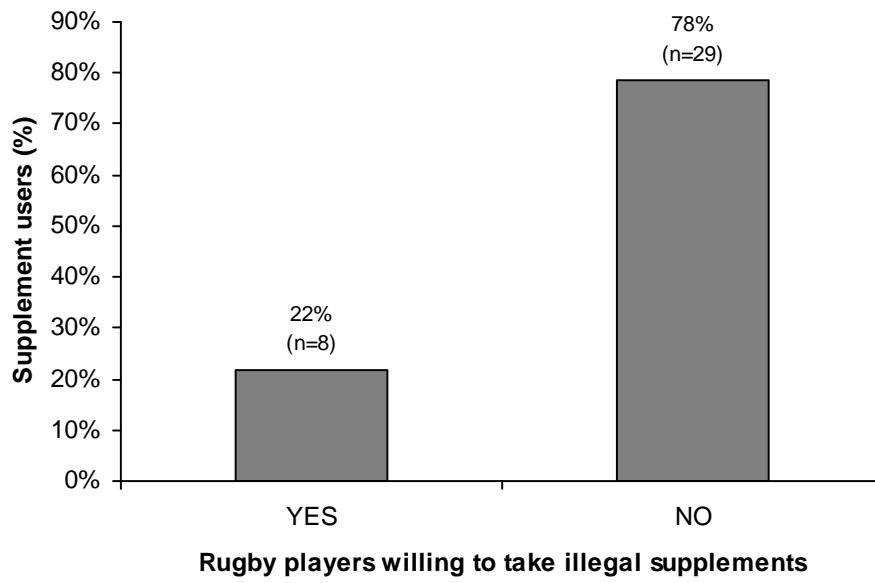


Figure 3.20: Prevalence of supplement users willing to try illegal supplements

CHAPTER 4: DISCUSSION

The results of this survey indicates that at least half (54%, n=37) of the adolescent rugby players in KZN schools who participated in this study, admitted to using a form of nutritional supplementation for improved sports performance. In these schools, adolescents are thus susceptible to and are engaging in supplementation in order to increase their level of performance. This is in accordance with a study from the UK which reported a high prevalence of supplement usage of 62%,¹¹ while another conducted in USA reported a prevalence of 42%.³⁵ The majority of other studies (from France, Canada, and USA) reported a relatively low prevalence of supplement use ranging from 8-13.5%.^{16, 14, 17, 18} Reasons for this difference in SA may relate to advertising methods used by supplement companies (elite-level rugby players used as role models to promote products through sponsorship contracts), ready accessibility and exposure to supplements in supermarkets and pharmacies. It may also be related to the sport surveyed in this study, rugby is a very popular sport in SA and there is much pressure for young school players to increase their size and may reflect the type of advice given to rugby players about ways to bulk up.

The majority of the current study population take their supplements 2-3 times per week (n=10), or more than once a day (n=8). Thirty five percent (n=13) of those boys who take supplements use a product daily, with 24% (n=9) using something 3-4 times per week. A study looking at nutritional supplement practices amongst UK junior national track and field athletes found that the athletes supplemented their diets daily with an average of 2.4 different products.¹¹

The question arises over where their peers are getting their information from. The current data indicates that information on these products was more commonly obtained from friends (32%, n=12), or a supplement company representative (22%, n=8), or at the gym (19%, n=7), sports magazines (19%, n=7), coaches (5%, n=2) and TV (3%, n=1) were less frequently used sources. Similarly, the adolescents training and learning to avoid steroids program revealed that

the 31 high school football teams believed team mates ($p < 0.001$) to be the most reliable sources for information on drugs, nutrition and exercise.³⁶ A study amongst adolescent athletes in Central Nebraska demonstrated that coaches were the most popular source of information (38%), followed by fitness clubs (25%), health store clerks (11%) and books and magazines (10%).¹² Similarly, the findings of the current study confirm fitness clubs (gyms), health store clerks (supplement representatives) and printed media (magazines) as common and well-used sources of information used by adolescent athletes. All of which support the fact that athletes rely on information sources where accuracy cannot be guaranteed.

Company representatives' main objective is to create hype around the product and to promote sales but at the same time they are not necessarily adequately knowledgeable on the nutritional requirements of young athletes.⁵ Information gained from the gym environment is likely to be fraught with misinformation, based on anecdotal and subjective ratings and likely not to be applicable to adolescent athletes. Most sports magazines, although probably informative, typically base advice on largely anecdotal evidence which has poor scientific backing. In addition to this, information is typically biased towards creating hype and sensational content, combined with cleverly worded advertisements.^{5, 10, 11}

All of these popular sources of information are likely to be highly influential to these young athletes, particularly if iconic athletes are used to promote the products. In the literature, the most common and influential sources of information typically reported include the athletic trainer and the coach.^{10, 11, 12} This is in contrast to the current study where only 5 % of respondents indicated the coach as their source of information versus their friends as being the most popular source (32%). Concerning the role of dietitians, one survey indicated that registered dietitians are used less frequently, and that availability / accessibility of the dietitians might be the constraining factor.¹⁰ Similarly, in a study involving UK junior national field and track athletes

indicated that although 75% of the athletes had access to a sports dietitian, the majority used this service infrequently, this survey also showed the coaches to be most influential.¹¹

Being minors these athletes are not likely to buy these products themselves, but their parents will be the ones getting the information and advice at point of sale. Data from the current survey indicate that 70% (n=26) obtain their product from a pharmacy. Similarly, the people at a pharmacy are not likely to have adequate knowledge of young athlete's nutritional and exercise or training requirements, and in fact there may be incentives to sell such products thus motivating them to increase their sales. Lambert et al. found that gymnasia were the most common source of supply, albeit this study was investigating the prevalence of steroid use in 16-18 year old scholars, other sources included friends, veterinary surgeon, coaches, doctors, pharmacists and parents.²¹

Protein and creatine were the most popular products (43% (n=16) and 22% (n=8) respectively) at most of the schools. Overall they were both thought by participants to increase strength, endurance and weight gain. However, protein and creatine were not believed by participants to facilitate harder training, increase energy or improve recovery. Creatine has been well-researched in the adult sporting population and is well-known for its role in facilitating recovery from maximal, short-duration bouts of exercise (e.g. number of high-intensity repetitions within a training bout) thus facilitating harder training and increased strength.⁸

The sooner protein is ingested after training the faster the shift to anabolic protein synthesis.²⁶ Thus protein is important in recovery, as well as in obtaining increased strength, endurance and weight (muscle) gain,²⁶ but ingesting more than is required to maintain a positive nitrogen balance will not offer further benefit.^{27, 26, 2} In addition, in order to achieve muscle gain the provision of sufficient carbohydrate (energy) is vital.^{26, 27} Excessive protein intake (>2g per kg

body weight) is detrimental,²⁶ particularly if this is at the expense of sufficient carbohydrate intake. Excessive protein intake may contribute to fat weight gain, increased urinary calcium losses, hypotension, tumor stimulation, mental retardation and fatty liver.²⁶ Assessments have shown that most athletes obtain enough protein easily meeting the higher requirements provided they have a well balanced diet, with high quality protein foods, and of adequate calories.^{1, 27}

A vast majority (92% (n=36)) of the boys from the current study believed they had obtained the results they expected from the products, with only 3% (n=1) reporting adverse effects (reported as “weight loss” by one subject). Most had been using their chosen product for at least one month, but as long as 3 months, which is long enough to recognise the potential benefits or adverse effects. A factor which may have played a role in achieving this high percentage of reported benefits from using these supplements is the placebo effect which is well documented in literature.⁵ This particular adolescent study population may be far less critical and objective and hence susceptible to a placebo effect. Adolescents are typically easily-influenced due to their limited knowledge and experience, particularly when comparing themselves to a famous iconic athlete;¹³ this may make them highly subjective in their rating of the benefit of taking the supplement. This population groups’ misguided beliefs can also be largely attributable to the subjective and uninformed information provided by such sources as company representatives and sports magazines which provide highly convincing claims and marketing strategies. Hence there is a need for education to be a large component of any intervention programme. A study investigating the nutritional supplement practices amongst UK junior national track and field athletes found that a majority (95%) of those using supplements denied taking the supplements more frequently when training intensity increased, despite the fact that 83% felt that exercise increased the need for supplements.¹¹ This is further evidence suggesting that adolescent athletes have limited understanding of the role of supplements and how to best utilize them.

A total of 41% (n=15) of the participants of this study use a product 1-2 a week or less, which raises the question of whether this is sufficient to gain a benefit from taking the product. This may highlight the poor knowledge of the athletes on the role of these products and their understanding of how they function. The fact that friends of the athletes are the most common source of information (32% (n=12)) reinforces this concern.

The average cost per month to 81% of study participants was between R200 and R400. Interestingly, a study looking at the use of nutritional supplements by high school football and volleyball players in the USA found that players spent anything from \$0-125 (R0-1000) per month on supplements.¹⁸ It is the opinion of the author that the same value of money can be better spent being used to seek consultation with qualified professional regarding dietary intake (such as registered dietitian), and then buying healthy food alternatives. The money would thus be invested in better dietary choices negating the need for supplementation. This ensures a more sustainable, healthy approach in the short- and long- term rather than engaging in unfounded or unnecessary supplementation practices that are potentially harmful to health and development. This approach would empower the athletes to take charge of their health and manage their sporting performance by understanding the role of nutrition in achieving their sporting goals, whilst supporting optimal growth and development.¹⁰ Only 5% of the participants (n=2) were sponsored by supplement companies, but in professional athletes this figure is likely to be significantly higher, it would be ideal if such companies employed a dietitian with an interest in sports nutrition to assess each individual athlete to determine their supplementation requirements and to provide the necessary dietary advice to ensure an adequate nutritional foundation.

A large proportion of the athletes taking supplements (70% (n=26)) realise the benefit of making dietary changes to achieve their sporting goals. These changes appear to largely comprise of choosing healthy foods (81% (n=21)), and increasing protein intake (65% (n=17)) and carbohydrate content of the diet (62% (n=16)). Dietary choices of these athletes also demonstrates the common misbelieve that protein intake needs to be increased to meet requirements. As already mentioned, protein requirements are often met quite easily when a calorie-sufficient and well balanced diet is maintained.²⁷ Excessive protein intakes can lead to detriment to one's health^{8, 26} and may mean that the diet is not correctly balanced, possibly resulting in inadequate intakes of carbohydrates. Increased fruit and vegetable intake (50% (n=13)) and planning snacks between meals (35%), and snacks around exercise (35% (n=9)), were found to be of less importance as they were not as highly rated. Apart from their belief that they need to increase their protein intake, a large proportion (62%) believe that they need to increase carbohydrate and (50%) fruit and vegetable intake, which indicates that they actually have a good understanding of what is required, but at the same time still place huge emphasis on the use of supplements, which if these dietary changes are adequately made, the benefit of taking supplements as well is questionable.^{6, 27} Interestingly, of those who made dietary changes, 76% (n=26) felt they had benefited from the expected results, which is a good argument for the importance of making dietary changes. The fact that the services of a dietitian are reported to be infrequently utilized by athletes taking supplements^{10, 11} implies that they have not had their diet assessed, and therefore cannot be certain that the supplement being consumed is actually appropriate based on their needs.

When asked how important the participants ranked practice sessions, weight training, diet, rest and supplements none were found to be more important, but practice sessions appeared to be weighted the most, with the other factors all receiving similar value. Supplements are seen by 8% to be critical to success.

Finally, despite a sense of sound attitude regarding diet, and relative low importance of supplements in achieving results, 22% (n=8) of these athletes are prepared to try illegal supplements, a reminder of the pressures experienced by these young athletes. Lambert et al.²¹ found that the prevalence of androgenic-anabolic steroid use was 1.4% (n=2772) in school children from two geographical areas of South Africa (Cape and Parow school boards of the Cape Education Authority and East, West, North, Central, Northwest and Northeast Johannesburg school boards in Gauteng Province).

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of key findings

At least half (54%) of rugby-playing school boys aged 16-18 years are engaging in using current popular nutritional supplements claimed to enhance sporting performance. The sources of information most commonly used according to this study were friends (32% (n=12)), supplement companies (22% (n=8)), sports magazines and gyms (both 19% (n=7)). The source of purchase of supplements most commonly stated in this study was the pharmacy (27% (n=26)), with supermarkets (11% (n=4)) and company representatives (5% (n=2)) the next popular. Cost does not appear to be a limiting factor, an indication of how effective the marketing of these products are combined with the willingness or eagerness of this study population to improve their sporting performance. Although it does appear that nutritional intake is seen to play an important role, it is questionable what the understanding of these athletes is of what is required to optimise growth and sporting performance.

5.2 Recommendations

A consistent message of the risks and concerns involved must be given regarding nutritional and ergogenic supplement use in this age group specifically. Supplement use in the absence of a specific need, deficiency or disease is not recommended.²⁴ Furthermore, the use of supplements that lack scientific evidence in terms of efficacy and safety, particularly in youth populations, should be discouraged. Once a permissive attitude is adopted towards nutritional supplements in adolescents, the likelihood of progression to more dangerous performance enhancing substances is greater.^{21, 15, 8} It is reasonable to argue that with greater knowledge of strategies other than supplement-use to improve performance, and an understanding of the side effects of using particular supplements, an athlete will be less likely to try these products. Education therefore forms an important part of any intervention programme.³⁷ Importantly, a balanced education program should be implemented to avoid a biased message which may be less successful in changing behaviour and beliefs. An education program should include both

the positive and negative effects of taking supplements as well as other interventions to affect performance. Previous drug and alcohol use prevention research found an unbalanced negative strategy to encourage use.¹³

The best target of any intervention programme should be the adolescent, according to these results, there may also be value in including the coach who potentially has an influence over these rugby-playing boys. The common sources of information (such as coaches, sports magazines, company representatives etc.) leading to the use of these products is concerning as generally they are not adequately knowledgeable to advise in this manner.¹² These sources of information are particularly influential to this group due to their limited understanding and their desire to mirror famous sports people used in the advertising of these products. Coaches spend the most time with these boys in comparison to other information sources and for this reason may have an important influence. The most popular source of purchase of supplements according to this study is pharmacies which should also be targeted in any education intervention programme. Personnel should be trained accordingly rather than being biased in any way towards any particular product, and ideally should be able to refer people to qualified registered dietitians where necessary. The boys should also be educated so that they can make informed choices when purchasing supplements, and they should understand that any company representative receives incentives for sales.

A primary prevention programme designed to reduce the incidence of new anabolic steroid users was conducted among 34 high schools (more than 3000 students) in the Portland, USA.³⁶ The programme included curriculum time for the intervention group covering sports nutrition and strength training for performance enhancement as healthy alternatives to anabolic steroid use, while the control group received brochures with similar information.³⁶ A questionnaire was completed prior to participation, at the end of the programme and again after 1 year to measure

the effect.³⁶ Immediate and short-term effects of alcohol and other illicit drugs were emphasised rather than long-term effects in order to appeal to adolescent's focus on the present.³⁶ Outcomes of the programme included improved nutrition behaviour and less use of sport supplements, an increased knowledge of steroids and their risks as well as a greater understanding of their personal vulnerability to the side effects.³⁶ They were also more able to reject drug offers from peers and were less likely to believe supplement adverts.³⁶ It was also found that participants in the intervention group had improved confidence in their athletic abilities, increased self-esteem, less impulsivity and a greater awareness that parents and coaches oppose steroid use.³⁶ These effects were sustained at 1 year.³⁶

The literature suggests that in order for a school-based programme to be effective in preventing ergogenic usage amongst adolescent athletes the following evidence-based strategies must be incorporated.¹³ The programme should be led by their peers with common goals, a team approach should be adopted with the team being the facilitator to the education process, the programme should be interactive (including role-playing and critical thinking practices), parents should be incorporated into the programme, the topics of ergogenics and nonregulated supplements must be covered comprehensively including discussion of benefits, short-term effects and a strong focus on negative effects, and the healthy alternatives of optimal nutrition and exercise must be included.¹³ Classroom interventions should be used with planned in-services scheduled after completion of the programme for relearning and reinforcement.¹³

Nutritional supplementation should be tailored, ideally by a qualified, registered dietitian, to the specific needs of adolescents and distinction should be made between those supplements suitable for adults and adolescents, respectively. Supplements suitable for adolescent use should be made readily available through schools and at a cost accessible to all.

Furthermore, legislation is required to closely govern the manufacture, labelling and marketing of supplements to limit the range of supplements available to athletes to those that are scientifically proven to be effective (including ideal dosages, timing and sporting types), safe in terms of health, and free of illegal (banned) substances. In terms of supplements for adolescent use there must be strict and clear guidelines discouraging use of supplements with a strong focus on correcting eating habits and tailoring dietary practices to help achieve sporting goals. Further research is needed to determine safety and efficacy for long term use of supplements specifically to this age group, as well as in adults.

Focus is needed on the provision of sports nutrition advice to optimise sports performance and nutritional goals using methods that is sure not to be harmful to short or long term health, especially where minors (<18 years) are concerned. At schools the education and regulation of nutritional supplements use should be instigated. This should include the promotion of healthy food choices, even for the non-athletic learners. For example, tuck shops should offer healthy foods encouraging these food choices. Residential houses at schools should offer menu items and portions appropriate for young athletes, with consideration for their increased needs, for example additional snacks and larger portions of carbohydrates. Schools should arrange information sessions on pertinent topics for parents, scholars, and coaches presented by professionals in the field of sports medicine and nutrition. With these sessions the safety issues regarding the illicit use of nutritional supplements should be highlighted, and guidance provided as to what type of nutritional supplementation can be used safely if needs be. Dietitians should form professional relationships with trainers and coaches and provide support to parents to offer a reliable and evidence-based source of nutritional information. Any nutritional education programme should include coaches as athletes are highly influenced by these members of the sports team.¹¹

CHAPTER 6: LIMITATIONS OF THE STUDY

The poor response rate limited the numbers of participants and the ability to draw conclusions from the results, with a minimum of 9% (n=6) of invited boys at two schools and a maximum of 32% (n=22) at one school (average response rate of 28.8%). The main contribution to this poor rate was the poor compliance in completing and returning consent forms, rather than obvious refusal to participate. Some of the schools have boarding facilities and several of the boys did not see their parents regularly. Despite the school faxing copies of the consent form to parents to try to overcome this barrier, forms were still not returned. Some athletes admitted that forms had been lost at the time that the questionnaire was to be completed at the school, and due to time constraints this process of getting forms to their parents could not be repeated. There appears a general attitude of non-compliance in schools, with all coaches or teachers who were assigned to assist in collecting these forms complaining of the participants showing poor discipline in attending meetings called to collect these forms, as well as boys who had submitted a completed consent form not appearing at the designated time and venue to complete the questionnaire. In order to obtain a larger more representative sample it is recommended that a greater number of schools are included, and a system implemented to contact each participant to remind them of the meetings and that consent forms are required in order to participate.

Another limitation is the small sample size of the study population which as a result makes the significance of the findings less powerful. The main reason for this, in the author's opinion, was the necessity for signed consent from parents / legal guardians. Many of the boys are boarders and seldom see their parents, despite the forms being faxed to the parents, forms were lost. School holidays also posed a problem despite forms being sent home with report cards, forms again were lost and boys forgot about the study. Several boys who had not returned the consent form were interested in taking part, but had to be excluded from the study. Obviously among this number of non-responders are boys who chose not to participate possibly for reasons of

concern about the degree of confidentiality, despite it being made clear that the results were to be kept anonymous.

This study focused on one supplement per participant and requested that participants identified the most important product that they use, should they use more than one supplement. Future studies should investigate the combinations of supplements that participants may be using as this practice significantly increases their risk associated with inappropriate usage and raises concern of safety issues. It would also be valuable to establish the quantity of supplements being taken, whether manufacturer guidelines are adhered to or whether larger doses are taken more frequently.

The questionnaire listed 8 benefits from which the participant had to select which benefits applied to them. An open question on benefits (i.e. allowing participants to provide their own answers as opposed to having to select one) would have been more reflective of true reasons for using a particular supplement.

LIST OF REFERENCES

1. Petrie HJ, Stover EA, Horswill CA. Nutritional concerns for the child and adolescent competitor. *Nutr* 2004; 20:620-631.
2. Duhamel J, Bougle D, Guincestre J, Laurans M, Duhamel A. Feeding from toddlers to adolescence: Nutrition and physical exercise in young athletes. 1996; 37 *Nestle Nutrition Workshop Series*.
3. Bertelloni S, Ruggeri S, Baroncelli GI. Effects of sports training in adolescence on growth, puberty and bone health. *Gynecological Endocrinology*. Nov 2006; 22(11):605-612.
4. Eliakim A, Brasel JA, Mohan S, Wong WL, Cooper DM. Increased physical activity and the growth hormone-IGF-I axis in adolescent males. *Am J Physiol* 1998; 275:R308-R314
5. O'Dea JA. Consumption of nutritional supplements among adolescents: usage and perceived benefits. *Health Educ Res* 2003; 18(1):98-107.
6. Schwenk TL, Costley CD. When food becomes a drug: Nonanabolic nutritional supplement use in athletes. *Am J Sports Med* 2002; 30(6):907-916.
7. Maughan RJ. Contamination of dietary supplements and positive drug tests in sport. (Sent direct from author via e-mail) Personal Communication.
8. Ahrendt DM. Ergogenic Aids: Counseling the athlete. *Am Fam Physician* 2001; 63(5):913-922.
9. Metz J. Strength training and nutritional supplement use in adolescents. *Current opinion in pediatrics* 1999; 11:292-296.
10. Burns RD, Schiller MR, Merrick MA, Wolf KN. Intercollegiate student athlete use of nutritional supplements and the role of athletic trainers and dietitians in nutrition counselling. *J Am Diet Assoc* 2004; 104:246-249.
11. Nieper A. Nutritional supplement practices in UK junior national track and field athletes. *Br J Sports Med* 2005; 39:645-649.

12. Scofield DE, Unruh S. Dietary supplement use among adolescent athletes in central Nebraska and their sources of information. *Journal of Strength and Conditioning Research* 2006; 20(2):452-455.
13. Rosenfield C. The use of ergogenic agents in high school athletes. *The journal of School Nursing* Dec 2005; 21(6):333-339.
14. Laure P, Binsinger C. Adolescent athletes and the demand and supply of drug to improve their performance. *J Sports Sci Med* 2005; 4:272-277
15. Metzl JD, Small E, Levine SR, Gershel JC. Creatine use among young athletes. *Paediatrics* 2001; 108(2):421-425.
16. Field AE, Austin B, Camargo CA, Taylor C, Striegel-Moore RH, Loud KJ, Colditz GA. Exposure to the mass media, body shape concerns, and the use of supplements to improve weight and shape among male and female adolescents. *Paediatrics* 2005; 116:214-220.
17. Bell A, Dorsch KD, McCreary DR, Hovey R. A look at nutritional supplement use in adolescents. *J Adolesc health* 2004; 34:508-516.
18. Mason MA, Giza M, Clayton L, Lonning J, Wilkerson RD. Use of Nutritional Supplements by High School Football and Volleyball Players. *Iowa Orthopaedic Journal* 2001; 21:43-48.
19. DesJardin M. Supplement use in the adolescent athlete. *Current Sports Medicine Reports* 2002; 1:369-373
20. Bahrke MS, Yesalis CE, Brower KJ. Anabolic-androgenic steroid abuse and performance enhancing drugs among adolescents. *Child Adolesc Psych Clin North Am* 1998; 7(4):821-837.
21. Lambert M, Titlestad SD, Schweltnus MP. Prevalence of androgenic anabolic steroid use in adolescents in two regions of South Africa. *S Afr Med J* 1998; 88(7):876-880.

22. Calfee R, Fadale P. Popular ergogenic drugs and supplements in young athletes. *Paediatrics* 2006; 117(3):e577-589.
23. Van der Merwe PJ, Grobbelaar E. Inadvertent doping through nutritional supplements is a reality. *Sports Med* 2004; 16(2):3-7.
24. Burke L. An interview with Dr Gary Green about supplements and doping problems from an NCAA perspective. *Int J Sport Nutr Exerc Metab* 2001; 11:397-400.
25. Meltzer S, Kohler R, Jakoet I, Noakes T. A practical guide to the use of nutritional supplements in South Africa. *Cont Med Educ* 2004; 22(3):142-144.
26. Wright, HH, Claassen A, Davidson J. Dietary macronutrient recommendations for optimal recovery post-exercise: Part II. *Sports Medicine* 2004; 16(2):33-38.
27. Lemon, PWR. Beyond the zone: Protein needs of active individuals. *Journal of the American College of Nutrition* 2000; 19(5):513S-521S.
28. National diet and nutrition survey: Adults aged 19-64years 2003. [online] available: <http://www.food.gov.uk/multimedia/pdfs/ndnsv2.pdf>. Accessed 17 November 2008.
29. National food consumption survey in children aged 1-9 years: South Africa 1999. [online] available: <http://www.sahealthinfo.org/nutrition/updatenfcspart2.pdf>. Accessed 17 November 2008.
30. Shao A, Hathcock JN. Risk assessment for creatine monohydrate. *Regulatory Toxicology and Pharmacology* 2006; 45:242-251
31. The South African Institute for Drug-free Sport: Athlete's handbook 2007, 6th ed.
32. Supplements position statement. Position statement of UK Sport, Version 5, issued in July 2008. [online] available: http://www.uk sport.gov.uk/pages/supplements_position_statement/ Accessed: 14 November 2008.
33. Position Statement on Nutritional Supplements from the Sport Nutrition Advisory Committee of Coaching Association Canada. August 2006. [online] available:

http://www.coach.ca/eng/nutrition/documents/NUT_Position-statement-supplement_SEPT06.pdf Accessed: 14 November 2008

34. Pipe A, Ayotte C. Nutritional Supplements and Doping. *Clin J Sports Med* 2002; 12(4):245-249.
35. Jonnalagadda SS, Rosenbloom CA, Skinner R. Dietary practices, attitudes, and physiological status of collegiate freshman football players. *J Strength Cond Res* 2001; 15:507-513
36. Goldberg L, MacKinnon DP, Elliot DL, Moe EL, Clarke G, Cheong J. The adolescents training and learning to avoid steroids program: Preventing drug use and promoting health behaviours. *Arch Pediatr Adolesc Med* 2000; 154:332-338.
37. Coopoo Y, Manjra SI. Knowledge and perception of elite South African Athletes on doping and doping control, 1998 v. 2002. *Sports Med* 2004; 16(3):14-18.

APPENDICES

1. Supplement usage questionnaire

**SURVEY OF SUPPLEMENT USAGE IN ADOLESCENT RUGBY PLAYERS AGED BETWEEN
16-18 YEARS IN KZN SCHOOLS**

The purpose of this survey is to investigate the most frequently used sports supplements among school rugby players, and explore the reasons for use, knowledge of the role of supplements in sports performance and the sources of information most used by this age group.

Participation is voluntary, and completion of the questionnaire will be considered as given informed consent. Results will be kept anonymous.

1. Do you use sports or nutritional supplements? **Yes No**

If yes, how often:

- Daily
- 3-4 times per week
- Once or twice per week
- Once a week
- Less than weekly

If your answer is no, then there is no need to complete any further questions

2. **If yes**, what do you most frequently use? (select one of the following and give product names where appropriate)

- Protein shake e.g. whey protein Product Name: _____
- Creatine Product Name: _____

- | | |
|---|---------------------|
| <input type="checkbox"/> Fat-burner e.g. Phedra-cut | Product Name: _____ |
| <input type="checkbox"/> Amino Acids e.g. Glutamine | Product Name: _____ |
| <input type="checkbox"/> HMB | Product Name: _____ |
| <input type="checkbox"/> Energy drinks e.g. Powerade | Product Name: _____ |
| <input type="checkbox"/> Mass builder e.g. Muscle fuel | Product Name: _____ |
| <input type="checkbox"/> Meal replacement e.g. Ensure | Product Name: _____ |
| <input type="checkbox"/> Other? _____ | |
| <input type="checkbox"/> I'm taking a supplement, but don't know what it is | |

3. How often do you use this product?

- more than once a day
- once daily
- 2-3 times per week
- 4-6 times per week
- less than once per week

4. Where did you find out about this product?

- Sport magazine
- Gym
- Coach
- Friends
- TV commercials
- Supplement company / manufacturer / rep.

5. By taking this supplement, which of the following benefits do you expect to experience?

- Increased speed

- Increased strength
- Greater endurance
- Ability to train harder
- Weight (muscle) gain
- Weight (fat) loss
- Greater energy levels
- Better recovery

Other? _____

6. Has it given you these results? **Yes No**

7. How long have you been taking it?

- Less than one month
- About one month
- More than one month
- More than 3 months

8. Did you experience any adverse effects? **Yes No**

9. **If yes: What?** _____

10. What does it cost you per month? R _____

11. Where do you get the product from? (choose one)

- Pharmacy

- Doctor
- Supermarket
- Friend
- Sports Shop
- Bought directly from supplement manufacturer
- Sponsored by supplement company / manufacturer

12. Have you made changes to your diet to help you achieve your goals? **Yes No**

13. **If yes**, Which of the following: (TICK ALL APPROPRIATE ANSWERS)

- Increase portions of carbohydrate foods
- Decrease portions of carbohydrate foods
- Included snacks between meals
- Planned snacks around exercise
- Cut out snacking between meals
- Healthier food choices, no junk food
- More vegetables and fruit
- Increased portions of protein foods
- Decreased portions of protein foods

Other? _____

14. Rate on a scale from 1 - 5 how important you think each of the following is in helping you achieve your sporting goals

1=Not important; **2**=Helps a little; **3**=Fairly important; **4**=Very important; **5**=critical, can't achieve without it! (select the most appropriate number by circling it)

- a. Your exercise / practice sessions 1 2 3 4 5
- b. Doing gym (weight) training 1 2 3 4 5
- c. Your diet / What you eat 1 2 3 4 5
- d. Rest 1 2 3 4 5
- e. The supplements you take 1 2 3 4 5

15. Would you consider taking an illegal supplement (that may get you banned and/or have negative side-effects) if it would improve your sporting performance or help you achieve your goals? **Yes** **No**

THANK-YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY!

2. Informed Consent Form

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT:

Observational descriptive study to describe current perceptions and usage practices of supplements among adolescent male athletes in Kwazulu Natal schools.

REFERENCE NUMBER: N08/04/093

PRINCIPAL INVESTIGATOR: Keri Strachan

ADDRESS: 29 Surprise Ridge Rd, Hillcrest Park, 3610

CONTACT NUMBER: 082 448 6696

Your son is invited to take part in a research survey. Please take some time to read the information presented here, which will explain the details of this survey. Please ask the investigator any questions about any part of this survey that you do not fully understand. It is very important that you and your son are fully satisfied that you both clearly understand what this research entails and how you could be involved. Also, your son's participation is **entirely voluntary** and he is free to decline to participate. If he says no, this will not affect him negatively in any way whatsoever. He is also free to withdraw from the study at any point, even if he does initially agree to take part.

This study has been approved by the Committee for Human Research at Stellenbosch University and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- *The survey aims to investigate what the perceived value of supplements is and how these products are being used within your son's age group. Specifically the following questions will be answered:*
 - *How frequently are supplements being used?*
 - *Which types are more frequently used?*
 - *Why are these products being used?*
 - *What knowledge do you have about the role of these supplements?*
 - *Where do you get your information about supplements?*
- *Your son's participation requires him to complete the following questionnaire answering each question honestly according to his knowledge and habits.*
- *He have been randomly selected from a random list of names of boys who play rugby between 16-18 years of age*

Why has your child been invited to participate?

- He is a rugby player between the ages of 16-18years which complies with the inclusion criteria for this study.

What will your responsibilities be?

- Complete the consent form to permit your son's participation and ensure that he attends school on the day that the investigator will attend the school to distribute the questionnaires for completion.

Will he benefit from taking part in this research?

- There are no personal benefits for his participation, however, it is hoped that the information obtained will be used to improve the knowledge of school athletes on the role of supplements to improve sporting performance.

Are there any risks involved in your child taking part in this research?

- No, there are no risks involved as he is only required to complete a simple questionnaire.

If you do not agree to your son taking part, what alternatives does he have?

- *Return the uncompleted consent form and he will be excluded from the survey.*

Who will have access to his completed questionnaire?

- *Your son's anonymous questionnaire will be collated by the investigator and other personnel from Stellenbosch university will have access to the raw data, but any reports created from the results will not identify any individual who has participated in the survey.*

Will your son be paid to take part in this study and are there any costs involved?

He will not be paid to take part in the study. There will also be no costs involved for you should your son take part.

Is there any thing else that you should know or do?

- You can contact the Committee for Human Research at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by the study investigator.
- You will receive a copy of this consent form for your own records.

Assent of participant

I (*Name of participant*)..... have been invited to take part in the above research project.

- The study investigator has explained the details of the study to me and I understand what they have said to me.
- They have also explained that this study will involve answering the questions in the questionnaire.
- I also know that I am free to withdraw from the study at any time if I am unhappy.
- By writing my name below, I voluntarily agree to take part in this research project. I confirm that I have not been forced to take part.

.....
Name of participant

.....
Independent witness

Declaration by parent/legal guardian

By signing below, I (*name of parent/legal guardian*) agree to allow my child (*name of child*) who is years old, to take part in a research study entitled (*insert title of study*)

I declare that:

- I have read or had read to me this information and consent form and that it is written in a language with which I am fluent and comfortable.
- If my child is older than 7 years, he/she must agree to take part in the study and his/her ASSENT must be recorded on this form.

- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to let my child take part.
- I may choose to withdraw my child from the study at any time and my child will not be penalised or prejudiced in any way.
- My child may be asked to leave the study before it has finished if the study doctor or researcher feels it is in my child's best interests, or if my child do not follow the study plan as agreed to.

Signed at (*place*) on (*date*) 2005.

.....
Signature of parent/legal guardian

.....
Signature of witness

Declaration by investigator

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understand all aspects of the research, as discussed above
- I did/did not use a interpreter

Signed at (*place*) on (*date*) 2005.

.....

Signature of investigator

.....

Signature of witness

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