DIETARY SUPPLEMENT USE AMONG DIETETICS STUDENTS AT THE UNIVERSITY OF KWAZULU-NATAL

BY

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ABSTRACT

Introduction:

A dietary supplement is a product, which aims to add nutritional value to the diet. The use of dietary supplements is favoured among many countries, with a steady increase in use. There are many groups that are known to make use of dietary supplements such as females, the elderly, health professionals, gym goers, pregnant women, children under the age of 18 years and university students. University students are a group that are known to make use of dietary supplements in order to improve their academic performance, increase energy and promote overall general health. It is assumed that students studying towards a nutrition-related degree such as dietetics would be more likely to use dietary supplements, due to their interest in and exposure to nutrition. However, there is a lack of published data investigating the prevalence of dietary supplement use, factors associated with use and reasons for use among South African university students, studying towards a nutrition-related degree. Therefore, this study aimed to assess the use of dietary supplements by dietetics students at the University of KwaZulu-Natal (UKZN).

Aim:

The aim of the study was to assess the use of dietary supplements by students registered for a Bachelor of Science or a Post Graduate Diploma in Dietetics, at UKZN.

Objectives:

a) To determine the prevalence of dietary supplement use among dietetics students at UKZN.

b) To determine the factors associated with dietary supplement use among dietetics students at UKZN.

c) To determine the reasons for use of dietary supplements among dietetics students at UKZN.

Methods:

A cross-sectional, descriptive study was conducted using students registered for a Bachelor of Science or a Post Graduate Diploma in Dietetics, at UKZN. A self-administered questionnaire consisting of both open and close-ended questions was developed to collect data. The sample comprised of 139 dietetics students.

Results:

The use of dietary supplements was reported by 23% of the dietetic students. The most commonly used supplement among the students was Centrum (multivitamin) (21.9%, n=7), followed by calcium supplements (15.6%, n=5). There was a significant relationship between use of dietary supplements and gender and race. White and Indian students used dietary supplements more than the other race groups ($p<0.05$). Females ($p=0.018$) and students who lived at home were more likely to consume dietary supplements (46.9%; n=15) ($p=0.008$). Fourth year students (34%) used dietary supplements the most. There was no relationship between dietary supplements and physical activity, eating habits or ability to meet dietary requirements. Common reasons for using dietary supplements were to strengthen the immune system, improve energy levels and enhance health. Expense (32.7%; n=35), adequate diet (22.4%; n=24), deem it unnecessary/waste of money (15.0%; n=16) and unsure about supplements (14.0%; n=15), were statistically significant reasons for not using a dietary supplement ($p<0.05$). A significant proportion of the sample (72.2%) indicated that their source of information on dietary supplements was the internet ($p=0.011$), followed by dietetics/nutrition lectures (41.7%). About 73.3% (n=22) of the students who used supplements indicated that they had experienced an overall improvement in physical health after use of dietary supplements ($p=0.016$). Other results achieved included: more energy (53%; n=16) and better memory/concentration (53.3%; n=16). Furthermore, half of the sample that used supplements (50%; n=15) reported an improved resistance to illness/ability to fight illnesses earlier. Just over half the sample (51.4%) indicated that they planned to use a dietary supplement in the future.

Conclusion:

There was a low prevalence of use of dietary supplements among dietetics students at UKZN. Factors such as race, gender, residence and year of study influenced the use of dietary supplements. Use of dietary supplements was more common among white and Indian students, females and those in the fourth year of study. Dietary supplements were used to strengthen the immune system, improve energy levels and enhance health. The high cost of supplements was the main deterrent to use of dietary supplements.

PREFACE

This dissertation was written between January 2017 and November 2017 under the supervision of Dr Kirthee Pillay, using data collected from the dietetics students at the University of KwaZulu-Natal in 2017.

Signed: _____ Date: _____
Lynelda Pillay (Candidate)

As the supervisor of the candidate, I agree to the submission of this dissertation.

Signed: _____ Date: _____
Dr Kirthee Pillay (Supervisor)

DECLARATION OF ORIGINALITY

I, Lynelda Pillay, declare that:

1. The entirety of the work contained in this dissertation is my original work, except where otherwise stated.

2. This dissertation, or any part of it, has not been submitted for any degree or examination at any other university.

3. Where other sources have been used they have not been copied and have been properly acknowledged.

4. This dissertation does not contain text, graphics or tables copied and pasted from the internet, unless specifically acknowledged, and the source being detailed in the dissertation and in the relevant reference section.

Signed: _____ Date: _____

Lynelda Pillay (Candidate)

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CHAPTER 1: INTRODUCTION, THE PROBLEM AND ITS SETTING

1.1 Importance of the study

A dietary supplement is a product which intends to add nutritional value to the diet [Food & Drug Administration (FDA) 2015]. According to Lieberman, Marriott, Williams, Judelson, Glickman, Geiselman, Dotson & Mahoney (2015), the use of dietary supplements is favoured among many countries, with a steady increase in use. The different supplements used include multivitamins, multiminerals, amino acids and individual vitamin and mineral supplements such as vitamin A, B-complex, C, magnesium and zinc. Dietary supplementation is considered an important strategy in the treatment and prevention of chronic diseases such as cancer and coronary heart disease. Furthermore, given the harmful effects of micronutrient deficiencies, dietary supplementation has been shown to improve quality of life (Suleiman, Alboqai, Yasein, Al-Essa & El-Masri 2008).

There are many groups that are known to make use of dietary supplements such as females, the elderly, health professionals, gym goers, pregnant women, children under the age of 18 years and university students, particularly health science students. According to Bailey, Gahche, Lentino, Dwyer, Engel, Thomas, Betz, Sempos & Picciano (2010), more females compared to males consumed dietary supplements, which also increased with age. In addition, it was also reported that individuals with a higher education and income status were more inclined to consume dietary supplements (Bailey *et al* 2010). There is also frequent dietary supplementation amongst the elderly in order to improve their overall nutrient intake (Weeden, Remig, Holcomb, Herald & Baybutt 2010). According to Gardiner, Woods & Kemper (2006), the use of dietary supplements was prevalent among healthcare professionals, particularly those with knowledge that is more clinical and those that discussed dietary supplements with their patients. Gym goers, specifically those who do not exercise for monetary value, are also a group that is known to make use of dietary supplements in order to improve body shape, performance and health (Jawadi, Addar, Alazzam, Alrabieah, Al Alsheikh, Amer, Aldrees, Al Turiki, Osman & Badri 2017; El Khoury & Antoine-Jonville 2011). Dietary supplementation among pregnant women is common for optimal nutritional support and development for both the mother and fetus (Lee, Tsui & Wang 2016). Moreover, children under the age of 18 years are also known to make use of dietary supplements in order to “prevent health problems” and “boost immunity” (Bailey *et al* 2010).

Students are a group known to make use of dietary supplements to aid their academic performance (Aina & Ojedokun 2014; Steele & Senekal 2005). Specifically, students studying medical and health-related degrees have been shown to have a higher prevalence of supplement use (Aina & Ojedokun 2014). Some of the reasons cited for use of dietary supplementation, by university students, include recommendation by doctor to improve health and immune status, to supplement the current diet, to provide energy, aid weight loss, increase muscle strength and promote overall general health (Lieberman *et al* 2015; Aina & Ojedokun 2014). A South African study by Steele & Senekal (2005) found that students used supplements for 'physical health', 'body conditioning' and 'dietary reasons'. Some of the reasons cited for not using supplements included 'cost', 'not important' and 'adequate diet' (Driskell 1999). Although students may share a variety of interests and have similar lifestyles, their use of dietary supplements may differ from the general population (Lieberman *et al* 2015). Steele & Senekal (2005) also reported that a 'perceived dietary inadequacy', 'convenience' and the idea that food contains an inadequate amount of nutrients were reasons for use of dietary supplements by students. However, dietary adequacy and intake was not investigated (Steele & Senekal 2005).

Van der Kruk, Jager-Wittenaar, Niewag & van der Schans (2013) found that knowledge on nutrition improved with education, among students studying nutrition-related courses. However, it is not known if this exposure and knowledge on nutrition influences them to make use of dietary supplements (Van der Kruk *et al* 2013). Van der Kruk *et al* (2013) found that there was an increased prevalence of supplement use by students studying nutrition or dietetics as they progressed with their studies (Van der Kruk *et al* 2013).

It is assumed that students studying a nutrition-related degree such as dietetics would be more likely to use dietary supplements to improve performance, nutritional status and their overall health. However, there is a lack of published South African studies on this topic. Therefore, this study aimed to assess the use of dietary supplements by dietetics students at the University of KwaZulu-Natal (UKZN).

1.2 Aim of the study

The aim of the study was to assess the use of dietary supplements by students registered for a Bachelor of Science or a Post Graduate Diploma in Dietetics, at UKZN.

1.3 Type of Study

This was a descriptive, cross-sectional study.

1.4 Objectives

1.4.1 To determine the prevalence of dietary supplement use among dietetics students at UKZN.

1.4.2 To determine the factors associated with dietary supplement use among dietetics students at UKZN.

1.4.3 To determine the reasons for use of dietary supplements among dietetics students at UKZN.

1.5 Hypotheses

1.5.1 There is a high prevalence of dietary supplement use among dietetics students at UKZN.

1.5.2 Dietetics students who have poor eating habits and inadequate dietary intake are more likely to use dietary supplements.

1.5.3 Dietetics students are more likely to use dietary supplements to ensure adequate nutritional status, improve overall physical health and increase energy levels.

1.5.4 Female students and those who live at home are more likely to use dietary supplements.

1.6 Study parameters

Only students registered for the Bachelor of Science in Dietetics degree or the Postgraduate Post Graduate Diploma in Dietetics at UKZN, were included in this study.

1.7 Assumptions

1.7.1 It was assumed that the students understood the English language used in the questionnaire.

1.7.2 It was assumed that all students answered the entire questionnaire honestly.

1.8 Definition of terms

Dietary Supplement: A dietary supplement is a product with its intended purpose to add nutritional value to the diet (FDA 2015).

Dietetics students: For the purpose of this study, these are students registered for either the B.Sc Dietetics degree or the Post Graduate Diploma in Dietetics at UKZN, at the time of the study.

University of KwaZulu-Natal: This is a university with five campuses in KwaZulu-Natal, South Africa. It was formed on the 1 January 2004 because of a merger between the University of Natal and the University of Durban-Westville (UKZN 2017a).

1.9 Abbreviations

BMI	Body Mass Index
DSHEA	Dietary Supplement Health and Education Act
CAMs	Complementary and Alternative Medicines
FDA	Food and Drug Administration
HPCSA	Health Professions Council of South Africa
MCC	Medicines Control Council
NHANES	National Health and Nutrition Examination Survey
NRV	Nutrient Reference Value
UK	United Kingdom
UKZN	University of KwaZulu-Natal
USA	United States of America
SPSS	Statistical Package for the Social Sciences

1.10 Summary

A dietary supplement is a product which has the purpose to add nutritional value to the diet. The use of dietary supplements is common, with many countries showing increased use. There are many groups that are known to make use of dietary supplements such as females, the elderly, health professionals, gym goers, pregnant women, children under the age of 18 years and university students. However, students, particularly medical and health science students have shown increased use of dietary supplements, in order to aid their academic performance. Although students may share a variety of interests and have similar lifestyles, their use of dietary supplements may differ from the general population. It has also been found that knowledge on nutrition improves with education among students studying nutrition-related courses. There is evidence of an increased prevalence of supplement use by students studying nutrition or dietetics as they progressed with their studies. It is assumed that students studying a nutrition-related degree such as dietetics would be more inclined to use dietary supplements, to improve academic performance, nutritional status and their overall health. However, there is a lack of local South African studies on this topic. Due to a paucity of published South African studies, this study aimed to assess the use of dietary supplements by dietetics students at UKZN.

1.11 Outline of dissertation

This dissertation is laid out as follows:

Chapter 1: Introduction, the problem and its setting

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4: Results

Chapter 5: Discussion

Chapter 6: Conclusion and Recommendations

1.12 Referencing style

The referencing style used in this dissertation is in accordance with the referencing guidelines used at Dietetics and Human Nutrition, University of KwaZulu-Natal, Pietermaritzburg.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews the literature relating to the use of dietary supplements. The first part of the chapter gives an overview of dietary supplements; particularly the definition, groups that are known to use dietary supplements, commonly used dietary supplements and its effects. Furthermore, claims and labeling associated with dietary supplements are also reviewed, with particular focus on South Africa. The second part of this chapter investigates the use of dietary supplements by the student population, including their sources of information for dietary supplements.

2.1 Overview of dietary supplements

In this section, an overview is presented with particular focus on the definition of dietary supplements, use of dietary supplements by the general population and students. Groups who use dietary supplements, commonly used dietary supplements, sources of information, a South African perspective of the Dietary Supplement Health and Education Act (DSHEA) of 1994, safety, claims and labeling of dietary supplements are also reviewed.

2.1.1 Definition of dietary supplements

According to the FDA (2015), a dietary supplement is, lawfully, defined as a product, ingested orally, containing a "dietary ingredient" which intends to enhance the diet by improving its nutritional value. The dietary ingredients found in these supplements may include vitamins, minerals, amino acid, herbs or enzymatic substances. Dietary supplements are consumed in various forms such as capsules, tablets, softgels, gelcaps, liquids or powders (FDA 2017). It is important to note that dietary supplements are not designed to diagnose, cure or alleviate chronic diseases. Furthermore, although dietary supplements cannot entirely prevent chronic diseases, as is noted with vaccines, they are able to reduce the risk (FDA 2015).

2.1.2 Use of dietary supplements

Over the years, the knowledge and awareness of nutrition, among the general population, has amplified dramatically. Society has evolved, resulting in more individuals aiming for optimal health, thus trying to improve their daily intake of nutrients (Bailey *et al* 2010). According to Gahche, Bailey, Burt, Hughes, Yetley, Dwyer, Picciano, McDowell & Sempos (2011), data obtained from the National Health and Nutrition Examination Survey (NHANES) in the

United States of America (USA), showed widespread use of dietary supplements among adults aged 20 years and older. The percentage of Americans that used, at least one dietary supplement increased from 49%, between 1998 to 1994, to 53%, between 2003 to 2006 (Figure 2.1).

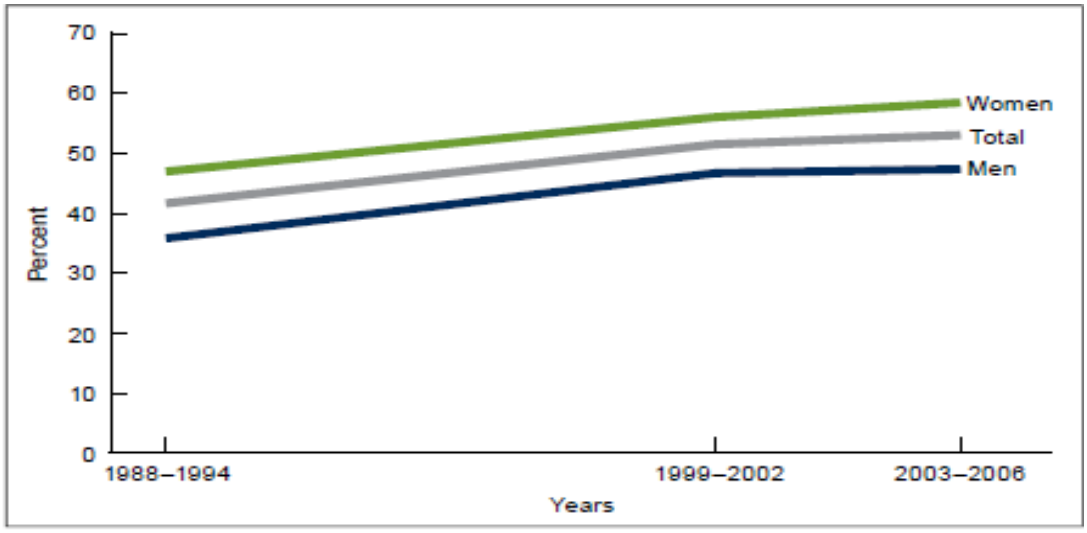

Figure 2.1 Dietary supplement use by adult Americans 20 years and older using data from the NHANES (Gahche *et al* 2011)

Similarly, Wardenaar, van den Dool, Ceelen, Witkamp & Mensink (2016), reported a high prevalence (62%) of dietary supplement use among the Dutch population. There was increased use by the younger age categories (15-20 years and 21-35 years) compared to the older age categories (51-65 years and 66-80 years). Dietary supplement use was more prevalent among women in the various age categories, compared to men (Wardenaar *et al* 2016).

The following section discusses the use of dietary supplements among the various sub-populations.

2.1.3 Groups who use dietary supplements

The NHANES, a nationally represented cross-sectional survey conducted in the USA, showed that 53% of females and 44% of males used dietary supplements, which increased with age. Overall, 54% of adults used dietary supplements. Furthermore, overweight individuals had the highest intake of dietary supplements (57%), followed by normal weight individuals (56%) and obese individuals with the lowest intake (48%). The intake of dietary supplements varied among the different education levels and race groups. Those with more than a high

school education had the highest intake (61%) of dietary supplements, compared to those who had less than a high school education (37%). Additionally, Mexican-Americans had the lowest intake (34%), while non-Hispanic white Americans had the highest intake (59%) (Bailey *et al* 2010).

Dietary supplementation is frequently reported among the elderly. Weeden *et al* (2010) who conducted 24 hour recalls on 263 participants aged 60 years and older, with sound cognitive ability, confirmed the use of at least one dietary supplement. More females (n=204), compared to men (n=59), used dietary supplements. Most of the participants had at least a high school education and chronic illnesses were reported in about 90% of the participants, together with the use of various prescription medications (Weeden *et al* 2010).

Van der Horst & Siegrist (2011) aimed to investigate the correlation between the use of dietary supplements and dietary supplement users, based on their diet and lifestyle. These results revealed that there was an important relationship between gender, age, education, chronic illness, food fortification benefits and carbonated sweetened beverages, and the use of dietary supplements. Van der Horst *et al* (2011) reported that females were more likely to use supplements compared to males. Older, more educated subjects were found to use dietary supplements more. Furthermore, subjects who had chronic illnesses were more likely to use dietary supplements. Users of dietary supplements were more likely to have an unhealthy diet (31%), compared to those with a healthy diet (20.6%). However, individuals who used dietary supplements where more likely to consume less carbonated sweetened beverages, compared to those who did not use dietary supplements. It is unknown whether dietary supplements are intended to compensate for an unhealthy lifestyle or for people who already have a healthy diet (Van der Horst *et al* 2011).

This was re-iterated by Kim, Giovannucci, Rosner, Willett & Cho (2014), who aimed to investigate the secular and longitudinal trend of dietary supplementation among health professionals between 1986-2006 in the USA. The use of dietary supplements increased with age and was more common amongst females. This study showed that students over the age of 23 years had an increased intake of dietary supplements, compared to their younger peers. In 1986, the prevalence of use among participants was 71.3% for women and 56.4% for men. According to Kim *et al* (2014), this increased in 2006 to 88.3% for women and 80.7% for men. The high use of dietary supplements in this population could be attributed to the

participants being healthcare professionals, who are more likely to have better knowledge on dietary supplementation compared to the general population (Kim *et al* 2014).

Similarly, a cross-sectional study by Gardiner *et al* (2006) which surveyed 1249 healthcare professionals between September 2004 and May 2005, found that 81% of the participants used either a vitamin, mineral or non-herbal dietary supplement. Nurses displayed the highest use (88%), followed by physician assistants/ nurse practitioners (84%), with the lowest use among pharmacists (66%). Dietitians showed the highest intake of calcium (54%). Among these healthcare professionals, women used dietary supplements more than men, which increased as they aged. Older clinicians, those with more clinical knowledge and those who discussed dietary supplements with their patients, showed increased use (Gardiner *et al* 2006).

Dietitians are healthcare professionals who are educated in the field of nutrition science and living a healthy lifestyle. A cross-sectional pilot study conducted by Hoeve (2011), assessed the recommendation practices, personal use and beliefs of dietary supplements among dietitians in the Netherlands. Out of 94 completed questionnaires, 84% of the participants reported using a vitamin supplement, whilst 60% used a mineral supplement (which includes multivitamin-mineral supplement), in the previous five years. In addition, approximately, 71% of the dietitians reported recommending supplements at times (Hoeve 2011).

Similar to other studies, Kishiyama, Leahy, Zitzelberger, Guariglia, Zajdel, Calvert, Kaye & Oken (2005), also found that dietary supplementation was more predominant among females compared to males. A significant relationship between the education level and the use of dietary supplementation was reported, showing that educated individuals were more likely to consume dietary supplements. On the other hand, dietary supplementation decreased with age (Kishiyama *et al* 2005).

El Khoury & Antoine-Jonville (2011) who conducted a cross-sectional study on dietary supplementation among those that exercised in a gym, reported a 36.3% prevalence of use among the 515 Middle Eastern participants. This study included only individuals that exercised at gym and not athletes. The use of dietary supplements was significantly associated with gender and the total exercise duration. Unlike other studies, El Khoury & Antoine-Jonville (2011) revealed that more males compared to females used dietary supplements (72% versus 28%, respectively). The highest prevalence of dietary supplement use was among the 20-30 year age group (64%). Approximately 62.4% of the supplement users indicated that they exercised 3-5 times a week for 1-2 hours/day. In addition, 59.1% of

those who used supplements had a bachelor's degree, compared to other levels of education. However, factors such as age, level of education, alcohol intake, smoking status, disease history, frequency and total time of daily exercise had no statistical significance in this population. The level of activity such as strength training ($p<0.001$), treadmill ($p<0.05$) and fights and martial arts ($p<0.05$) was significantly associated with the use of dietary supplements. This indicated that participants involved in the treadmill (57%) and strength training (80.6%) used dietary supplements whilst those involved in martial arts and fights (14.5%), had a lower prevalence of dietary supplement use (El Khoury & Antoine-Jonville 2011).

In a very recent and similar cross-sectional study, Jawadi *et al* (2017) investigated the prevalence of dietary supplement use among gymnasium users in Saudi Arabia. The participants had to be a gymnasium user who engaged in sport for enjoyment and not for monetary or professional benefit. Of the 299 participants, 37.8% reported the use of dietary supplements. This was similar to results reported by El Khoury & Antoine-Jonville (2011). According to Jawadi *et al* (2017), more males compared to females used dietary supplements (44.7% and 16.4%, respectively). The gender based analysis showed that males exercised more regularly than females, and cardiovascular exercise was more common among males. Participants, particularly males (62.8%), exercised for about 3-5 days a week. Furthermore, those that had a bachelor's degree (54.9%) had the highest frequency of dietary supplement use, compared with other levels of education. On the other hand, 58.1% of the participants who had a bachelor's degree reported not using supplements. Jawadi *et al* (2017) also reported a statistical significance on the non-use of dietary supplements and overweight participants ($p<0.0001$). This could be due to supplement users exercising for a longer period (<10 years), compared to the overweight non-users (Jawadi *et al* 2017).

Another group commonly known to use dietary supplements is pregnant women. According to Lee *et al* (2016), optimal nutritional support is vital for fetal growth and development, as well as to ensure that the pregnant woman remains healthy. In a Norwegian mother and child cohort study, data from 22500 women with deliveries between 2000 and 2003 were analysed. The patterns and predictors of maternal folic acid supplementation from two months before gestation to eight months of gestation were examined. This study reported that the intake of folic acid supplements increased from 11.8% from two months before gestation to 46.9% at the third month of gestation. However, the intake of folic acid supplements decreased to 46.9% at the eight month of gestation. Furthermore, it was reported that women who used

folic acid supplements consistently during the peri-conceptional period, were more likely to be married/living together, older, non-smokers, have higher incomes, more educated and with planned pregnancies (Nilsen, Vollset, Gjessing, Magnus, Meltzer, Haugen & Ueland 2006).

Al Rakaf, Kurdi, Ammari, Al Hashem, Shoukri, Garne & Majeed-Saidan (2015), investigated the prevalence of neural tube defects and the intake of folic acid supplements in pregnant Saudi Arabian women. This case-control study on 30531 pregnant women, revealed a high occurrence of neural tube defects in mothers with a low intake of folic acid supplements. This indicated that dietary supplementation could be used to decrease the risk of an illness or complication. Only 9.7% of participants in group one reported full folic acid supplementation. However, group two (82%) reported a partial course of folic acid supplementation, which could be attributed to their increased awareness, unlike group one (Al Rakaf *et al* 2015)

Parents who use dietary supplements are more likely to have children who also use dietary supplements (Dwyer, Nahin, Rogers, Barnes, Jacques, Sempos & Bailey 2013). Dwyer *et al* (2013) described the prevalence and predictors of the use of dietary supplements in children. This study consisted of children under the age of 18 years who participated in the Complementary and Alternative Medicine supplement of the National Health Interview Survey of 2007, in the USA. Approximately 37% of the participants used dietary supplements, with users more likely to be Asian, white or non-Hispanic. The parents of the participants had higher educational and income levels and were reported to be in either 'good', 'very good' or 'excellent' health (Dwyer *et al* 2013). A more recent study by Kang & Lee (2014) analysed the intake of dietary supplements among Korean preschool children. The data from the fifth Korean National Health and Nutrition Examination Survey, between 2010 and 2012 was analysed. A high prevalence of dietary supplement use was reported among preschool children, compared to infants (49-54.2% in 1-6 year olds vs. 19.6%-30.3% in children <1 year old). There was also a significant association between level of parental income and the intake of dietary supplements ($p<0.001$). The intake was higher in families with a higher income compared to families with a lower income. Furthermore, there was a significant association between gender and the intake of dietary supplements. More boys (53.9%) compared to girls (47.8%), reported use of dietary supplements (Kang & Lee 2014).

Students are a group known to make use of dietary supplements to aid their academic performance (Aina & Ojedokun 2014; Steele & Senekal 2005). Although students are known

to share similar characteristics and lifestyle patterns, their intake of dietary supplements may differ from the general population (Lieberman *et al* 2015). The use of vitamin and mineral supplements by undergraduate pharmacy students was investigated in Philadelphia, USA. Of 692 students, 47% consumed dietary supplements, which was more common in females (n=190; 27%), compared to males (n=131; 19%) (Ranelli, Dickerson & White 1993).

It is evident that females, compared to males, and particularly as they age, are more likely to use dietary supplements. However, the use of dietary supplements was shown to be more common among men that exercised compared to females. Furthermore, a relationship was established between the level of education and higher income status with the use of dietary supplements. Individuals with a higher education and income level, including children with educated and/or affluent parents, were more likely to consume supplements (Jawadi *et al* 2017; Kang & Lee 2014; Dwyer *et al* 2013; Van der Horst *et al* 2011; Gahche *et al* 2011; El Khoury & Antoine-Jonville 2011; Bailey *et al* 2010; Steele & Senekal 2005).

2.2 Dietary supplement use by students

Dietary supplementation is widespread in the USA, United Kingdom (UK) and a variety of other countries (Guallar, Stranges, Mulrow, Appel & Miller 2013). Although there is a common interest in many countries, there is a paucity of data among sub-populations, such as students. Students are known to make use of dietary supplements in order to aid their academic performance (Aina & Ojedokun 2014; Steele & Senekal 2005).

Since students share similar characteristics and lifestyle patterns, their intake of dietary supplements may differ from the general population. One thousand two hundred and forty eight (1248) university students, from five American universities were surveyed on their dietary supplementation use, reasons for use and the factors associated with use, using a self-administered questionnaire. The results indicated that almost 66% of the students reported use of dietary supplements. Supplements were used to promote general health (73%), increase energy (29%), improve muscle strength (20%) and enhance performance (19%) (Lieberman *et al* 2015).

In a similar South African study, Steele & Senekal (2005) investigated the regularity of dietary supplement use among 400 undergraduate and postgraduate university students attending Stellenbosch University, in the Western Cape. These students completed a questionnaire that consisted of both open and close-ended questions. Participants were asked

to rate their overall health, dietary intake and their regular, sporadic or non-use of dietary supplements. Of the 400 students that were interviewed, approximately 57% were female and 43% were male, with an average age of 20.8 years. About 42% of the participants revealed regular supplement use, 19.5% reported sporadic use and 38.5% did not use dietary supplements at all. The Bachelor of Science students reported regular use (30.5%) and sporadic use (30.8%) of dietary supplements.

Furthermore, Steele & Senekal (2005) reported that students with 'poor' health or dietary intake were less likely to consume dietary supplements compared to students who indicated a 'good' or 'very good' health or dietary intake. Reasons for using dietary supplements included: a 'perceived dietary inadequacy', 'convenience', 'physical health', 'energy' and the idea that food contains an inadequate amount of nutrients. However, dietary adequacy and intake were not investigated. Therefore, it could not be concluded if there was a relationship between supplement use and dietary adequacy, for this particular population (Steele & Senekal 2005).

Aina & Ojedokun (2014), in an analogous study, sampled 300 final year students at a Nigerian University. Students completed a questionnaire consisting of open and close-ended questions. There were more female participants (53%) compared to males (47%) and about 65% of the participants were between 21-25 years. Both Steele & Senekal (2005) and Aina & Ojedokun (2014) indicated that females were more likely to use dietary supplements than male students. Aina & Ojedokun (2014) also reported that less than half of the participants (48%) deemed dietary supplements to be 'very important', whilst 12.3% deemed them as not important and 18% did not know the importance of dietary supplements. Most of the participants (86.9%) had used dietary supplements previously, whilst 50% used dietary supplements in the previous 12 months. According to Aina & Ojedokun (2014), students who used dietary supplements in the previous 12 months, indicated sporadic use. In addition, the reasons provided for the use of dietary supplements were for 'good health' (58.9%), 'poor diet' (35%) and 'energy' (26.8%) (Aina & Ojedokun 2014). Steele & Senekal (2005) also cited similar reasons for use. However, it is important to note that 64.4% of the students mentioned that dietary supplements could be used to substitute the nutrients found in food. This indicates a serious knowledge deficit as dietary supplements, according to the FDA (2015), aim to enhance the diet and not replace nutrients from food (Aina & Ojedokun 2014).

A cross-sectional study conducted by Suleiman *et al* (2008) at a Jordan University, also aimed to determine the prevalence of dietary supplementation among students. Study participants were recruited from five faculties (medicine, dentistry, science, agriculture and humanities). A total number of 1187 students (399 males and 788 females) completed a self-administered questionnaire. These students ranged in age from 17-28 years with 17% listed as smokers, 27% as physically active and 83.8% with a normal body mass index (BMI). The results indicated that 27.4% of the participants used dietary supplements in the previous year. There was also a significant pattern in the use of dietary supplements and smokers. This study indicated that students who were non-smokers were more likely to use dietary supplements, compared to students who smoked, indicating an interest in their health and well-being. Thirty two percent of students who had a family income of ≥ 500 Jordanian Dinar (JD) (R 9558) consumed dietary supplements, compared to the 25.8% of participants whose income was between 300 JD and 500 JD (R 5735- R 9558). This also includes the 17.7% of students with a family income of less than 300 JD (R 5735). A higher family income was associated with a higher use of dietary supplements (Suleiman *et al* 2008).

Suleiman *et al* (2008) revealed that female students from a higher family income bracket and those who were non-smokers, physically active with a normal BMI and vegetarian, were more likely to use dietary supplements. This indicated that these students were more health conscious. However, as the students increased in age they were less likely to take dietary supplements. Unfortunately, this study investigated overall prevalence, thus not attributing a link to dietary supplement use and the faculty. Furthermore, unlike Steele & Senekal (2005) and Aina & Ojedokun (2014), this study reported a low prevalence of dietary supplement use among the Jordanian students.

According to Suleiman *et al* (2008), the main reasons for dietary supplementation use were for treatment purposes. However, 'physical appearance', 'supplement diet', 'promote health' and 'prevent diseases' were some of the other reasons cited, similar to Steele & Senekal (2005) and Aina & Ojedokun (2014). Some of the reasons cited for not using supplements included 'cost', 'not important' and 'adequate diet' (Driskell 1999).

Ayranci, Son & Son (2005) investigated the extent of non-vitamin and non-mineral supplement use among 1871 Turkish university students. Overall prevalence of use was 16.5% (16.6% in male and 16.3% in females). Unlike the results depicted for South Africa, Nigeria, USA and Jordan, this study revealed that slightly more men consumed dietary

supplements compared to women. These results indicated a relatively modest prevalence of use of non-vitamin and non-mineral supplementation, in comparison to studies previously mentioned. Moreover, the three most common reasons cited for the use of dietary supplementation were to improve athletic performance (64.3%), promote weight loss (71.1%) and improve energy (78.6%), thus coinciding with the South African, Nigerian and Jordanian studies. Ayranci *et al* (2005) found a positive association between exercising and the use of non-vitamin and non-mineral dietary supplements. Moreover, there was a significant association with family income and the use of non-vitamin and non-mineral supplements. Most of the students (86.7%) that came from a low family income bracket were less likely to consume a non-vitamin and non-mineral supplement, which is in line with the results reported by Suleiman *et al* (2008).

2.2.1 Dietary supplement use by student athletes

According to McDowall (2007), nutrition is a vital component in an athletic training programme. There was a high prevalence of dietary supplementation among university student athletes to ensure optimal performance (Potgieter, Visser, Croukamp, Markides, Nascimento & Scott 2014; Yager & O'Dea 2014; Hoyte, Albert & Heard 2013). An Australian study conducted by Yager & O'Dea (2014) on boys between 12 to 22 years of age, reported that 37% of the participants used vitamin and mineral supplements. This demonstrated a low use of dietary supplements. Furthermore, boys who consumed dietary supplements were more likely to have a negative perception of their body image and were more likely to make use of illegal drugs to enhance their sport performance (Yager & O'Dea 2014).

Potgieter *et al* (2014) conducted a cross-sectional study, with an analytical component, on 35 rugby players from the Stellenbosch Maties Varsity cup. This study collected information regarding habitual dietary intake, body composition and supplement use. The results showed that 91% of the players used dietary supplements, habitually. This study also reported a high habitual intake of supplements combined with a nutritional intake that was inadequate in total energy, although there was higher intake of total protein. Supplements were used for illness prevention (10%), weight gain (40%), performance enhancement (70%), muscle building (40%), increased energy (50%) and protein and carbohydrate supplementation (Potgieter *et al* 2014).

College students in the USA who participated in sport showed a similarly high consumption of supplements from a cross-sectional study conducted online, using participants from different colleges in the USA. Of the 462 participants, who played sports at various levels, 397 (85.9%) reported using dietary supplements, prescription medications (53.3%) and energy drinks (80.1%). There were no correlations between gender, type or level of sport and the use of supplements (Hoyte *et al* 2013).

In a similar study by Darvishi, Askari, Hariri, Bahreynian, Ghiasvand, Ehsani, Mashhadi, Rezai & Khorvash (2013), the relationships between BMI, age, training volume, type of sport and the consumption of dietary supplements were investigated among male Iranian university students. Of the 173 male students, 45% used dietary supplements. These students were 21 years and older, with a BMI of approximately 21-25 kg/m^2 and trained for about 5.5 hours/week for individual sport, to 7.5 hours/week for team sport. There was no significant relationship between use of dietary supplements and age, BMI and training load. However, type of sport played, such as team or individual, influenced the type of dietary supplement used. Darvishi *et al* (2013) reported that student athletes who participated in individual sports were more likely to consume dietary supplements and ergogenic aids ($p<0.05$). On the other hand, student athletes who participated in team sports were more likely to consume recovery nutrients (a combination of carbohydrates, proteins, fluids, and electrolytes to ensure the body is refueled and re-hydrated and to repair and rebuild muscle tissue) ($p<0.01$). Both Hoyte *et al* (2013) and Darvishi *et al* (2013) reported that supplements were used to enhance performance. In addition, Darvishi *et al* (2013) also reported that dietary supplements were used to "reduce fatigue" and promote a "faster recovery".

Tian, Ong & Tan (2009) also reported a high prevalence (76.8%) of dietary supplementation among university athletes between 18 to 33 years of age, enrolled at a Singapore university. Approximately 82 student athletes (42.5%), from various sport disciplines completed a questionnaire distributed via the various team captains. The participants reported an average BMI of 21.3 ± 2.2 kg/m^2, with 20.7% classified as overweight and 12.2% as underweight. The majority of the participants consumed meals from the hostels or university cafeteria with 94.7% choosing rice, pasta and bread as a low fat carbohydrate option. This indicated moderate to sound dietary practices (Tian *et al* 2009). There was a significant difference in the use of dietary supplements among male and females (66.7% and 33.3%, respectively). Furthermore, 81% of the males researched the product used, compared to females (52%).

Unfortunately, 38% had no knowledge of the product they chose to use. According to Tian *et al* (2009), athletes who spent more than five hours a week on cardiovascular training, were more inclined to use sports drinks/bars/meal replacements ($p=0.04$), multivitamins ($p<0.01$) and antioxidants ($p=0.04$). In addition, vitamin C, glucosamine and multivitamins ($p=0.02$) was more likely to be used by students that played three or more sports. There was no significant relationship between the use of the different supplements and BMI, duration of sport, participation level or academic background (Tian *et al* 2009).

Of all the studies reviewed, Kristiansen, Levy-Milne, Barr & Flint (2005) reported the highest prevalence (98.6%) of supplement use by student athletes. Students at a Canadian university were about 21 years of age, had a mean BMI of 25.3 kg/m^2 and exercised for approximately 9.8 hours/week. No link was identified between age, BMI, duration of exercise, type of sport and type of dietary supplement. However, reasons for the use of dietary supplements were supported by previous studies. Primary reasons for supplementation among students was to increase muscle mass, provide energy and fluid, reduce fatigue, supplement the diet, prevent illness and stay healthy (Tian *et al* 2009; Kristiansen *et al* 2005).

2.2.2 Dietary supplement use by health science students

Students, studying medical and health-related degrees, have been shown to have a higher prevalence of supplement use. This could be attributed to their medical training and nature of courses taken, thus increasing awareness and use of dietary supplements (Aina & Ojedokun 2014). A cross-sectional study conducted on 882 medical, pharmacy and nursing students at the International Medical University in Malaysia, reported a high use of supplements (Lieng, Kuan, Hong, Feng, Nordin, Mun, Zakaria & Ying 2008). About 71.9% reported using dietary supplements for the previous year whilst 43.4% of the students reported daily use. Although a high dietary supplement usage was reported, these health science students were ambivalent about the benefits of the products used (Aina & Ojedokun 2014).

Similarly, Aina & Ojedokun (2014) also reported that almost two-thirds of the students stated that dietary supplements could be used to substitute the nutrients consumed from food, i.e. substitute for a healthy diet. Therefore, this indicates insufficient knowledge and understanding on the purpose of dietary supplements. Pharmacy students were least likely to use dietary supplements as a substitute for a healthy diet. This could be due to the fact that dietary supplements are related to drugs, which are the foundation and driving force of their training.

Spencer, Bendich & Frank (2006) found that medical students were more prone to dietary supplementation in this longitudinal study. The consumption of calcium supplements, which was prevalent among females, increased as the year of study increased. However, the regular use of calcium was only slightly linked with the understanding of the importance of calcium ($p=0.08$), but not with the regularity of nutrition counselling ($p=0.9$). Spencer *et al* (2006) also found that students were inclined to use multivitamins if they exercised often, had children, were female, did not consume alcohol excessively and were underweight. Correlations between dietary and lifestyle factors were also established. These students were either underweight, exercised often or had a family history of osteoporosis, resulting in the intake of calcium supplements. Therefore, medical students, particularly female students, were more consistent in the use of dietary supplements compared to the male students (Spencer *et al* 2006).

Results from Spencer *et al* (2006) showed a lower prevalence of dietary supplement use, compared to Driskell (1999) and Lieng *et al* (2008). According to Driskell (1999), 105 (59.6%) of the participating students (67% of females; 52% of male) used vitamin or mineral supplements. However, it is important to mention that a sample size of 176 subjects was used, compared to the 2316 subjects used in Spencer *et al* (2006).

A cross-sectional study by Sharma, Adiga & Ashok (2014) aimed to determine the usage of dietary supplements among health science students, particularly medical, nursing and dental students, at the University of South India. Of the 339 participating students aged 20-25 years, 167 were enrolled for medicine, 92 for nursing and 80 for dentistry. Most of the students presented with a normal body weight (68.7%) whilst some were overweight (14.2%), underweight (14.2%) and obese (3%). Furthermore, the majority of students did not smoke (94.7%) or consume alcohol (76.7%), consumed a non-vegetarian diet (73.3%) and exercised sporadically (54%). This study reported that about 49.6% of the students, mostly females, consumed dietary supplements with the highest from the nursing students (97.7%) and the lowest from the medical group (69.4%). It is also interesting to note that the students studying towards a medical degree had a better knowledge on micronutrients compared to nursing students. Sharma *et al* (2014) reported that common reasons for the use of dietary supplements were to prevent diseases, enhance performance, promote optimal nutrition, maintain good health and meet the body's energy requirements, similar to reasons cited by Aina & Ojedokun (2014).

Kostka-Rokosz, Camiel, Tataronis, Steinberg & McCloskey (2015) investigated the use of dietary supplements among 342 pharmacy and 77 nursing students, aged between 18-29 years old in Boston. Both pharmacy (69%) and nursing students (83%) used dietary supplements (vitamin and mineral combination). Both courses educate on health promotion, disease prevention, self-care and wellness. However, pharmacy students were more likely to use dietary supplements on a regular basis, compared to nursing students. Furthermore, pharmacy students were more dubious and less adherent in the use of dietary supplementation, compared to the nursing students. Primary reasons for dietary supplementation were to treat illness/infection, prevent disease and reduce fatigue/insomnia. However, reasons for not wanting to use dietary supplements were cost ($p<0.02$), ineffectiveness ($p<0.003$), preference for conventional medications (21% pharmacy and 13% nursing) and insufficient experience with dietary supplement products (20% pharmacy and 16% nursing) (Kostka-Rokosz *et al* 2015).

A similar study by Ranelli *et al* (1993), investigated the use of vitamin and mineral supplementation among 692 undergraduate pharmacy students. These students classified their health as 'excellent' (92.6%) whilst 75.3% classified their health as 'fair'. This study reported that 47% of the students had taken dietary supplements in the previous weeks, whilst 65.4% reported frequent use. However, the prevalence of use of dietary supplements in this study was lower than that of Kostka-Rokosz *et al* (2015). Furthermore, the students did not express an opinion regarding dietary supplements, indicating a possible lack of exposure and knowledge on the topic. Furthermore, Ranelli *et al* (1993) reported that the two main reasons for dietary supplementation among science students were inadequate diet (54.5%) and to increase energy (50.8%).

2.2.3 The use of dietary supplements by dietetics and nutrition students

It is assumed that students studying a nutrition-related degree would be more likely to use dietary supplements to aid academic performance and improve nutritional status and overall health. A cross-sectional study by Van der Kruk *et al* (2013), on Dutch nutrition and dietetics students revealed that knowledge on nutrition improved with education among students studying nutrition-related courses. However, it is not known if exposure to and knowledge on nutrition influenced them to use dietary supplements (Van der Kruk *et al* 2013). Van der Kruk *et al* (2013) found an increasing prevalence of supplement use by students as they progressed with their studies, as 29% used supplements in first year compared to 37% in fourth year.

Furthermore, students who lived away from home reported a better nutritional intake, compared to the students who resided with their parents. Those that lived away from home had a better intake of water, vegetables, iron, magnesium and niacin. They were also more likely to meet their Recommended Dietary Allowance (RDA) for calcium, zinc and magnesium, compared to their classmates who lived at home. Although no specific reasoning was provided, it could be due to the fact that the students were receiving well-balanced, regular meals at the university residence (Van der Kruk *et al* 2013).

A cross-sectional study by Steyn, Labadarios, Nel & Roberston (2005) evaluated the knowledge and practices of dietitians on dietary supplements in South Africa. This study included 105 dietetic interns, 367 registered dietitians and 48 nurses. An experienced academic group who evaluated the relevance and knowledge developed a questionnaire consisting of about 50 knowledge-based questions. The average knowledge score of the registered dietitians ranged from 56.5% to 62.5%, with the oldest age category having the highest score ($p=0.018$). This indicates that the more experienced dietitians had more knowledge on dietary supplements. In addition, it was found that 51% of the participants used dietary supplements and 38% of the dietitians' recommended dietary supplements to clients or patients, at least three times a week. This study found that students studying towards a nutrition-related degree were more inclined to consume dietary supplements (Steyn *et al* 2005).

2.2.4 Commonly used dietary supplements

There is a wide variety of dietary supplements currently available to consumers. According to Lieberman *et al* (2015), the intake of dietary supplements of students differs from the general population.

The most common dietary supplements used by university students is depicted in Table 2.1

Table 2.1 Common dietary supplements used by students

Author/s and year	Country	(n)	Commonly used supplements
Kostka-Rokosz *et al* (2015)	USA, Boston	342	Highest used supplement (69% pharmacy, 83% nursing): multivitamin and multiminerals. Second highest (pharmacy, nursing): calcium (32%), vitamin C (38%), respectively Lowest (pharmacy): magnesium (5%), vitamin E (9%) Lowest (nursing): magnesium (5%), folic acid (7%)
Lieberman *et al* (2015)	USA	1248	Highest: multivitamin (42%) Second highest: sports drinks (35%) Followed by: vitamin C (18%), proteins/amino acids (17%), calcium (13%) Lowest: iron (7%), vitamin E (6%)
Aina & Ojedokun (2014)	Nigeria	268	Highest: vitamin C (79.8%), vitamin B complex (52.9%), multivitamins (52%), vitamin A (31%), vitamin B_{12} (27.6%)

Table 2.1 Common dietary supplements used by students (continued)

Author/s and year	Country	(n)	Commonly used supplements
Sharma *et al* (2014)	India (south)	339	Multivitamins Vitamin A Vitamin B complex Vitamin C Folic Acid Lowest: Protein powders
Reid, Ramsarran, Brathwaite, Lyman, Baker, Cornish, Ganga, Mohammed, Sookdeo & Thapelo (2014)	Trinidad/Tobago	1994	Energy drinks (38%) but 86.2% reported to use energy drinks at least one time. Highest energy drink consumed: Monster (37%) Lowest: Red Bull (31%)
Darvishi *et al* (2013)	Iraq	173	Highest: Multivitamins (64%) Vitamin C (42%)
Tian *et al* (2009)	Singapore	82	Sports drinks (90%) Vitamin C (49.2%) Multivitamins (30.2%) Herbal/traditional supplements (11%) Ergogenic aid (20.6%) Least: Ginkgo biloba, creatinine, coenzyme Q_{10} (1.6%)

Table 2.1 Common dietary supplements used by students (continued)

Author/s and year	Country	(n)	Commonly used supplements
Lieng *et al* (2008)	Malaysia	882	Vitamin C (48.6%) Multivitamins (38%) Minerals (12.6%) Non-vitamin and non-mineral (30.4%)
Suleiman *et al* (2008)	Jordan	1187	Highest: Multivitamins (39.6%) Vitamin C (10.4%) Multivitamins-multiminerals (10%) Vitamin B_{12} (9.7%) Calcium (2.4%) Lowest: Antioxidant combination (1.9%)
Spencer *et al* (2006)	USA	2316	Multivitamin (Approximately half of the medical students) Calcium: 19%
Steele & Senekal (2005)	South Africa	400	Highest: Multivitamins (63.7%) Vitamin C (15.5%) Vitamin B complex (13.1%) Lowest: Vitamin B_6 / other mineral combination (0.6%)

Table 2.1 Common dietary supplements used by students (continued)

Author/s and year	Country	(n)	Commonly used supplements
Ayranci *et al* (2005)	Turkey	1871	Three most frequently used: Echinacea (38.6%), gingseng (36.4%), gingko biloba (32.8%) Lowest: evening primrose/ astragalus (0.3%) 28.9% also reported the use of protein powders/ amino acids
Kristiansen *et al* (2005)	Canada	211	Sports drinks: 86.7% males, 63.6% females Carbohydrate gels: 39% males,18% females Caffeine: 87% males, 71% females Creatinine: 11% males, 0% females Vitamins/Minerals: 51.7% males, 62.9% females Iron: 3% males, 24.7% females
Froiland, Koszewski, Hingst & Kopecky (2004)	USA	207	Highest: energy drinks (73%) 61.4% calorie replacement 37.2% creatinine Lowest: pyruvate, other proteins, caffeine/aspirin, dehydroepiandristerone (DHEA) (2.4%)

According to Kostka-Rokosz *et al* (2015), multivitamin/multimineral dietary supplements were the most commonly used among nursing and pharmacy students. However, more nursing students (83%) compared to pharmacy students (69%) were inclined to choose this type of dietary supplement. Furthermore, a greater number of pharmacy students had not used any dietary supplements in the previous year. Both groups in this study also reported using probiotic drinks/yoghurt, fish oil and cranberries (Kostka-Rokosz *et al* 2015). Lieberman *et al* (2015), similarly to Kostka-Rokosz *et al* (2015), also reported a high intake of multivitamins and a low intake of vitamin E. It was also reported that 16% of the subjects used caffeine. Fish oil, echinacea, creatinine supplements, lycopene, melatonin, coenzyme Q_{10} and alpha lipoic acid were used at least once a week (Lieberman *et al* 2015).

Darvishi *et al* (2013) reported that students participating in individual sports were inclined to consume ergogenic aids ($p<0.01$) such as creatinine and caffeine and dietary supplements ($p<0.05$). Conversely, students that participated in team sports were more likely to consume 'recovery nutrients'. It is noteworthy that this study did not investigate and consider sports bars/drinks, thus indicating a limitation. Tian *et al* (2009) also reported similar results, indicating that student athletes who participated in three or more sports were more likely to use vitamin C, multivitamins and glucosamine. In addition, an increased intake of vitamin C was reported when students participated in three or more sports (Tian *et al* 2009).

Froiland *et al* (2004) reported a high use of energy drinks among student athletes. Majority of the students (86%) reported using an energy drink, with Powerade and Red Bull, being the most popular. Furthermore, protein powder was used by 21.7% of the subjects. More than half of the athletes reported the use of vitamins (67%), of which 47% reported the use of multivitamins and 32% used vitamin C. Some of the other supplements used were vitamin E (15%), vitamin A (10%), ginseng (13%) and echinacea (9.7%). Echinacea was the most popular herbal supplement used. There was minimum use of minerals such as calcium (18.8%) and iron (10.6%) among student athletes. Froiland *et al* (2004) also reported that the type of sport influenced the dietary supplement used. Students involved in football/wrestling consumed more calorie replacement drinks, whereas students involved in football/baseball were more likely to use creatinine. Calorie replacement drinks were used to increase energy, replace nutrients after workouts and to promote increased performance together with recovery and muscle repair. Football/basketball student athletes used creatinine to increase muscle, to provide more energy for weight lifting, to increase strength, decrease body fat and increase speed (Froiland *et al* 2004).

The consumption of dietary supplements, particularly multivitamins, vitamin C and vitamin B complex was common among students (Kostka-Rokosz *et al* 2015; Lieberman *et al* 2015; Aina & Ojedokun 2014; Sharma *et al* 2014, Darvishi *et al* 2013; Lieng *et al* 2008, Suleiman *et al* 2008; Steele & Senekal 2005). In addition, student athletes participating in various sports indicated frequent use of sports and energy drinks (Tian *et al* 2009; Kristiansen *et al* 2005; Froiland *et al* 2004). The type of sport influenced the supplements used by the student athletes. Student athletes who wanted to increase muscle strength and decrease body fat were more likely to consume creatinine. The student athletes who aimed to increase energy and replace nutrients were more inclined to consume calorie replacement drinks (Froiland *et al* 2004).

2.2.5 Side effects associated with dietary supplementation

According to Tian *et al* (2009), only 54% of participants reported a concern for possible side effects and safety of dietary supplements, whilst 86% reported that they were unaware that dietary supplementation could even have adverse side effects. Nevertheless, about 95.9% of the student athletes did not experience adverse effects. However, one runner did have diarrhoea after the consumption of a sports bar and a canoeist experienced heart palpitations after drinking a Red Bull. On the other hand, about 81.4% of users reported that they benefited from supplementation and 43% of the students who consumed sports drinks, reported an improved hydration status. Others, who consumed dietary supplements, reported reduced fatigue, improved energy, faster post work-out recovery and decreased risk for infection, particularly upper respiratory tract infection (URTI), thus correlating with their reasons for consuming dietary supplements (Tian *et al* 2009).

In a study conducted by Aina & Ojedokun (2014), medical students reported experiencing side effects such as; bulimia (35.7%), gastrointestinal effects (35.7%) such as; nausea, vomiting, constipation or diarrhoea and central nervous system effects (21.4%) such as headaches and dizziness. Similarly, Ayranci *et al* (2005) reported nausea (61.5%), vomiting (30.7%) and gastrointestinal disturbances (15.4%) among student athletes after the consumption of non-vitamin and non-mineral supplements. However, Darvishi *et al* (2013) reported positive effects from dietary supplementation, including reduced fatigue (23%), faster recovery (14%) and improved performance (34.6%) among student athletes.

Reid *et al* (2014) conducted a cross-sectional study with university students from Trinidad and Tobago to investigate the intake of energy drinks and their adverse consequences. Although

the majority of the participants reported consuming energy drinks, 53% believed they did not benefit from these energy drinks. In addition, 62% of the participants reported experiencing adverse effects. The most frequent were restlessness (23%), jolt and crash effect (18%) and tachycardia (17.5%), with no significant difference between male or female. Additionally, about 59% of the participants were aware of the possible adverse effects from the excessive consumption of energy drinks (Reid *et al* 2014).

2.2.6 Sources of information on dietary supplements for students

The common sources of information regarding dietary supplements were also investigated in order to determine from where students obtained their information regarding dietary supplements. This would help to assess the validity and reliability of the information provided to students. According to Froiland *et al* (2004), females were more likely to obtain information from family members while; male students obtained information on dietary supplementation from fellow athletes, friends, store nutritionists and their coaches. The type of sport played influenced the source of information on dietary supplements. For example, wrestlers were more likely to consult their coaches; however, soccer, football or track students were more likely to obtain information from a professional. However, according to Kristiansen *et al* (2005), coaches were least likely to be consulted as a source of information, especially when using a new product (Kristiansen *et al* 2005).

Frequent sources of information for dietary supplements are health professionals, family members, friends, internet/magazines and coaches/trainers (Lieberman *et al* 2015; Aina & Ojedokun 2014; Tian *et al* 2009; Suleiman *et al* 2008). It is important to note that although the use of dietary supplements among students was high; there was a clear lack of knowledge and understanding on supplementation (Sharma *et al* 2014). Darvishi *et al* (2013) reported that 77% of the male student athletes were influenced to take supplements by their friends, trainers and advertisements. None of the participants obtained information from healthcare professionals or textbooks. Most trainers, friends and advertisements had limited knowledge on nutrition, which could lead to inaccurate advice. Given that all students have easy access to an increasing and diverse range of supplements, there is a need to educate them and provide reliable information regarding appropriate use, potential benefits and the adverse effects. This would allow them to make educated decisions and decrease the risks associated with the misuse of dietary supplements (Darvishi *et al* 2013).

2.3 The Dietary Supplementation Health and Education Act of 1994 - A South African perspective

The DSHEA of 1994 was passed in the USA because of a public debate concerning the importance of dietary supplements, to promote health and the need for consumers to have reliable information (National Institutes of Health 1994). However, it is important to mention that this is not the law in South Africa. For many years, dietary supplements have been sold in South Africa without government control. However, in 2013 the Complementary and Alternative Medicines (CAMs) was established to govern the sale of dietary supplements. Therefore, products that were not evaluated by the Medicines Control Council (MCC) were required to have a disclaimer stating that the product had not been evaluated by the MCC, to ensure safety and quality (MCC 2013). This is discussed further in the section on safety, claims and labeling.

2.3.1 Safety of dietary supplements

According to the South African Consumer Protection Act (2008), nutritional supplements require on-going batch-to-batch evaluation. This is vital to detect any contaminants and to ensure good-quality products and early detection of products that are contaminated and harmful to consumers. Adverse effects, both short-term and long-term, caused by a particular product, should be reported to the authorities and consumers for corrective action. There should also be continuous supervision during production, which highlights the importance of detecting contaminants, but this is not necessary for nutritional supplements (Government Gazette 2009).

According to the Health Professions Council of South Africa (HPCSA) (2017), the MCC in South Africa governs medicines in order to ensure that all medicines, available for public use, meet the strict criteria. When a product is made in an MCC-licensed facility, that product complies with high-quality standards. However, the supplement industry is not regulated and there is a potential for companies who do not meet the strict MCC criteria, to sell their products. Unfortunately, not all supplements manufactured in South African are monitored by the MCC, especially if imported (HPCSA) (2017).

2.3.2 Dietary supplement claims and labelling

In South Africa, there is a lack of clarity in the distinction, between dietary supplements, food and medications. Dietary supplements, food and medications are regulated differently, thus,

developing grey areas in implementing legislation, especially for dietary supplements (Gabriels, Lambert, Smith & Hiss 2011).

According to the South African Consumer Protection Act (2008), a trade description is applied to all products. This can be applied to the actual product itself or the covering/label in which the product is packaged. Moreover, a person is not allowed to apply a trade description to a product that is likely to mislead consumers. Furthermore, the retailer is prohibited from supplying or displaying the product if the retailer suspects that the trade description on the product, is likely to mislead the consumer. It is also important for the producer or importer, of the product, to disclose the country in which the product originated, together with the prescribed information, such as the nutritional content. The supplier is not allowed to express any false or misleading statements about the product to the consumer (Government Gazette 2009).

According to the South African Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972) (Department of Health 2014), messages that pose any health claim or benefit on a food label are prohibited. This complete restriction will also make sure that the latest published evidence has increased regularity on the benefits and harmful effects on health. It is also important to mention that claims on social media and newspapers may cause confusion with the public, if they are not up-to-date (Department of Health 2014). Prins (2008) also explains that peer-reviewed articles do not support some marketing claims regarding the effectiveness of dietary supplements. This leaves the consumer bewildered, as they are unable to decipher between accurate and false information (Prins 2008).

According to the South African Foodstuffs, Cosmetics and Disinfectants Act, 1972 (2010), where vitamins and minerals are provided in amounts of 5% to 15% of the Nutrient Reference Values (NRV), they must be listed in the nutritional information. However, claims for them are prohibited. All complementary medicines, also known as alternative medicine that is in addition to the standard medical care, that are not registered with the MCC, must comply with the following labeling requirements. The product information must be written in English and one other official language. Furthermore, it is mandatory that these words be found on the product; “This medicine has not been evaluated by the Medicines Control Council. This medicine is not intended to diagnose, treat, cure or prevent any disease” (MCC 2013).

A South African study conducted by Gabriels, Lambert & Smith (2012) analysed 40 dietary supplements manufactured locally (48%) and internationally imported products, consisting of

powders, capsules and tablets. The aim of this study was to explain the labelling and claims information on the nutritional products. Only 10% of the dietary supplements cited an article as a reference, not necessarily peer-reviewed and 75% cited studies carried out on human beings. About 95% of the products contained a warning statement on the label and 85% had a disclaimer on the label. It is important that information is regulated and forms part of the labeling process in order for consumers to make an informed decision. This would incorporate identifying potential harmful effects, potential banned substances and warning statements explaining that dietary supplements are not intended to cure diseases (Gabriels *et al* 2012).

Nonetheless, it is important to mention that South Africa needs stronger regulations to ensure continued monitoring of dietary supplements. Regulations should also be readily accessible to help ensure safety and to ensure that there are no contaminants or undeclared prohibited substances in dietary supplements. This is imperative to protect consumers, especially since production, marketing and use of dietary supplements has amplified (Gabriels *et al* 2012).

2.4 Conclusion

It is evident from the literature review that the use of dietary supplements is favoured in many countries, with a steady increase in use (Lieberman *et al* 2015). From the studies reviewed, there was a higher use of dietary supplements among females compared to males. The use of dietary supplements also increased as the participants increased in age (Bailey *et al* 2010). There was a significant relationship between education level and the use of dietary supplements. Participants who had more than just a high school education, particularly a bachelor's degree, were more likely to consume dietary supplements (El Khoury & Antoine-Jonville 2011; Bailey *et al* 2010). Students are a group known to make use of dietary supplements to aid their academic performance, improve their nutritional status and overall health (Aina & Ojedokun 2014; Van der Kruk *et al* 2013; Steele & Senekal 2005). However, student athletes used dietary supplements to increase muscle mass, enhance athletic performance, reduce fatigue and provide energy and fluid (Tian *et al* 2009; Kristiansen *et al* 2005). Vitamin C and multivitamins were the most frequently used supplements among students (Sharma *et al* 2014; Darvishi *et al* 2013; Lieng *et al* 2008; Steele & Senekal 2005). Common sources of information for dietary supplements were health professionals, family members, friends, internet/magazines and coaches/trainers (Lieberman *et al* 2015; Aina & Ojedokun 2014; Tian *et al* 2009; Suleiman *et al* 2008). It is important to note that although the

use of dietary supplements among students was high, there was a clear lack of knowledge and understanding on supplementation (Sharma *et al* 2014). Most trainers, friends and advertisements provide limited knowledge on nutrition, which could lead to incorrect advice. More education needs to be given to students on dietary supplementation. Students studying medical and health-related degrees have been shown to have a higher prevalence of supplement use (Aina & Ojedokun 2014). This could be due to their medical training and the nature of their courses. However, there is a paucity of data regarding supplement use among South African students, particularly those studying towards a nutrition-related degree. Due to a lack of published studies in this area, this study aimed to assess the use of dietary supplements by dietetics students at UKZN.

CHAPTER 3: METHODOLOGY

This chapter describes the background information on the study site, type of study, study population and sample selection, study methods and materials, pilot study, statistical analysis, reduction of bias, data quality control and ethical considerations.

3.1 Background information on the study site

This study was conducted at the University of KwaZulu-Natal (UKZN), Pietermaritzburg campus. Pietermaritzburg is the capital and the second largest city of KwaZulu-Natal. The city was founded in 1838 and is currently governed by the Msunduzi Local Municipality in the UMgungundlovu district (Figure 3.1). The University of Natal and its forerunner, Natal University College, originated in Pietermaritzburg in 1910, registering about 57 students. Two years later, upon the completion of the main building, the Pietermaritzburg campus was established (UKZN 2017b). The Pietermaritzburg campus offers a range of academic programmes such as science and agriculture, education, law and human and management sciences. Dietetics and human nutrition which is part of the College of Agriculture, Engineering and Science, has been housed in the basement of the Rabie Saunders Building, Life Sciences Campus, Pietermaritzburg since 1979 (UKZN 2017b) (Figure 3.2 and Figure 3.3).

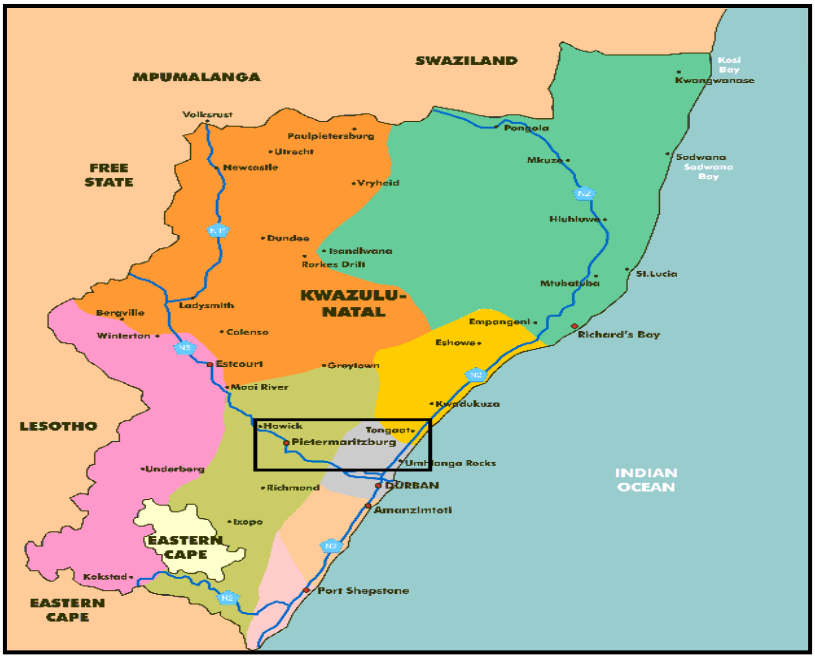

Figure 3.1 Map of the KwaZulu-Natal province, highlighting Pietermaritzburg

Figure 3.2 Ariel view of the Rabie Saunders Building on the Life Sciences campus, Pietermaritzburg

Figure 3.3 Entrance to the Rabie Saunders Building

3.2 Type of study

This was a cross-sectional study, which involves the collection of data from a cross-section or range of the population at one point in time (Mann 2012). It is conducted mainly in the form of a questionnaire. The aim of a cross-sectional study is to determine prevalence, which involves the number of cases of the researched population, at a given point in time (Mann 2012). According to Mann (2012), cross-sectional studies are less expensive, less time consuming and cost-effective, as fewer resources are required for the study. Cross-sectional

studies can be repeated at various times, to assess for any changes or trends. However, as there may be different participants, it may be challenging to assess if changes in prevalence reflect a trend or just differences between the participants (Sedgwick 2014).

3.3 Study population and sample selection

3.3.1 Study population

The study population consisted of all students registered for the Bachelor of Science in Dietetics degree or the Post Graduate Diploma in Dietetics at UKZN in semester 2 of 2017. This would have included all students registered between first year to fourth year. At the time of the study there were 156 students registered altogether. This information was obtained from the Administrative Office of the College of Agriculture, Engineering and Science in Pietermaritzburg.

3.3.2 Sample selection

Convenience sampling was used to recruit students to participate in the study. According to Etikan, Musa & Alkassim (2016), convenience sampling is also known as 'accidental sampling'. This is a method of non-probability or non-random sampling, whereby the subjects of the target population meet the practical criteria for the study, such as the geographical location or the convenient accessibility. Convenience sampling is easy, affordable and subjects are readily available (Etikan *et al* 2016). In order to achieve a statistically significant representation of the whole population in this study, a minimum sample of 113 subjects was required.

3.4 Study methods and materials

3.4.1 Questionnaire

A self-administered questionnaire (Appendix A) was formulated to assess the use of dietary supplements by students registered for a Bachelor of Science or a Post Graduate Diploma in Dietetics, at UKZN. The questionnaire was developed in English as this is the medium of instruction at UKZN. It was assumed that all students understood English. The questionnaire was made up of both open and closed-ended questions and consisted of four sections: socio-demographic (Section A), lifestyle factors (Section B), dietary factors (Section C) and dietary supplementation (Section D). Section A (socio-demographic) was designed to obtain information on age, gender, race, marital status, place of residence during the semester, year

of study, degree/diploma currently registered for, part-time employment, amount earned from part-time employment (if applicable) and the amount of money spent on food. Section B (lifestyle factors) was designed to obtain information on the overall health of the students. In this section, students were asked to rate their state of health from excellent to very poor. Information regarding the consumption of alcohol, the use of recreational drugs, smoking and participation in sport or exercise was also obtained. It is also important to note that the students who were involved in sport had to stipulate whether their level of sport was recreational or at university, provincial or national level. The students also had to rate the level of sport/exercise that they were generally involved in, from strenuous to mild. Section C (dietary factors) was designed to determine the dietary habits of the participating students. The students were asked to rate their eating habits from excellent to very poor, together with consumption of foods such as fruits and vegetables, meat and meat products, dairy and dairy products, starches, carbonated beverages, fat and fat products, pulses and unhealthy snack foods. Students were also asked whether they followed a specific diet. The options were vegan, vegetarian, lacto-ovo vegetarian, lacto vegetarian, pescatarian, high protein/low carbohydrate, Banting (low carbohydrate and high fat) or weight reducing. The final section, Section D (dietary supplements) was designed to determine the prevalence of use of dietary supplements, reasons for use, type of dietary supplements used, sources of information regarding dietary supplements, sporadic or frequent use of dietary supplements, amount of money spent on dietary supplements and whether or not they achieved their desired results. Furthermore, the students were also asked to assess their overall impression of dietary supplementation, from very unhelpful to very helpful.

3.4.2 Data collection

The researcher approached lecturers from the Department of Dietetics and Human Nutrition at UKZN, via email for permission to visit the class, inform students about the study and invite them to participate. Once permission was obtained, the researcher was given time during lectures to recruit students. Data collection was conducted at UKZN, Pietermaritzburg campus and the Innovation Centre, UKZN, Durban for the Durban-based students registered for the Post Graduate Diploma in Dietetics. The researcher explained the nature of the study and invited students to participate. The students were not forced to participate in this study and were free to withdraw at any given moment. Consent forms (Appendix B) were given to those who were interested to participate. After reading the information sheet and signing the consent form, the questionnaire was issued. The researcher was present during the entire time the

questionnaire was being answered in order to answer questions or queries from the students. Out of 156 registered undergraduate and postgraduate dietetics students, 145 students participated in the study. However, six questionnaires obtained from participating questions were invalid as they were incomplete. This resulted in 139 completed valid questionnaires with a response rate of 89%.

3.5 Pilot study

According to Leon, Davis & Kraemer (2011), a pilot study is an imperative aspect of the study process. If any study components are seen as unfeasible after the pilot study is conducted, it would need to be altered for the main study (Leon *et al* 2011). The purpose of this pilot study was to detect and correct any methodological errors in the questionnaires. It was conducted on ten students registered for qualifications other than dietetics at UKZN, prior to the main study. The students were approached randomly and invited to participate in the study. The researcher explained the nature of the study and invited the students to participate. Once the students agreed to participate, consent forms were provided. Once the information sheet was read and consent forms were signed, the questionnaires were handed out and explained. Students took about 10-15 minutes to complete the questionnaire. The students from the pilot study had no queries or concerns answering the questionnaire. No changes were made to the questionnaire after the pilot study.

3.6 Statistical analysis

Statistical Package for Social Sciences (SPSS) version 22 was used to analyse data. Descriptive statistics, chi-square goodness-of-fit-test, chi-square test of independence and the binomial test were used to analyse data. A p-value of < 0.05 was considered significant.

3.7 Reduction of bias

In order to reduce bias, the researcher was present throughout the entire data collection process. In order to prevent students from discussing the questionnaire, the students were not allowed to communicate with each other whilst the questionnaire was being answered. The students were also not allowed breaks or to leave the data collection venue, unless their questionnaires were answered and submitted to the researcher.

3.8 Data quality control

All data was entered into an excel spreadsheet and cross-checked for inconsistencies by the researcher.

3.9 Ethical Considerations

Ethical approval was obtained from the University of KwaZulu-Natal, Humanities and Social Sciences Research Ethics Committee (reference number: HSS/00358/017M) (Appendix C). Gatekeeper's approval was obtained from the Registrar of the University of KwaZulu-Natal (Appendix D).

CHAPTER 4: RESULTS

This chapter presents and describes the results of the study.

4.1 Sample characteristics

The socio-demographic characteristics of the sample is shown in Table 4.1.

Table 4.1: Socio-demographic characteristics of the sample

Variables	**n**	**%***
Age (n=139)		
18-19 years	35	25.2
20-22 years	60	43.2
23-25 years	30	21.6
>25 years	14	10.1
Race (n=139)		
Black	101	72.7
White	10	7.2
Coloured	3	2.2
Indian	25	18.0
Gender (n=139)		
Male	36	25.9
Female	103	74.1
Marital status (n=139)		
Single	134	96.4
Married	5	3.6
Part-time employed (n=139)		
Yes	15	10.8
No	124	89.2
If employed: amount earned (per month) (n=15)		
<R500	5	3.6
R501-R1000	4	2.9
R1001-R2000	3	2.2
R2001-R3000	0	0
R3001-R4000	3	2.2

* Percentage of total sample (n=139)

Approximately 43.2% (n=60) of the sample were between 20-22 years of age. There were more females (74.1%; n=103) compared to males (25.9%; n=36). Black African students made up the majority of the sample (72.7%; n=101), with coloured the smallest proportion of

the sample (2.2%; n=3). Furthermore, 3.6% (n=5) of the students were married and 10.8% (n=15) had part-time employment.

4.2 Background information on the university students

Information on university programme, academic year of study, finances and accommodation are shown in Table 4.2.

Table 4.2: Information regarding university programme, year of study, finances and accommodation

Variables	**n**	**%***
Degree/diploma (n=139)		
Degree	118	84.9
Diploma	21	15.1
Academic year of study (n=139)		
First year	33	23.7
Second year	46	33.1
Third year	39	28.1
Fourth year/year of study	21	15.1
Finance of studies (n=139)		
Parents/guardian	49	35.3
Bursary/scholarship	22	15.8
Student loan	4	2.9
Financial aid	59	42.4
Other	5	3.6
Accommodation (n=139)		
Home	36	25.9
University residence	48	34.5
Commune/digs	32	23.0
Flat/apartment away from home	21	15.1
Other	2	1.4
Amount of money spent on food/month (n=139)		
Live at home and no money spent on groceries	34	24.5
<R500	25	18.0
R501-R1000	68	48.9
R1001-R2000	11	7.9
>R2000	1	0.7

*Percentage of total sample (n=139)

Students registered for the Bachelor of Science in Dietetics degree (84.9%; n=118) made up the majority of the sample. Most of the students were in their second year of study (33.1%; n=46,) while the fourth year students made up the smallest proportion of the sample (n=21, 15.1%). Approximately 42.4% (n=59) of the students received financial aid, whilst only 2.9% (n=4) used a student loan to fund their studies.

Just over a third (n=48) of the students lived in the university residence, followed by 25.9% (n=36) who lived at home and 23% (n=32) who lived in a commune/digs. Just less than half of the students (n=68) spent between R501-R1000 per month on food, while 24.5% (n=34) of the students lived at home and did not purchase food.

4.3 Lifestyle factors of the students

The current state of health as reported by the students is presented in Figure 4.1.

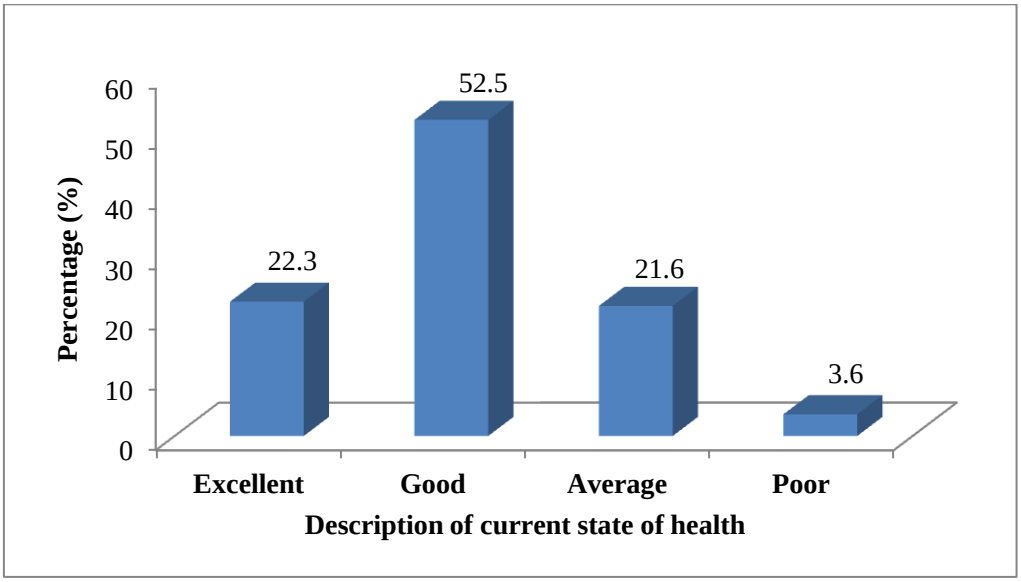

Figure 4.1: State of health reported by the students (n=139)

A chi-square goodness-of-fit-test was used to analyse the state of health reported. A significant number of students (52.2%; n=73) indicated that their current state of health was "good" [χ^2 (3) = 68.626, p<0.05].

Use of alcohol, smoking and recreational drugs as well as participation in sport is reported in Figure 4.2

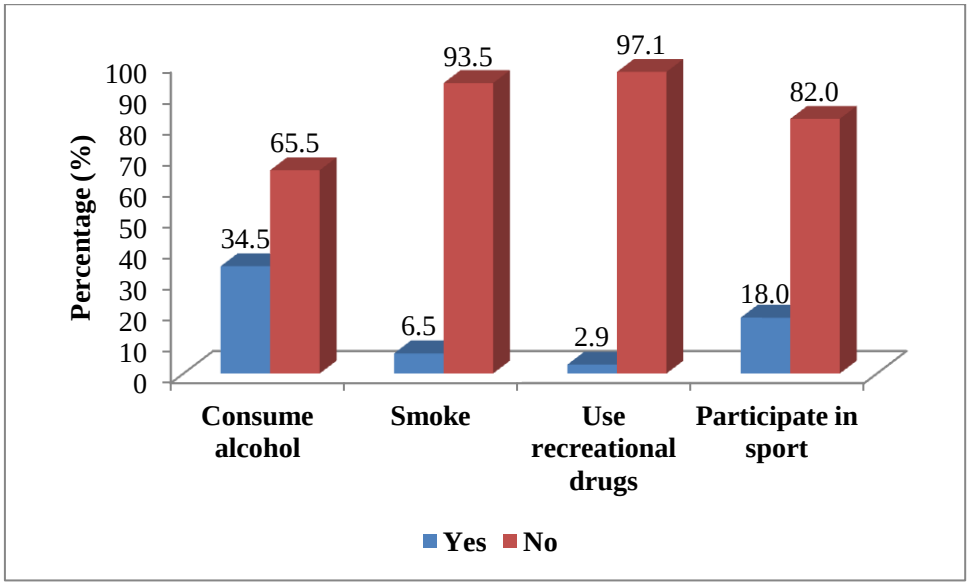

Figure 4.2: Student consumption of alcohol, smoking, use of recreational drugs and participation in sport (n=139)

A binomial test was used to analyse smoking, alcohol consumption and the use of recreational drugs. A significant proportion of the sample indicated that they did not consume alcohol (65%; n=91); smoke (93.5%; n=130) or use recreational drugs (97%; n=135); and (82%; n=114) participated in sport ($p<0.05$).

Twenty-five students (18%) reported participation in sporting activities (Table 4.3). A significant proportion of the sample who participated in sport, indicated that their participation was either recreational (48%; n=12) or at university level (44%; n=11) [$\chi^2(3)=17.720$; $p<0.001$] and that they trained for approximately 1-<2 hours per day [$\chi^2(3)=24.760$; $p<0.05$] (Table 4.3).

Table 4.3: Participation in sporting activities (n=25)

Physical Activity	**n**	**%***
Level of participation (n=25)		
Recreational	12	48.0
University	11	44.0
Provincial	1	4.0
National	1	4.0
Frequency of training (n=25)		
Up to twice a week	11	44.0
3-4 times a week	9	36.0
5-6 times a week	5	20.0
Duration of training (n=25)		
<1 hour	3	12.0
1- <2 hours	17	68.0
2-<3 hours	3	12.0
3-<4 hours	2	8.0

*Percentage of sample who participated in sporting activities (n=25)

Table 4.4: Participation in exercise (n=85)

Frequency and duration of training	**n**	**%***
Frequency of training (n=85)		
Up to twice a week	51	60.0
3-4 times a week	22	25.9
5-6 times a week	10	11.8
>6 times a week	2	2.4
Duration of training (n=85)		
<15 minutes	11	12.9
15-30 minutes	36	42.4
31 minutes – 1 hour	27	31.8
>1 hour	11	12.9

*Percentage of sample who participated in exercise (n=85)

A chi-square goodness-of-fit-test was used to analyse the frequency of training and duration of training with regards to exercise (Table 4.4). A significant proportion of the students, who exercised, exercised up to twice a week (60%) [$\chi^2(3)=65.071$; $p<0.05$] and 42.4% exercised for approximately 15-30 minutes or 31 minutes – 1 hour daily [χ^2 (3) = 21.682; $p<0.05$] (Table 4.4).

Table 4.5: Intensity of exercise/sport (n=110)

Type of physical activity	**n**	**%***
Strenuous	42	38.2
Moderate	20	18.2
Mild	30	27.3
Other	18	16.4

*Percentage of sample who participated in sport and exercise (n=110)

A chi-square test was used to analyse the results for intensity of exercise/sport (Table 4.5). A significant number of students were involved in either strenuous (n= 38.2%; n=42) or mild (27.3%; n=30) forms of physical activity [$\chi^2(3)=13.200$; $p=0.004$].

4.4 Dietary factors

This section presents the results for eating habits, food frequency, specific diets and meeting dietary requirements. Description of eating habits is presented in Figure 4.3.

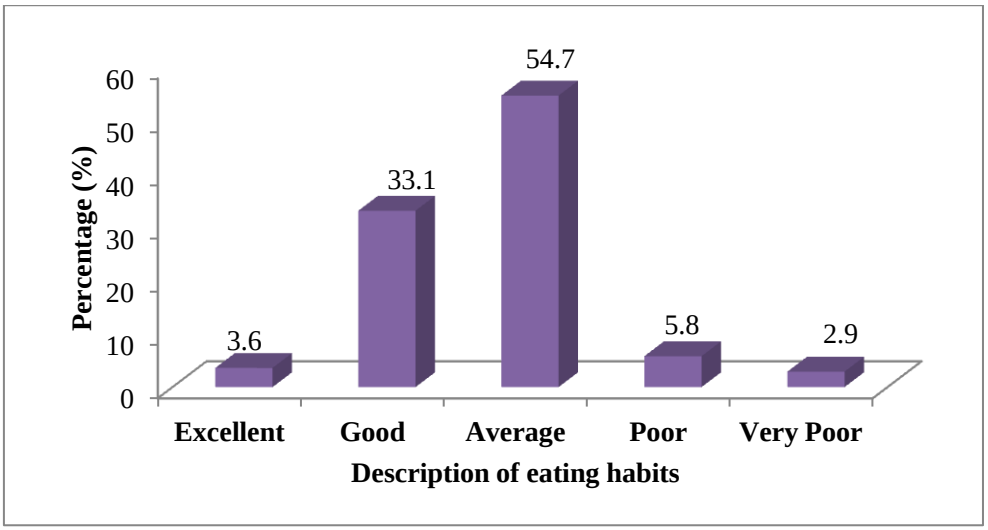

Figure 4.3: Eating habits of the students (n=139)

A chi-square goodness-of-fit-test was used to analyse the eating habits rated by the students. It was reported that a significant proportion of the sample indicated that their eating habits were good (33.1%; n=46) and average (54.7%; n=76) [$\chi^2(4)=148.662$; $p<0.05$].

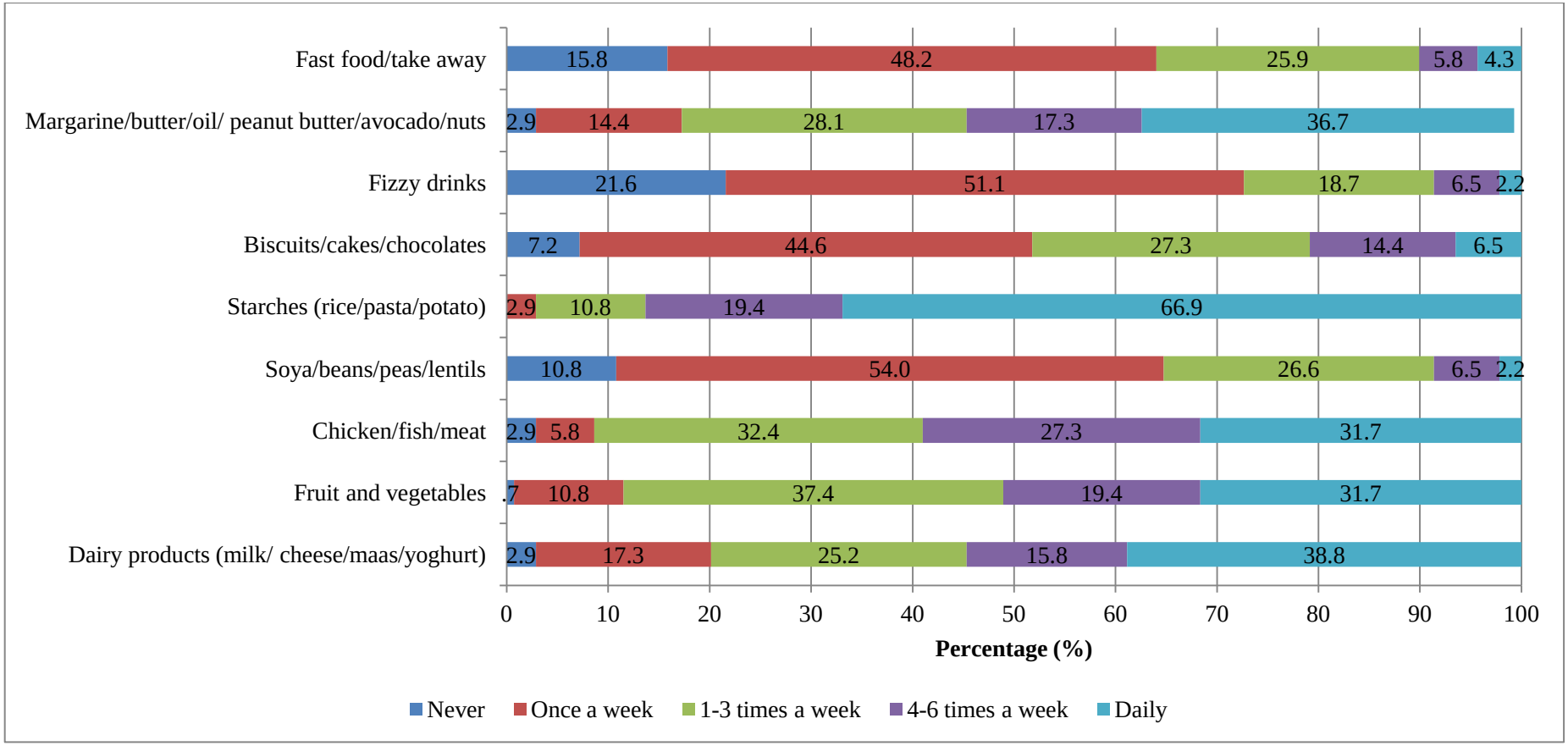

Figure 4.4: Frequency of consumption of food items (n=139)

Dairy products (38.8%; n=54) and starches (66.9%; n=93) were consumed daily (Figure 4.4). There was a significant consumption of fruits and vegetables and margarine/butter/oil/peanut butter/avocado/nuts, daily (31.7% and 36.7%, respectively) and 1-3 times a week (37.4% and 28.1%, respectively) ($p<0.05$). Students consumed chicken/fish/meat, 1-3 times a week (32.4%; n=45), 4-6 times a week (27.3%; n=38) and daily (31.7%; n=44) ($p<0.05$). Soya/beans/peas/lentils were frequently consumed (about 1-3 times a week) (26.6%; n=37). Furthermore, biscuits/cakes/chocolates were consumed approximately once a week (44.6%; n=62) and 1-3 times a week (27.3%; n=38). Fast food/take away were consumed once a week (48.2%; n=67) and 1-3 times a week (25.9%; n=36) ($p<0.005$). Moreover, 21.6% (n=30) of the students reported never drinking fizzy drinks, whilst 51.1% (n=71) reported consumption at least once a week.

Information regarding whether or not students followed a specific diet is reported in Table 4.6 (n=139).

Table 4.6: Students reporting on whether or not they followed a specific diet

Do you follow a specific diet? (n=139)	**n**	**%***
Yes	10	7.2
No	129	92.8

* Percentage of total sample (n=139)

The majority of the students (92.8%; n=129) did not follow a specific diet. Figure 4.5 shows the types of diets that were followed by those who answered yes to following a specific diet (7.2%; n=10).

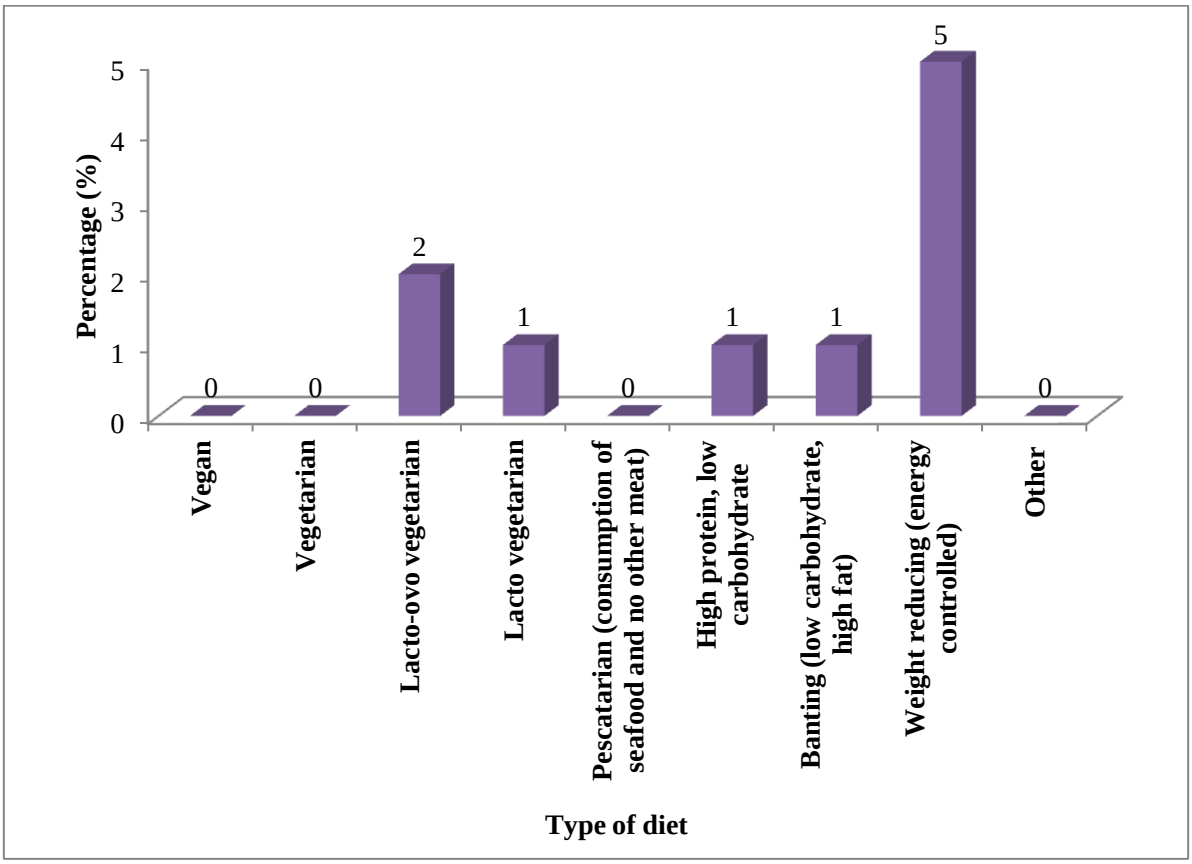

Figure 4.5: Types of diets followed (n=10)

Of the 10 students who followed a specific diet, half (n=5) were on a weight reducing (energy controlled) diet, while two (20%) were on a lacto-ovo vegetarian diet. One student was on the Banting diet (low carbohydrate, high fat), one on a lacto vegetarian diet and one on a high protein, low carbohydrate diet (Figure 4.5).

Table 4.7: Ability to meet dietary requirements

Do you feel that you are able to meet your dietary requirements with your current diet? (n=139)	**n**	**%***
Yes	45	32.4
No	94	67.6

***** Percentage of total sample (n=139)

A binomial test was used to analyse the results of whether or not the students were able to meet their dietary requirements with their current diet (Table 4.7). More than half of the sample (67.6%) indicated that they were not able to meet their dietary requirements with their current diet ($p<0.05$).

Reasons for not being able to meet dietary requirements are reported in Table 4.8.

Table 4.8: Reasons for not being able to meet dietary requirements

Reasons	**n**	**%***
Expensive	9	6.5
Too busy/insufficient time	9	6.5
Inadequate dietary intake/lack of variety	15	10.8
Skipping meals	4	2.9
Allergies	1	0.7
Difficult	1	0.7
I live at home and my mother does not have enough education about a meal	1	0.7
For now, it is not my priority	1	0.7
I don't do enough exercise	1	0.7
I haven't done proper calculations so I'm not 100% sure	1	0.7
It is not practical	1	0.7

***** Percentage of total sample (n=139)

4.5 The use of dietary supplements

Results on research, sources of information and use and disuse of dietary supplements are presented in this section.

The number of students who did/did not conduct research on dietary supplements is reported in Table 4.9 (n=139).

Table 4.9: Research on dietary supplements (n=138)

Have you ever conducted research on dietary supplements? (n=138)	**n**	**%****
Yes	36	26.1
No	102	73.9

**missing data (one participant did not answer)

A significant amount (73.9%) of the students indicated that they did not conduct research on dietary supplementation ($p<0.05$).

Reasons for researching dietary supplementation and sources of information are presented in Figure 4.6 and 4.7, respectively.

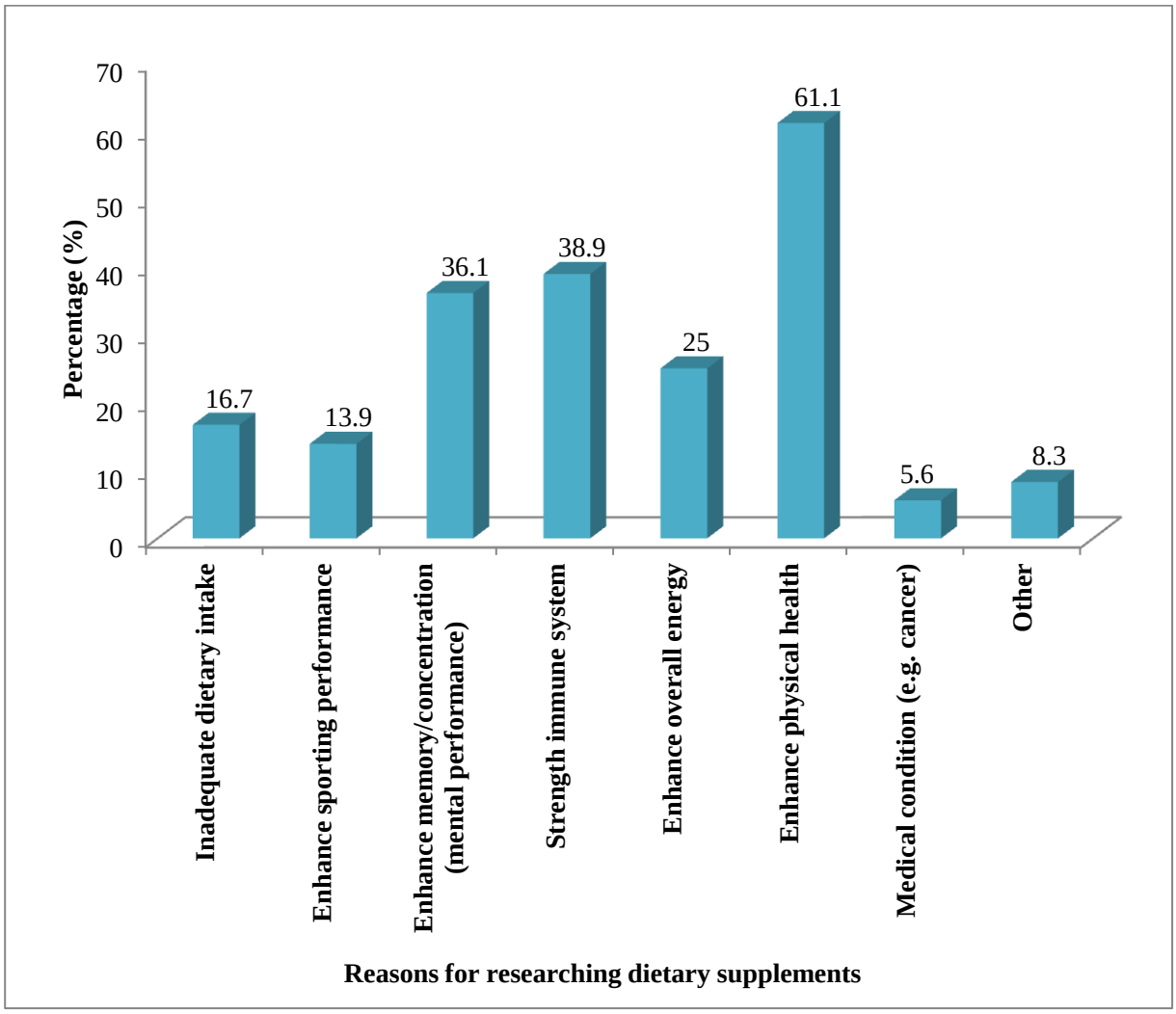

Figure 4.6: Reasons for researching dietary supplementation (n=36)

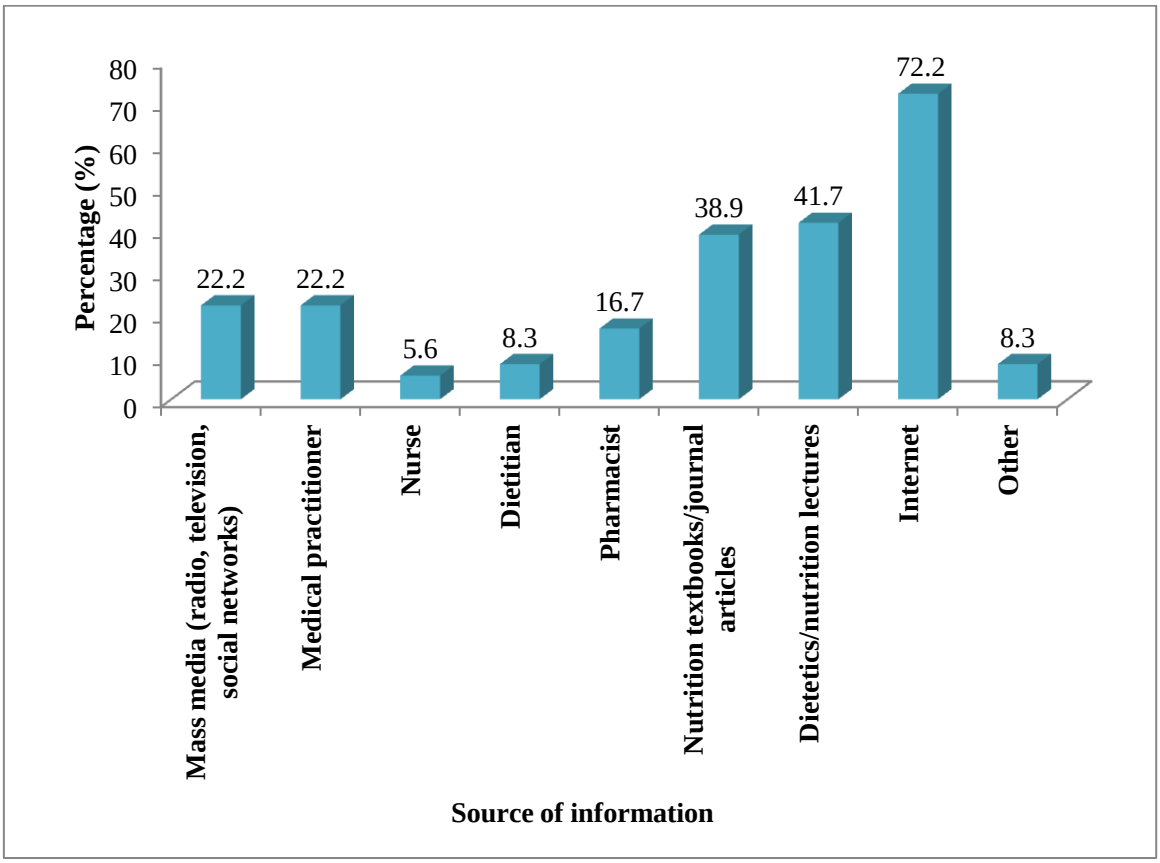

Figure 4.7: Sources of information for dietary supplementation research (n=36)

The most common reason for researching dietary supplements was to enhance physical health (n=22, 61.1%), followed by the need to strengthen the immune system (38.9%; n=14) and to enhance memory and concentration (36.1%; n=13) (Figure 4.6). A significant proportion of the students (72.2%; n=26) indicated that their source of information on dietary supplements was the internet (p=0.011) (Figure 4.7).

The current use or disuse of dietary supplements is indicated in Figure 4.8 (n=139).

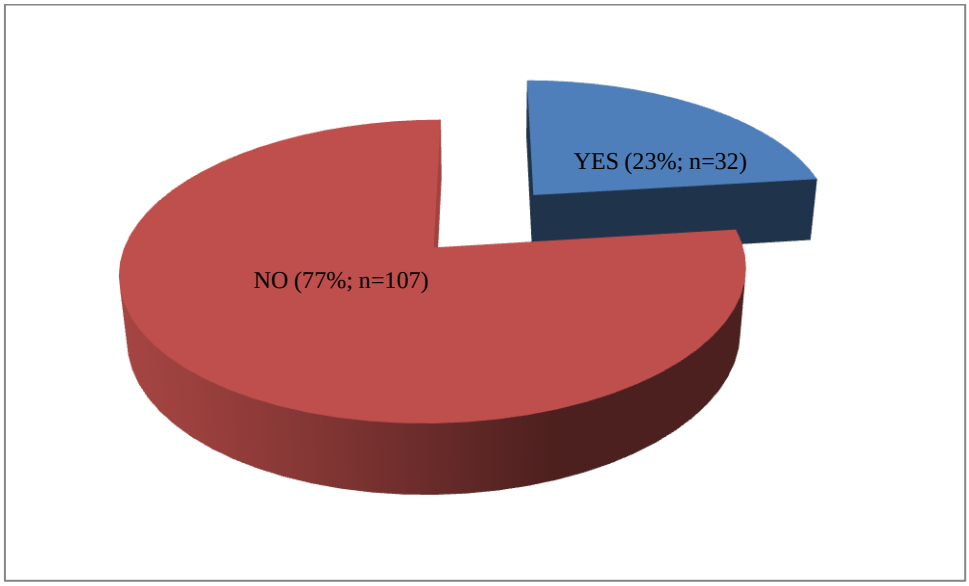

Figure 4.8: Current use of dietary supplements (n=139)

The majority of the students (77%; n=107) did not use dietary supplements (Figure 4.8)

The reasons for not using a dietary supplement are reported in Figure 4.9.

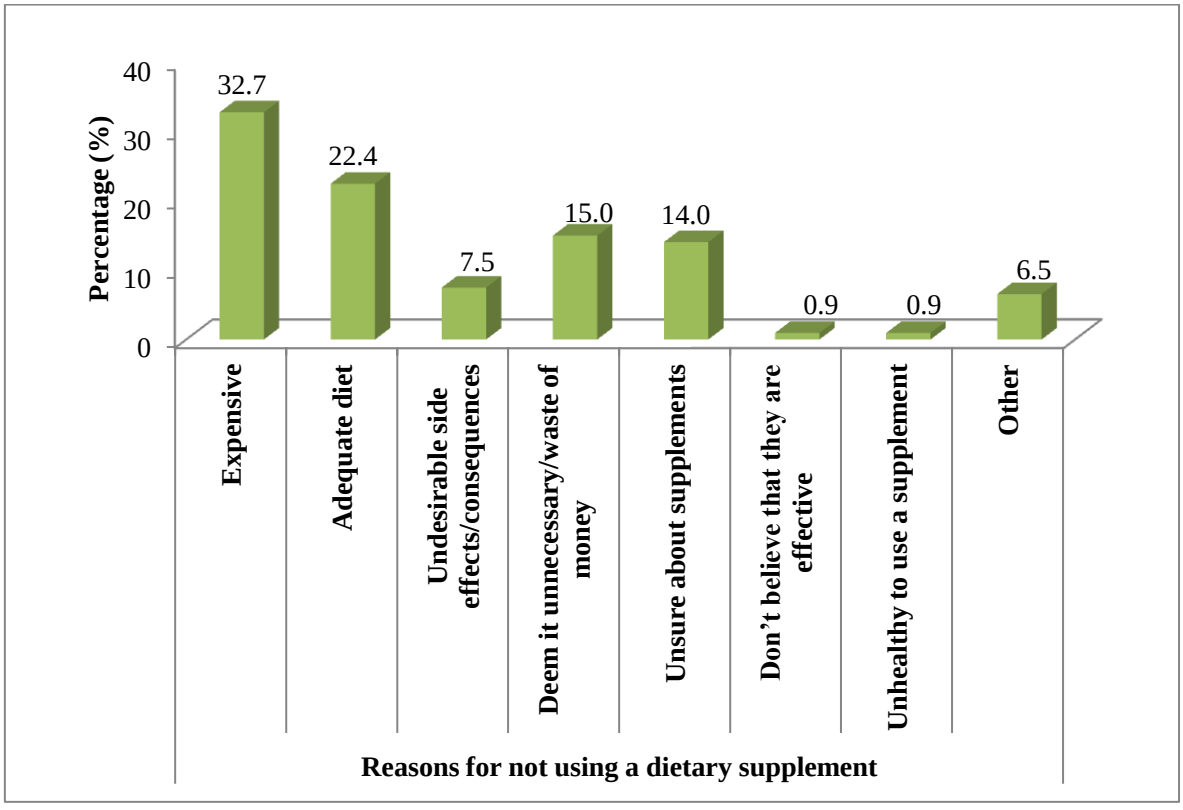

Figure 4.9: Reasons for not using a dietary supplement (n=107)

A chi-square test was used to analyse the reasons for not using dietary supplements. Expense (32.7%; n=35), adequate diet (22.4%; n=24), deem it unnecessary/waste of money (15.0%; n=16) and unsure about supplements (14.0%; n=15), were statistically significant reasons for not using a dietary supplement [χ^2 (7)=72.215; p<0.05].

Just more than half of the sample (51.4%) indicated that they planned to use a dietary supplement in the future (Table 4.10).

Table 4.10: Response to future dietary supplementation (n=107)

Do you plan to use a dietary supplement in the future?	**n**	**%***
Yes	55	51.4
No	52	48.6

*Percentage of sample who did not use a dietary supplement (n=107)

Table 4.11: Reasons for not using dietary supplements in the future (n=52)

Reasons	**n**	**%***
Nutrients are obtained from the food/balanced diet	16	30.8
Do not see the need	9	17.3
Adequate diet	9	17.3
Negative side effects/toxicity	7	13.5
Too expensive	3	5.8
Unsure about dietary supplements/lack of knowledge	3	5.8
Don't like some side effects and supplements are expensive	1	1.9
I don't think I can just use a dietary supplement unless given instructions by the doctor	1	1.9
I really do not like pills and if they are in a form of pills then I won't use them	1	1.9
Only if required to	1	1.9
Unhealthy to use a supplement	1	1.9

*Percentage of sample who will not use dietary supplements in the future (n=52)

Table 4.12: Reasons for future supplement use (n=55)

Reasons	**n**	**%***
Aging	5	9.1
To obtain adequate nutrients/nutrition	15	27.3
A healthy diet/overall healthy lifestyle	9	16.4
To boost the immune system	2	3.6
Medical/illness/health reasons	5	9.1
As more knowledge about nutrition/dietary supplements is achieved	3	5.5
Ability to afford dietary supplements	2	3.6
If it is required	3	5.5
Busy schedule	1	1.8
Memory	1	1.8
During pregnancy	1	1.8
To enhance energy	1	1.8
For losing weight and energy control and also balancing the body nutritional requirements	1	1.8
I don't see why not	1	1.8
I sometimes suffer from tiredness and shaking during menstruation. May get a supplement for anaemia.	1	1.8
I will use protein shakes and any supplements that I see necessary	1	1.8
Most probably will be curious to see if there are any noticeable differences	1	1.8
To help build beautiful skin, healthy hair and nails	1	1.8
To improve my mental programme and physical well-being	1	1.8

*Percentage of sample that will use dietary supplements in the future (n=55)

A significant proportion (75%; n=79) of the students indicated that they had not used dietary supplements in the past ($p<0.05$).

The reasons for preference of dietary supplementation over of dietary modification is indicated in Figure 4.10

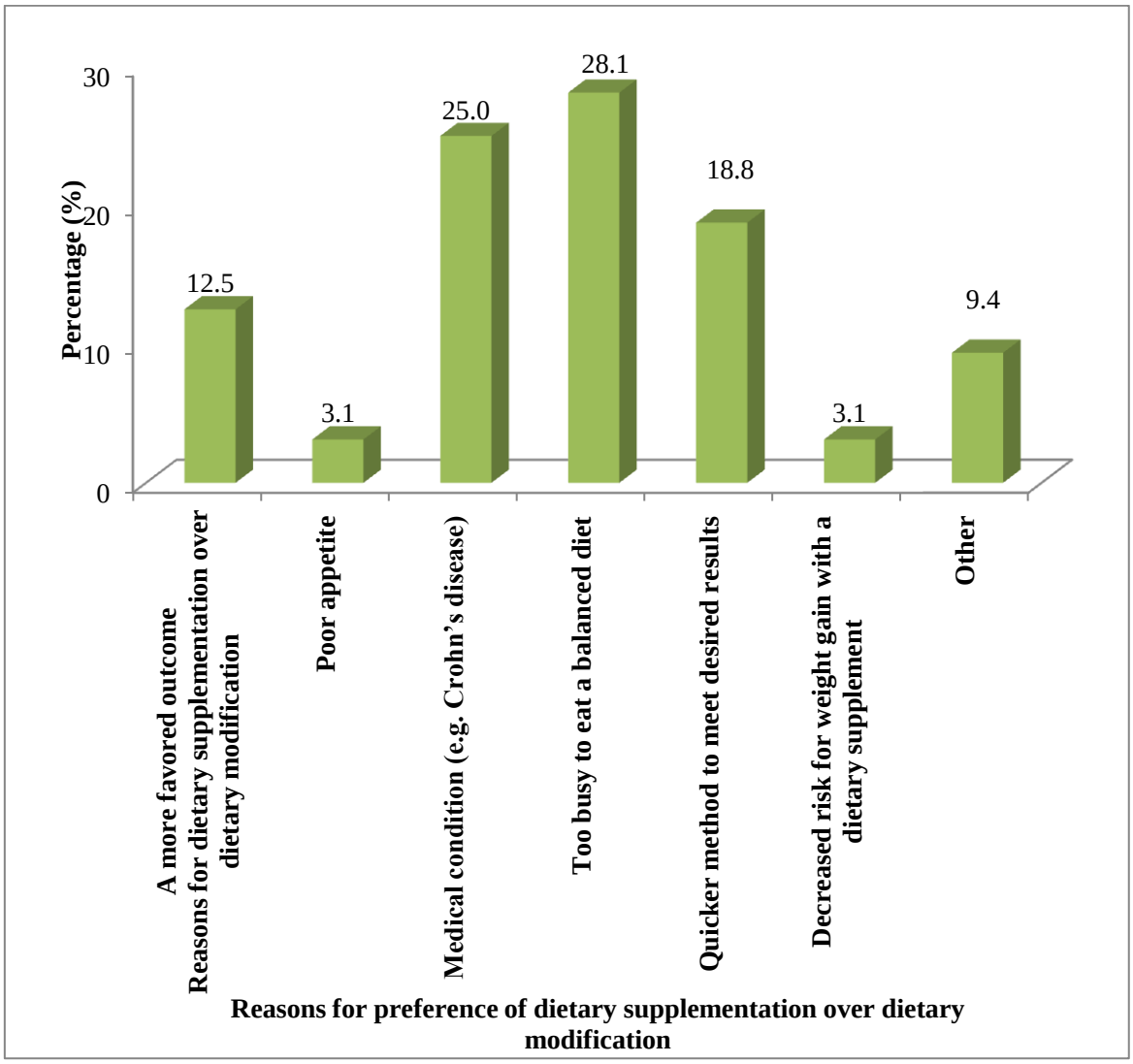

Figure 4.10: Reasons for preference of dietary supplementation over dietary modification (n=32)

Statistically significant reasons for dietary supplementation instead of dietary modification included: medical condition (25%; n=8), too busy to eat a balanced diet (28.1%; n=9) and quicker methods to meet desired results (18.8%; n=6) [χ^2 (6) = 13.500; p=0.036] (Figure 4.10).

The reasons for dietary supplementation are depicted in Figure 4.11 (n=32).

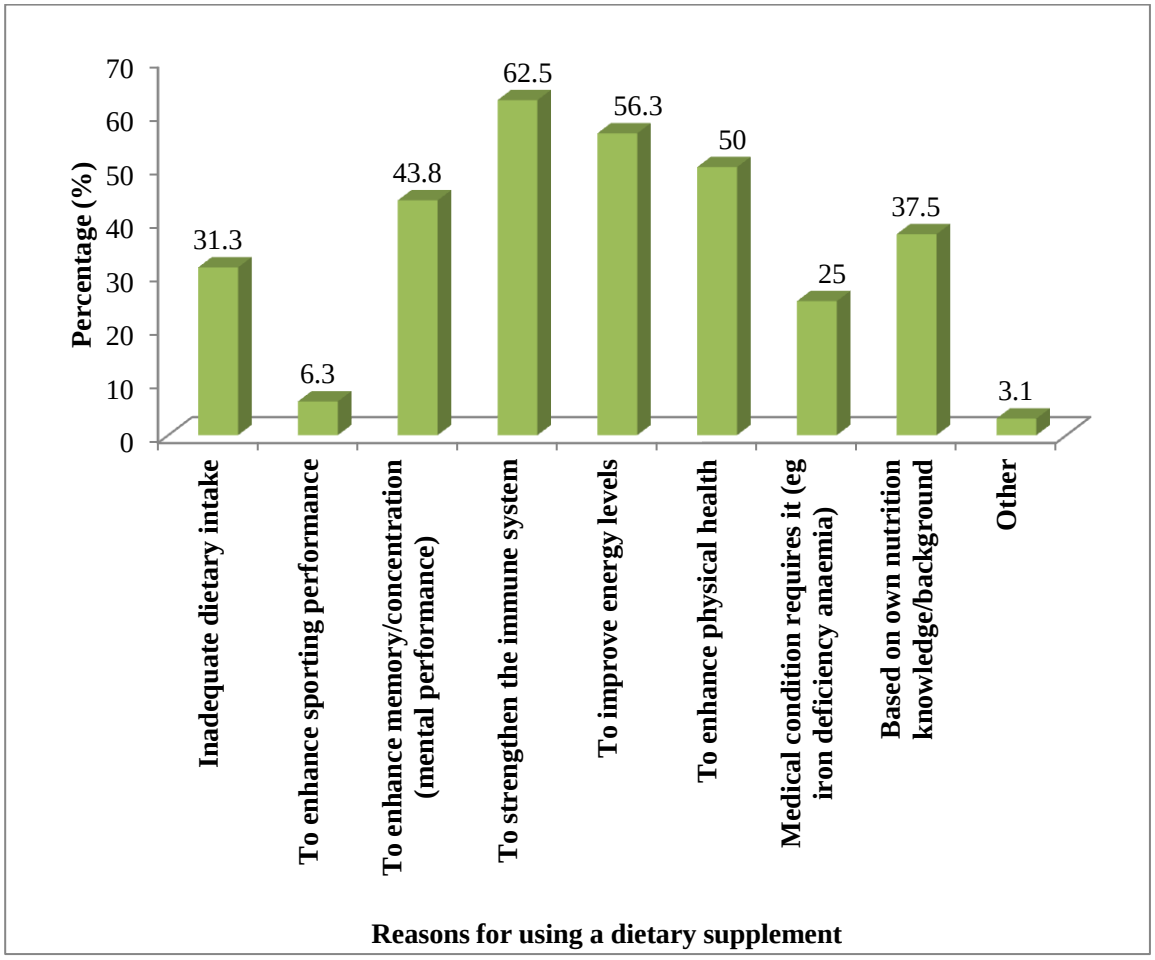

Figure 4.11: Reasons for dietary supplementation (n=32)

Approximately 62.5% (n=20) of students reported that dietary supplements were used to strengthen their immune system, whilst 56.3% (n=18) used dietary supplements in order to improve their energy levels. Approximately half of the supplement users (50%; n=16) used dietary supplements to enhance their physical health.

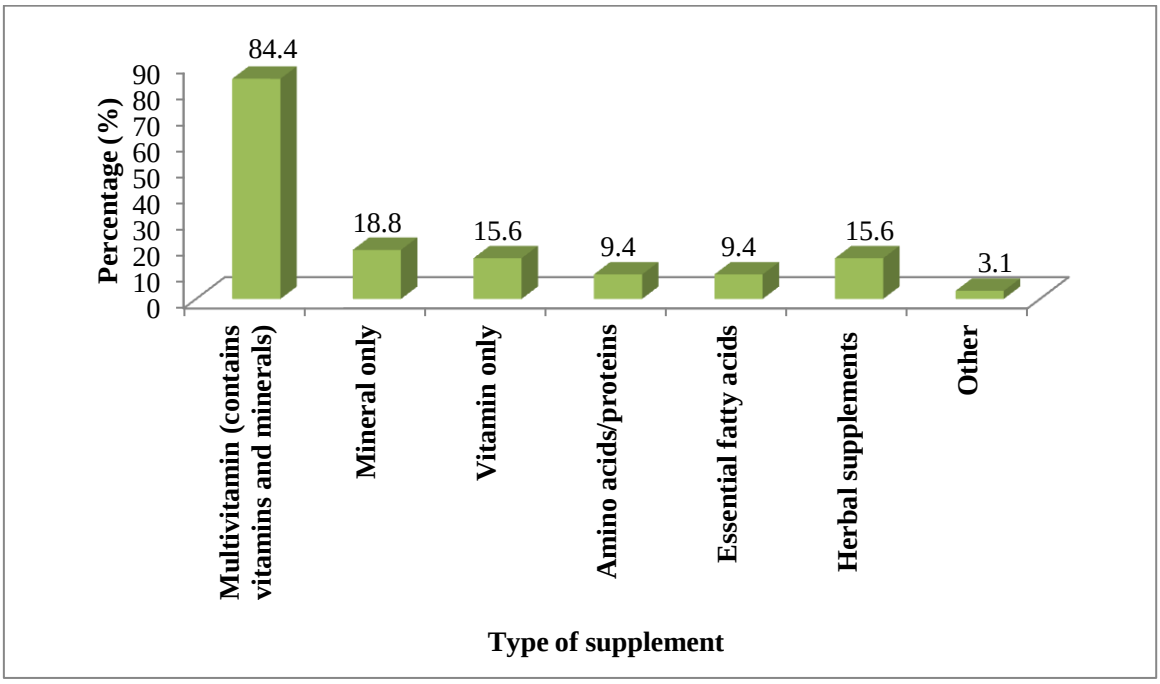

Figure 4.12: Types of supplements used (n=32)

A binomial test found that the majority of the students (84.4%; n=27) made use of multivitamins ($p<0.05$). This was followed by minerals only (18.8%; n= 6) and vitamins only (15.6%; n=5).

Table 4.13: Commonly used dietary supplements (n=32)

Dietary Supplements	**n**	**%***
Biostrath	3	9.4
BCO	1	3.1
Biotin (GNC)	1	3.1
Cannot remember the name	3	9.4
Centrum	7	21.9
Calcium	5	15.6
Multivitamin	5	15.6
Omega 3/ Omega 3 & 6/ Omega 3,6 & 9	3	9.4
Vitamin C	2	6.3
Activovite with Probiotics, Neurobin, Slow Mag,	1	3.1
Bioplus and nabs	1	3.1
Vital skin, hair and nails supplement	1	3.1
Iron supplements/ Feramed (Iron supplement)	4	12.5
Ferrous sulphate tablets	2	6.3
Folic acid	1	3.1
Pharmaton active	1	3.1
Mentat, Echina force	1	3.1
MVT - DS24 and Whey protein	1	3.1
Optimum Nutrition whey protein, Biogen CLA	1	3.1
Turbovite and Rescue	1	3.1
USN Iso-whey protein, Nutritech Creatinine HCL, USN BCAA	1	3.1
Vital - women	1	3.1
Vital B vitamins, Ensure shake	1	3.1
Zinc supplements, chela-fer, Unani Tibb "stress away"	1	3.1

* Percentage of sample (n=32)

According to Table 4.13, the most commonly used dietary supplement was Centrum (multivitamin) (21.9%; n=7), followed by calcium supplements (15.6%; n=5).

The common places from where students obtained their dietary supplements is reported in Figure 4.13 (n=32).

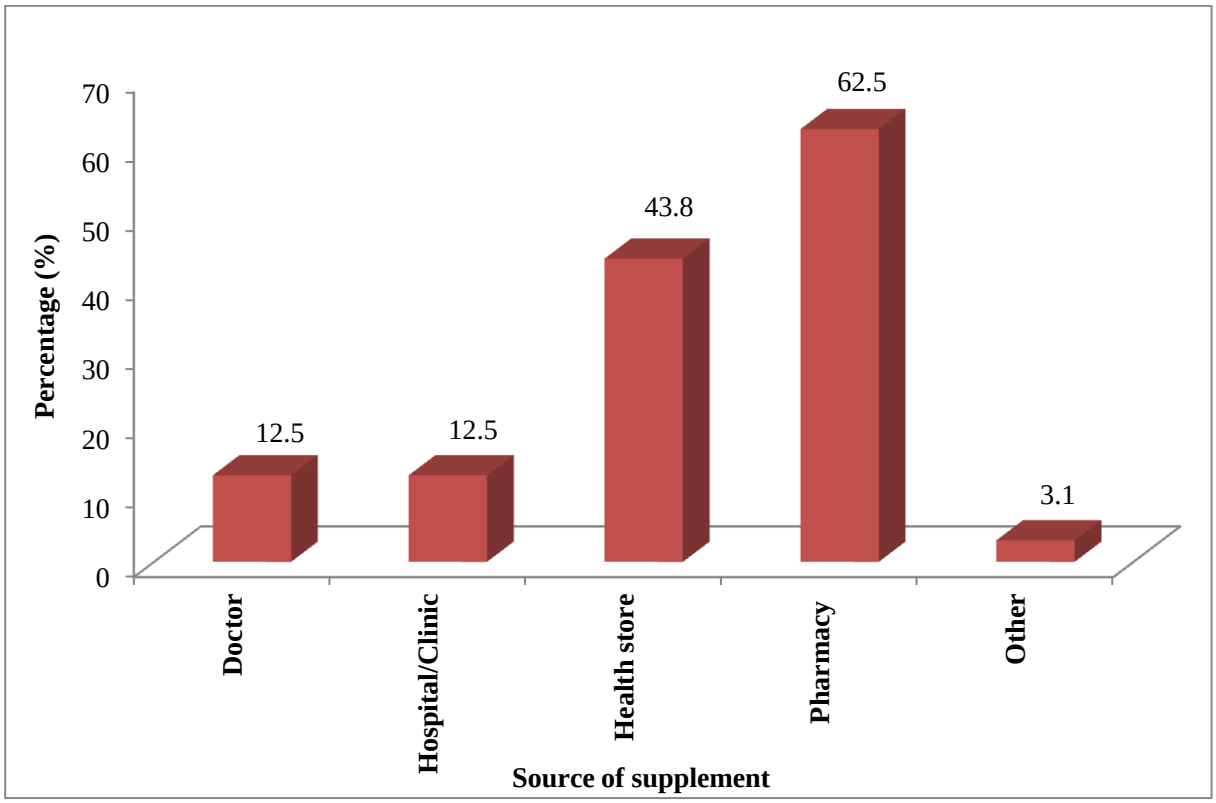

Figure 4.13: Location from where supplements were obtained (n=32)

More than half (62.5%; n=20) of supplement users obtained their dietary supplements from the pharmacy, followed by the health store (43.8%; n=14). Only 3.1% (n=1) chose other and listed Clicks (Figure 4.13).

Table 4.14: Frequent and sporadic use of dietary supplements (n=32)

How often do you take dietary supplements?	**n**	**%***
Sporadically/ At intervals (e.g. every 6 months)	3	9.4
Once a week	-	-
Two-three times a week	4	12.5
Four -six times a week	4	12.5
Everyday	21	65.6
Reasons for sporadic use of dietary supplements (n=3)		
Used when stressed (i.e. during tests/exams)	2	6.3
Forget to take dietary supplements	1	3.1

* Percentage of sample (n=32)

A chi-square test showed that more than half (65.6%; n=21) of the sample indicated that they used dietary supplements daily [χ^2 (3) = 28.250; p<0.05] (Table 4.14).

The duration of supplement use is depicted in Table 4.15 (n=32).

Table 4.15: The duration of dietary supplement use (n=32)

Duration	**n**	**%***
< 1 month	1	3.1
1 - <5 months	6	18.8
5 - <8 months	5	15.6
8 - <12 months	3	9.4
1 - <2 years	7	21.9
2 - <4 years	5	15.6
4 - <6 years	3	9.4
6+ years	2	6.3

* Percentage of sample (n=32)

According to Figure 4.15, 21.9% (n=7) of the students indicated that they had been taking dietary supplements for about 1- <2 years. The amount of money spent each month on dietary supplements is reported in Table 4.16 (n=32).

Table 4.16: The amount of money spent on dietary supplements (n=32)

	n	**%***
Free	6	18.8
<R150	9	28.1
R151-R200	7	21.9
R201-R300	3	9.4
R301-R400	3	9.4
R401-R500	2	6.3
>R500	1	3.1
Other	1	3.1

* Percentage of sample (n=32)

According to Table 4.16, about 28.1% (n=9) spent <R150/month while 21.9% (n=7) spent between R151-R200/month on dietary supplements. Only six (18.8%) of the students reported that they received supplements free. This could possibly have been obtained from the university campus health clinic or government hospital/clinic [$\chi^2(7)=15.500$; p=0.030].

The students who consumed dietary supplements were asked whether they had achieved their desired results from using the supplement. The majority of the students (93.8%; n=30) indicated that they had achieved their desired results (p<0.05) (Figure 4.14).

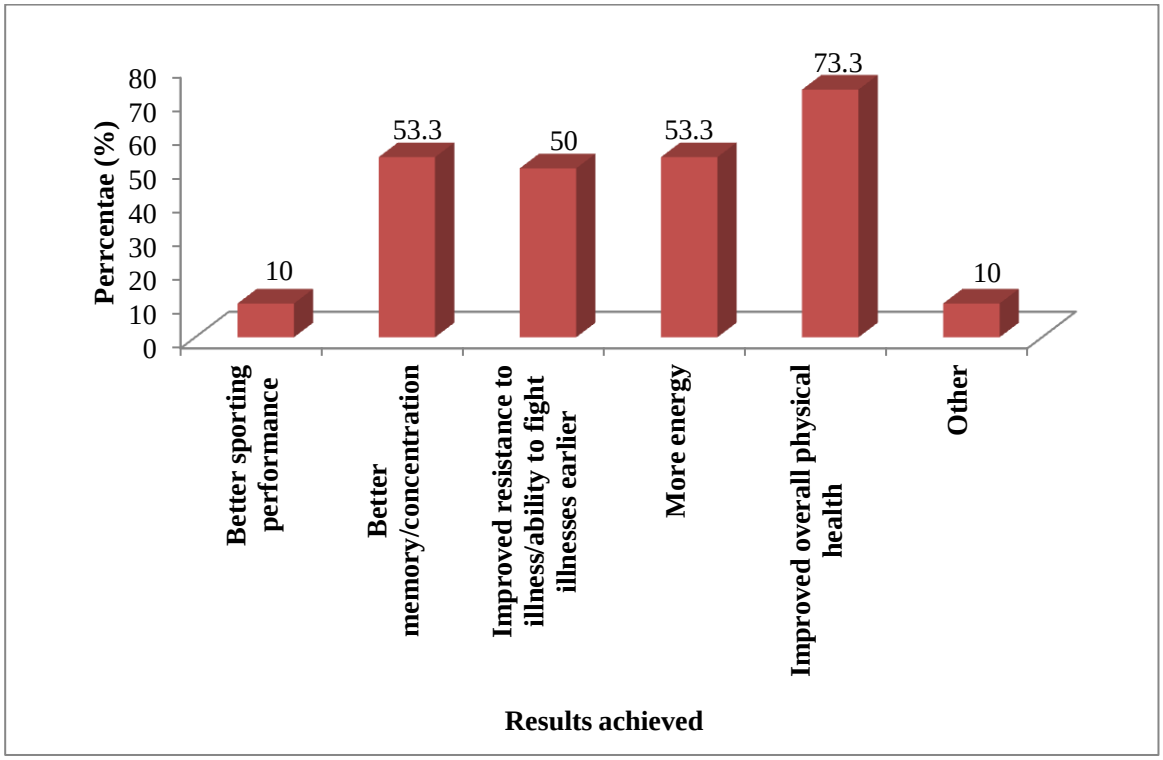

Figure 4.14: Results achieved from the use of dietary supplements (n=30)

About 73.3% (n=22) of the sample indicated that they had experienced an overall improvement in physical health after use of dietary supplements (p=0.016). Other results achieved included: more energy (53%; n=16) and better memory/concentration (53.3%; n=16). Furthermore, half of the sample (50%; n=15) reported an improved resistance to illness/ability to fight illnesses earlier.

The students who used dietary supplements at the time of the study were asked to rate their overall impression of the supplement, from 1= very unhelpful to 5 = very helpful (Table 4.17).

Table 4.17: Rating of dietary supplements used (n=35)

	n	%*
Very helpful (5)	6	34.4
Helpful (4)	15	46.9
Moderately helpful (3)	11	18.8
Unhelpful (2)	0	0
Very unhelpful (1)	0	0

* Percentage of sample (n=32)

Less than half of the dietary supplement users (46.9%) indicated that dietary supplements were helpful. This was followed by 34.4% (n=6) who rated them as very helpful and 18.8% (n=11) who felt that dietary supplements were moderately helpful. However, this was not statistically significant.

4.6 Factors related to the use of dietary supplements

A chi-square test was used to investigate the association of various factors and the use of dietary supplements.

The relationship between dietary supplement use and race is reported in Table 4.18.

Table 4.18: The use of dietary supplements and race (n=139)

Race	n		%*	
	Yes	No	Yes	No
Black	14	87	10.1	62.6
White	7	3	5.0	2.2
Coloured	0	3	0	2.2
Indian	11	14	7.9	10.1

* Percentage of total sample (n=139)

According to Table 4.1.8, a significant relationship was found between race and use of supplements. A significant number of whites and Indian students used dietary supplements ($p<0.05$).

The relationship between use of dietary supplements and gender was also investigated (Table 4.19).

Table 4.19: Relationship between dietary supplement use and gender (n=139)

Gender	**n**		**%***	
	Yes	**No**	**Yes**	**No**
Male	3	33	9.4	30.8
Female	29	74	90.6	69.2

* Percentage of total sample (n=139)

According to the Pearson chi-square test, there was a significant relationship between gender and the use of dietary supplements [$\chi^2(1)=5.583$, $p=0.018$]. More females used dietary supplements compared to males.

The students who lived at home were more likely to consume dietary supplements (46.9%; n=15), ($p=0.008$). It was also reported that the highest use of dietary supplements was observed among the fourth year students [$\chi^2(3)=12.370$, $p=0.006$].

4.7 Summary

Approximately 43.2% (n=60) of the sample were between 20-22 years of age and consisted of more females (74.1%; n=103) than males (25.9%; n=36). Black African students (72.7%; n=101) made up the majority of the sample with coloured students being the minority (2.2%; n=3). The majority of the sample were registered for a Bachelor of Science in Dietetics degree (84.9%; n=118) and most of the students were in the second year of study (35.1%; n=46). Approximately, 34.5% (n=48) of the students lived at the university residence and spent between R501 and R1000 per month on food (48.9%; n=68). A significant number of students rated their current state of health as 'good' (52.5%; n=73). A considerable amount of the students reported that they did not smoke (94%; n=130), consume alcohol (65%; n=91) or use recreational drugs (97%; n=135) and participated in sport (82%; n=114). A significant amount rated their eating habits as either 'good' (33.1%; n=46) or 'average' (54.7%; n=76), with most students not following a specific diet (92.8%;n=129). However, 68% (n=94) felt

that they were not able to meet their dietary requirements with their existing diet. The use of dietary supplements was reported by 23% (n=32) of the dietetic students. A significant relationship was found between race/gender and dietary supplements. Dietary supplementation was more common among white and Indian students ($p<0.05$) and females ($p=0.018$), compared to males. Students who lived at home were also more inclined to use dietary supplements ($p=0.008$). Dietary supplement use was highest among fourth year students (34%; n=11), with the intake of supplements increasing as the year of study increased. However, no relationship was found between dietary supplements and physical activity, eating habits or ability to meet dietary requirements.

CHAPTER 5: DISCUSSION

The aim of this study was to assess the use of dietary supplements by students registered for a Bachelor of Science or a Post Graduate Diploma in Dietetics at UKZN. This chapter discusses the results presented in chapter 4.

5.1 Sample characteristics

One hundred and thirty nine dietetics students participated in this study. There were more females (74.1%; n=103) than male students (25.9%; n=36). However, the sample size, in general, consisted of more female students compared to male students. This could be because dietetics is mainly a female dominated profession (Gheller & Lordly 2015). This was consistent with previous studies, which also reported predominantly female participants (Lieberman *et al* 2015; Aina & Ojedokun 2014; Weeden *et al* 2010). Less than half of the sample (42.4%; n=59) received financial aid for their studies. On the other hand, about 15 (10.8%) students worked part-time. This could be because financial aid may be insufficient and students are required to generate additional income, through part-time employment. The majority of the students in this study were black African (72.7%; n=101), which is in keeping with the demographic profile of the UKZN student population as well as KwaZulu-Natal and South Africa.

5.2 Background information on the university students

In this study, the majority of the students were registered for a Bachelor of Science in Dietetics degree (84.9; n=118) with more students being from the second year of academic study (33.1%; n=46). Approximately 42.4% of the students received financial aid, indicating a high reliance on financial aid. Just less than half of the students (n=68) spent between R501-R1000 per month on food. An amount of R501-R1000 per month for food is unlikely to be sufficient for students to maintain a healthy, varied diet. With a limited budget for food, they are likely to spend most of their money on staple products such as starchy foods which are bulky and filling. They would be less likely to purchase meat and meat products, fruit and vegetables due to cost.

5.3 Lifestyle factors of the students

A significant number of students in this study indicated that their current state of health was “good” (52.2%; n=73), whilst 22.3% (n=31) and 21.6% (n=30) indicated that their health was “excellent” and “average”, respectively. Furthermore, a considerable proportion of the

sample indicated that they did not consume alcohol (65%; n=91); smoke (93.5%; n=130) or use recreational drugs (97%; n=135); and participated in sport (82%; n=114) ($p<0.05$). Previous studies reported similar results indicating that the current health status of their participants was "good" (Spencer *et al* 2006; Steele & Senekal 2005; Ranelli *et al* 2003). However, a cross-sectional study by Baygi, Sotoudeh, Qorbani, Sadrzadeh-Yeganeh, Rahimi, Koohdani & Asayesh (2013), reported that 55.6% of their participants indicated their health status to be "moderate". Furthermore, other studies also reported that their students did not participate in sport (Ayranci *et al* 2005; Steele & Senekal 2005). Moreover, the significance of not smoking in this study was parallel to other studies which also indicated that significant amounts of their participants were non-smokers (Sharma *et al* 2014; Suleiman *et al* 2008; Ayranci *et al* 2005). Sharma *et al* (2014) also reported that a significant number of participants (76.7%; n=260) never consumed alcohol.

In the current study, 25 students (18%) reported participation in sporting activities. A significant proportion of the sample who participated in sport indicated that their participation was either recreational (48%; n=12) or at university level (44%; n=11) and that they trained for approximately 1-<2 hours per day. This implies that the students preferred to participate in sporting activities for leisure, rather than at a competitive level. This could also be because university studies are demanding and time consuming, and training at university level would take up the majority of their study time. Potgieter *et al* (2014) also reported a similar result in that students trained for about 121.0 minutes/day. Furthermore, 85 students indicated that they exercised instead of participating in sport. These participants exercised up to twice a week and 42.4% exercised for approximately 15-30 minutes or 31 minutes-1 hour, daily. Lieberman *et al* (2015) explained that participants exercised for about 31-150 minutes/week followed by >300 minutes/week. Physical activity was defined as at least 30-60 minutes of moderate-intense activity which should be performed on a daily basis (Petitt & Cureton 2003; Kraus, Houmard, Duscha, Knetzger, Wharton, McCartney, Bales, Henes, Samsa, Otvos, Kulkarni & Slentz 2002). This indicates that overall, the students did not meet their physical activity requirements, according to the recommendations stipulated.

5.4 Dietary factors

A significant proportion of the students (n=139) rated their eating habits as either 'average' (54.7%, n=76) and 'good' (33.1%, n=46). Similarly, Steele & Senekal (2005) reported that students rated their dietary intake as 'fair' (27.8%) and 'good' (46.5%). In the current study, the students also completed a food frequency questionnaire. The results of the food frequency

reported indicated a relatively healthy diet. A high intake of starch was evident as starches are relatively cheaper in comparison to other foods and bulky with a higher satiety value. The higher intake of starch is also in keeping with the lower amount of money spent on food. With a limited budget for food, the students are more likely to purchase starchy staples for their satiety value. There was a significant consumption of fruits and vegetables, which is expected in students studying towards a nutrition-related degree, reflecting healthy eating. However, it may suggest that the students may have prioritized fruit and vegetables, despite a limited budget. Moreover, meat and meat products and fast foods were not consumed as often, which could be due to cost.

A South African cross-sectional study assessed the dietary patterns, food frequency, alcohol consumption and physical activity of 2977 health science students and 26 408 non-health science students, in order to determine if health science students had a healthier lifestyle. The food frequency of the health science students reported that the majority (91%) of students consumed less than two glasses of milk a day. More than half (65%) of the students consumed less than one fruit a day and 70% consumed less than one vegetable portion a day. Furthermore, 75% of students reported consuming fast foods more than three times a week, whilst 50% consumed snacks (such as sweets) more than twice a week (Greese, Steenkamp & Pietersen 2015). The results from Greese *et al* (2015) are in contrast to the results obtained in the current study. However, another cross-sectional study by Ganasegeran, Al-Dubai, Qureshi, Al-abhed, Rizal & Aljunid (2012) on medical students attending a Malaysian medical university, reported fairy similar results to the current study. The medical students reported frequent consumption of vegetables (>3 times a week), whilst 51.5% of the medical students consumed fruits <3 times a week. Furthermore, 78.8% and 73.5% of the medical students reported consumption of fast foods and fried foods, respectively (Ganasegeran *et al* 2012). This was higher than in the current study and could be due to a greater budget being available for food.

The majority of the students (92.8%; n=129) in the current study did not follow a specific diet. Only 10 students (7.2%) followed a specific diet with half of these on a weight-reducing diet. This suggests that the majority of students were satisfied with their body weight and overall health status, and they did not see the need to follow a specific diet. More than half of the students (68%; n=94) felt that they were not able to meet their dietary requirements based on their current diet. This could be due to the high cost of food and a limited budget for food. There was a high reliance on financial aid by the students, which may not be sufficient to

ensure healthy, balanced meals. Furthermore, due to the demanding study schedules, students have limited time to prepare healthy meals resulting in meals being skipped or consuming foods that are nutrient deficient. This was parallel to a prior study on college students, which also indicated that students did not meet their dietary requirements (Huang, Harris, Lee, Nazir, Born & Kaur 2003).

5.5 The use of dietary supplements

A cross-sectional study by Van der Kruk *et al* (2013) on 568 Dutch nutrition and dietetics students found that there was an increasing prevalence of supplement use by students studying nutrition or dietetics (Van der Kruk *et al* 2013). However, this is in contrast to the current study. In the current study, only 32 students (23%) reported use of dietary supplements, whilst 76.9% (n=107) indicated that they were not using dietary supplements at the time of the study. This indicated that there was a low prevalence of use of dietary supplements in this sample. This could possibly be due to the sample size of the current study being smaller, with only 139 students. Suleiman *et al* (2008) also reported a low prevalence of dietary supplement use among health science and non-health science students in Jordan.

More than half of the supplement users in the current study researched dietary supplements because they wanted to enhance their physical health. This would be expected from students studying towards a health-related degree. The most common source of information was the internet (72.2%) followed by dietetics/nutrition lectures (41.7%) and nutrition textbooks/journal articles (38.9%). One would expect that nutrition textbooks, journal articles and dietetics/nutrition lectures would be the most common sources of information, as these are more reliable sources of information.

The students, in this study, cited expense, having an adequate diet, ‘deem it unnecessary/waste of money’, undesirable side effects/consequences and unsure about dietary supplements as their reasons for not using a dietary supplements. These reasons are similar to those cited by students from previous studies (Kostka-Rokosz *et al* 2015; Tian *et al* 2008; Steel & Senekal 2005). Due to the high reliance on financial aid, which indicates low economic levels and purchasing power, one would assume that expense would be the dominant reason for not using a dietary supplement among the students who are predominantly black African. However, 51.4% of the students reported that they would use a supplement in future with the common reason being to obtain adequate nutrients/nutrition. This suggests that the students valued their nutritional status and overall health. On the other hand, a busy schedule, medical

condition, ‘quicker method to meet desired results’ were some of the reasons reported by the students for the use of dietary supplements over dietary modification. Due to the demanding schedule of university students, it is likely that the students would not have sufficient time to eat healthy, balanced meals, thus opting for a dietary supplement to achieve optimal nutritional intake. Furthermore, it was reported that strengthening the immune system, improving energy levels, enhancing physical health and enhancing concentration and memory were some of the common reasons for using a dietary supplement. This also shows that students were concerned about their health and wanted to achieve optimal health, in order to aid their academic performance. This was supported by other studies, which also cited similar reasons (Lieberman *et al* 2015; Sharma *et al* 2014; Aina & Ojedokun 2014; Suleiman *et al* 2008).

The majority of the supplement users in the current study (84.4%; n=27) used multivitamins ($p<0.05$) followed by minerals only (18.8%; n= 6) and vitamins only (15.6%; n=5). This is in line with previous studies (Kostka-Rokosz *et al* 2015; Aina & Ojedokun 2014; Lieng *et al* 2008; Suleiman *et al* 2008). The most commonly consumed brand was Centrum, a multivitamin supplement. It would be assumed that a multivitamin supplement would be the most commonly consumed supplement among students, as they provide a variety of vitamins in one tablet, which is also convenient. In addition, more than half (62.5%; n=20) of supplement users obtained their dietary supplements from the pharmacy, whilst 43.8% (n=14) received their dietary supplement from a health store. Tian *et al* (2008) reported very similar results with the health food store (50.8%; n=32) and the pharmacy (20.6%; n=13) as the most common places from where dietary supplements were purchased. In this study, 65.6% of the supplement users (n=21) reported a daily consumption of their dietary supplement, while 21.9% (n=7) indicated that they had been taking dietary supplements for about 1-<2 years and 18.8% (n=6) had been taking their supplements for about 1-<5months. Because more than half of the students reported, earlier, to not being able to meet their daily requirements, one would assume that more than half of the students would take their dietary supplements daily, and for a longer duration, in order to optimise their nutritional status

According to Sharma *et al* (2014), more than half of their participants (58.9%; n=99) consumed dietary supplements daily, whilst Aina & Ojedokun (2014) reported that at least 51.5% of their participants had taken dietary supplements in the previous 12 months, similar to the results of the current study. In the current study, only three students reported sporadic use of dietary supplements, citing ‘used when stressed’ (n=2) or ‘forget to take the

supplements' (n=1) as their reasons. This is supported by Senekal & Steele (2005) who cited 'when stressed' (30.8%), 'when tired' (23.1%) and forgetting (16.7%) as the main reasons for the sporadic use of dietary supplements. Moreover, in the current study, <R150 was spent on purchasing dietary supplements (28.1%;n=4), followed by R151-R200 (21.7%; n=7). Approximately, 18.8% (n=4) got their dietary supplements for free. It can be assumed that some of these students obtained them from the university campus health clinic or government hospital/clinic (12.5%; n=4).

In the current study, the students who consumed dietary supplements were asked whether they had achieved their desired results from using the supplement. The majority of the supplement users (93.8%; n=30) indicated that they had achieved the desired results. Approximately, 73.3% (n=22) of the sample indicated that they had experienced an overall improvement in physical health after using dietary supplements. Other results achieved included: more energy (53%; n=16) and better memory/concentration (53.3%; n=16). Furthermore, half of the supplement users (50%; n=15) reported an improved resistance to illness/ability to fight illnesses earlier. Kostka-Rokosz *et al* (2015) also reported that their participants (nursing and pharmacy students) were either satisfied or somewhat satisfied with the efficacy and quality of the supplements. Approximately 55% of nursing students and 25% of pharmacy students were satisfied with the quality, whilst 49% of nursing students and 21% of pharmacy students were satisfied with the efficacy of the dietary supplement. Moreover, about 30% of nursing students and 29% of pharmacy students were somewhat satisfied with the quality, whilst 38% of nursing students and 44% of pharmacy students were somewhat satisfied with the efficacy of the dietary supplement (Kostka-Rokosz *et al* 2015).

5.6 Factors related to the use of dietary supplements

A significant relationship was found between race and use of supplements. Although the black African students made up the majority of the sample (72.7%; n=101), a significant number of whites and Indian students used dietary supplements ($p<0.05$). This could be because most of the white and Indian students lived at home and their parents may have been purchasing the dietary supplements for them. Furthermore, some of these students could have been using the supplements from a younger age, and thus continued with it into adulthood. Previous studies reported similar results indicating a high use of supplements among the white racial group/white non-hispanic group (Lieberman *et al* 2015; Bailey *et al* 2010; Steele & Senekal 2005), followed by Asians (Spencer *et al* 2006).

There was a significant relationship between gender and the use of dietary supplements with more females using dietary supplements compared to males. This was consistent with other studies who reported a higher use of dietary supplements among female participants (Kim *et al* 2014; Van der Horst *et al* 2011; Bailey *et al* 2010; Spencer *et al* 2006; Kishiyama *et al* 2005; Steele & Senekal 2005). It is also expected that more females would make use of dietary supplements as they not only made up a larger proportion of the sample, but it is assumed that they are also generally more concerned about their overall health and well-being than males.

Furthermore, it was hypothesised that students living at home would be more likely to consume dietary supplements. That was evident in this study as students who lived at home were more likely to consume dietary supplements. In the studies reviewed, there were no significant findings on the relationship between place of residence and the use of dietary supplements. In the current study, the highest use of dietary supplements was observed among the fourth year students. This is consistent with Van der Kruk *et al* (2013), who also reported that more fourth year dietetics students consumed dietary supplements compared to first year students. This could be due to the fact that fourth year students have more nutrition knowledge, in terms of the benefits, compared to first years, therefore they were able to make a more informed decision regarding supplementation. It could also be that with experience, senior students have come to realise the role of dietary supplements in enhancing academic performance and optimising overall nutritional status and health.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

The aim of this study was to assess the use of dietary supplements by students registered for a Bachelor of Science or a Post Graduate Diploma in Dietetics at UKZN. The specific objectives were:

(i) To determine the prevalence of dietary supplement use among dietetics students at UKZN.

(ii) To determine the factors associated with dietary supplement use among dietetics students at UKZN.

(iii) To determine the reasons for use of dietary supplements among dietetics students at UKZN.

This chapter concludes and critiques the study. It also gives recommendations followed by implications for further research.

6.1 Conclusions

Although it was hypothesised that there would be a high prevalence of dietary supplement use among the dietetics students, the findings of this study indicated that there was a low prevalence of dietary supplement use. Factors such as race, gender, residence and year of study influenced the use of dietary supplements among the students. Dietary supplementation was more common among white and Indian students, females and fourth year students. Students who lived at home were more inclined to use dietary supplements, than students who lived away from home. Dietary supplement use was highest among fourth year students, with the intake of supplements increasing as the year of study increased. There was no relationship between dietary supplement use and physical activity, eating habits or ability to meet dietary requirements. Moreover, a busy schedule, medical condition and 'quicker method to meet desired results' were some of the reasons reported by the students for the use of dietary supplements, over dietary modification. Furthermore, the students, in this study, cited expense, having an adequate diet, 'deem it unnecessary/waste of money', undesirable side effects/consequences and unsure about dietary supplements as their reasons for not using a dietary supplements. On the other hand, students reported that strengthening the immune system, improving energy levels, enhancing physical health, concentration and memory, were some of the common reasons for using a dietary supplement. Reasons for not using a supplement included expense, having an adequate diet, 'deem it unnecessary/waste of

money', undesirable side effects/consequences and unsure about dietary supplements. The most commonly used dietary supplement was a multivitamin followed by mineral or vitamin only. These were obtained from either the health store or pharmacy. Supplement users reported that they had experienced an overall improvement in physical health after using dietary supplements. Other benefits included more energy, better memory/concentration and an improved resistance to illness/ability to fight illnesses earlier.

6.2 Study limitations

6.2.1 A small number of questionnaires (6) were excluded, as they were not answered completely. This reduced the number in the sample.

6.2.2 The pilot study was conducted on non-dietetic students and may not have been reflective of students studying towards a nutrition-related degree.

6.2.3 This study was only conducted on dietetics students at the University of KwaZulu-Natal, which does not allow for generalised conclusions on dietetics students in general.

6.2.4 There was no control group consisting of non-dietetic students to allow for comparisons.

6.3 Recommendations

6.3.1 Education on dietary supplementation should be provided in order to empower and educate individuals to make informed choices, as there are many different types of dietary supplements available.

6.3.2 The campus clinic staff should include a dietitian or nutritionist to provide a nutrition service for the students. Although the nursing staff are expected to give nutritional advice, they may be too busy and unequipped with sufficient knowledge to advise the students accordingly.

6.3.3 If a dietitian or nutritionist were available then he/she would be able to assess the student's dietary intake and recommend the appropriate dietary supplements.

6.3.4 Nutrition education should be provided to all new first year students to help them understand the foundation and fundamental aspects of nutrition and its effect on their studies.

6.4 Implications for further research

6.4.1 This study was only conducted on dietetics students at UKZN. Future studies should be conducted on students registered for dietetics at other South African universities, where the degree is offered.

6.4.2 Future studies should include students studying towards other health science degrees such as medicine, physiotherapy, occupational therapy and pharmacy, to determine if the use of dietary supplements is consistent among these students.

6.4.3 The use of dietary supplements by students in the medical and health related fields; versus non-medical and non-health related fields, should be investigated. This would help to determine if dietary supplement use is influenced by qualification and area of study.

6.4.4 Further studies could also investigate whether students who use dietary supplements require them by comparing their nutrient intake (without supplementation) to the relevant dietary reference intakes (DRIs). It would also be worthwhile to determine if dietary supplements users are consuming more than required by comparing intake to the tolerable upper intake level (UL).

6.4.5 Future studies should investigate the relationship between dietary supplement use and anthropometric status in students.

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APPENDIX A QUESTIONNAIRE

DIETARY SUPPLEMENT USE AMONG DIETETICS STUDENTS AT THE UNIVERSITY OF KWAZULU-NATAL

Dear Participant,

Thank you for your participation in this research project, for a Master of Science in Dietetics.

Objectives of the Study:

1. To determine the prevalence of dietary supplement use among Dietetics students at UKZN.
2. To determine the factors associated with dietary supplement use among Dietetics students at UKZN.
3. To determine the reasons for use of dietary supplements among Dietetics students at UKZN.

Please answer all questions honestly. Tick the appropriate answer or fill in where required. Any queries can be directed to the researcher.

SECTION A: SOCIO-DEMOGRAPHIC FACTORS

1. What is your age?

18- 19 years	
20-22years	
23-25 years	
>25 years	

2. What is your race?

Black	
White	
Coloured	
Indian	
Other (Please specify)_____	

3. What is your gender?

Male	
Female	

4. What is your marital status?

Single	
Married	
Divorced	
Widowed	

5. Where do you live during the university term?

Home	
University Residence	
Commune/Digs	
Flat/Apartment away from home	
Other (Please specify):	

6. What degree/diploma are you currently registered for?

Bachelor of Science in Dietetics	
Post Graduate Diploma in Dietetics	

7. What is your current year of study?

First year	
Second year	
Third year	
Fourth year/Post Graduate Diploma	

8. How are your studies financed? (Select ONE option only)

Parents/Guardian	
Bursary/Scholarship	
Student Loan	
Financial aid	
Other (Please specify):	

9. Do you have any part-time employment?

Yes	
No	

10. If yes, how much do you earn per month?

<R500	
R501-R1000	
R1001-R2000	
R2001-R3000	
R3001-R4000	
>R4000	

11. How much money do you spend on food, per month?

I live at home and don't spend money on groceries	
<R500	
R501-R1000	
R1001-R2000	
>R2000	

SECTION B: LIFESTYLE FACTORS

12. How would you describe your current state of health?

Excellent	
Good	
Average	
Poor	
Very Poor	

13. Do you consume alcohol?

Yes	
No	

14. Do you smoke?

Yes	
No	

15. Do you use recreational drugs?

Yes	
No	

16. Do you participate in sport? *<u>If yes continue below: if no, proceed to question 20</u>*

Yes	
No	

17. If yes, at what level?

Recreational	
University	
Provincial	
National	

18. How often do you train for your sport?

Up to twice a week	
3-4 times a week	
5-6 times a week	
> 6 times a week	

19. How long do you train for?

<1 hour	
1-<2 hours	
2-<3 hours	
3-<4hours	
4+ hours	

Proceed to question 23

20. <u>If no sport is played</u>, do you exercise?

Yes	
No	

21. How often do you exercise?

Up to twice a week	
3-4 times a week	
5-6 times a week	
> 6 times a week	

22. How long is your exercise routine?

<15 minutes	
15-30 minutes	
31 minutes - 1 hour	
> 1 hour	

23. What type of exercise/sport are you <u>generally</u> involved in? (Select ONE option only)

Strenuous (e.g. circuit, swimming, soccer, spinning, sprinting)	
Moderate (e.g. golf, cricket, brisk walking)	
Mild (e.g. slow walking, gardening)	
Other (Please specify):	

SECTION C: DIETARY FACTORS

24. How would you describe your eating habits?

Excellent	
Good	
Average	
Poor	
Very Poor	

25. Please indicate how often you consume the following items

Food Items	Never	<Once a week	1-3 times a week	4-6 times a week	Daily
25.1. Dairy products (milk/ cheese/maas/yoghurt)					
25.2. Fruit and vegetables					
25.3. Chicken/fish/meat					
25.4. Soya/beans/peas/lentils					
25.5. Starches (rice/pasta/potato)					
25.6. Biscuits/cakes/chocolates					
25.7. Fizzy drinks					
25.8. Margarine/butter/oil/ peanut butter/avocado/nuts					
25.9. Fast food/take away					

26. Do you follow a specific diet?

Yes	
No	

27. If yes, select the type of diet from the list below: (Tick ALL that apply)

27.1. Vegan	
27.2. Vegetarian	
27.3. Lacto-ovo vegetarian	
27.4. Lacto vegetarian	
27.5. Pescatarian (consumption of seafood and no other meat)	
27.6. High protein, low carbohydrate	
27.7. Banting (low carbohydrate, high fat)	
27.8. Weight reducing (energy controlled)	
27.9. Other (Please specify):	

28. Do you feel you are able to meet your dietary requirements with your current diet?

Yes	
No	

29. If no, why not?

_____

_____

SECTION D: DIETARY SUPPLEMENTS

30. Have you ever conducted research to find out more about dietary supplements?

Yes	
No	

If YES, please proceed below. If NO, please proceed to question 33.

31. Please select the reason for researching dietary supplements. (Tick ALL that apply)

31.1. Inadequate dietary intake	
31.2. Enhance sporting performance	
31.3. Enhance memory/concentration (mental performance)	
31.4. Strengthen immune system	
31.5. Enhance overall energy	
31.6. Enhance physical health	
31.7. Medical condition (e.g. cancer)	
31.8. Other (Please specify):	

32. What was your source of information? (Tick ALL that apply)

32.1. Mass media (radio, television, social networks)	
32.2. Medical practitioner	
32.3. Nurse	
32.4. Dietitian	
32.5. Pharmacist	
32.6. Nutrition textbooks/journal articles	
32.7. Dietetics/nutrition lectures	
32.8. Internet	
32.9. Other (Please specify):	

33. Do you currently use a dietary supplement?

Yes	
No	

If YES, please proceed to Question 39. If NO, please continue below.

34. If no, why not? (Select ONE option only)

Expensive	
Adequate diet	
Undesirable side effects/consequences	
Deem it unnecessary/waste of money	
Unsure about supplements	
Don't believe that they are effective	
Unhealthy to use a supplement	
Other (Please specify):	

35. Do you plan on using a dietary supplement in the future?

Yes	
No	

36. If no, why not?

_____

_____

37. If yes, please explain.

_____

_____

38. Have you ever used a dietary supplement in the past?

Yes	
No	

Thank you for your participation ☺

If you answered YES to question 33, please continue below:

39. Why was a dietary supplement chosen instead of dietary modifications?

(Select ONE option only)

A more favored outcome (i.e. better results)	
Poor appetite	
Medical condition (e.g. Crohn's disease)	
Too busy to eat a balanced diet	
Quicker method to meet desired results	
Decreased risk for weight gain with a dietary supplement	
Other (Please specify):	

40. Please select the reason(s) for using a dietary supplement. (Tick ALL that apply)

40.1. Inadequate dietary intake	
40.2. To enhance sporting performance	
40.3. To enhance memory/concentration (mental performance)	
40.4. To strengthen the immune system	
40.5. To improve energy levels	
40.6. To enhance physical health	
40.7. Medical condition requires it (e.g. iron deficiency anaemia)	
40.8. Based on own nutrition knowledge/background	
40.9. Other (Please specify):	

41. Which of the following types of supplements do you use? (Tick ALL that apply)

41.1. Multivitamin (contains vitamins and minerals)	
41.2. Mineral only	
41.3. Vitamin only	
41.4. Amino acids/protein	
41.5. Essential fatty acids	
41.6. Herbal supplements	
41.7. Other (Please specify):	

42. Please indicate the name of the dietary supplement(s) used. (Please be as specific as possible)

_____

43. From where do you obtain the dietary supplement? (Tick ALL that apply)

43.1. Doctor	
43.2. Hospital/Clinic	
43.3. Health store	
43.4. Pharmacy	
43.5. Other (Please specify):	

44. How often do you take the dietary supplement(s)?

Sporadically/At intervals (e.g. every 6 months)	
Once a week	
Two-three times a week	
4-6 times a week	
Everyday	
Other (Please specify):	

If dietary supplements are taken <u>sporadically</u>, please continue below. If <u>not taken sporadically</u>, proceed to question 46.

45. <u>If you take dietary supplements sporadically</u>: Please indicate the possible reason. (Select ONE option only)

Used when tired/ill	
Used when stressed (i.e. during tests/exams)	
Forget to take the dietary supplements	
Taken when money is available to purchase the dietary supplements	
Other (Please specify):	

46. For how long have you been taking this dietary supplement?

< 1 month	
1 - <5 months	
5 - <8 months	
8 - <12 months	
1 - <2 years	
2 - <4 years	
4 - <-6 years	
6+ years	

47. How much money do you spend on dietary supplements in a month?

Free	
<R150	
R151-R200	
R201-R300	
R301-R400	
R401-500	
>R500	
Other (Please specify):	

48. Do you achieve the desired results from taking the dietary supplements?

Yes	
No	

49. If Yes, please indicate how the dietary supplement(s) help to achieve the desired results? (Tick ALL that apply)

49.1. Better sporting performance	
49.2. Better memory/concentration	
49.3. Improved resistance to illnesses/ability to fight illnesses earlier	
49.4. More energy	
49.5. Improved overall physical health	
49.6. Other (Please specify):	

50. Rate your overall impression of the 'helpfulness' of the dietary supplement(s) from 1 = very unhelpful to 5 = very helpful

Very unhelpful **1**	**2**	**3**	**4**	**Very helpful** **5**

Thank you for your participation ☺

APPENDIX B CONSENT FORM

PARTICIPANT INFORMATION AND CONSENT FORM

My name is Lynelda Pillay, a Registered Dietitian, who is currently a full time student, pursuing a Master of Science in Dietetics degree at the University of KwaZulu-Natal (UKZN). You are invited to participant in a research project which I am conducting. The aim of this study is to *assess the use of dietary supplements among dietetics students attending UKZN*. Please take note of the following:

- There information provided will be strictly confidential and will remain between the researcher and participants.
- Your privacy is guaranteed as the information provided, by the participant, will not be attributed to you, but reported only as an opinion.
- Any information provided cannot and will not be used against you as the data collected will solely be used for research purposes.
- Data will be confidentially stored and destroyed after five years.
- Participation, in this research project, is voluntary. Participants may leave the study, at any given point, without negative consequences.
- There are no potential benefits, such as financial rewards, from part-taking in this research project. Your involvement will be for academic purposes only.

Any queries and concerns can be forwarded to the contact details provided below:

Researcher: Lynelda Pillay, **Contact:** lyneldapillay@gmail.com
Supervisor: Dr Kirthee Pillay (PhD, UKZN), **Contact:** 033-2605674 or pillayk@ukzn.ac.za.

UKZN Research Office (Ethics): Mr P Mohun, **Contact:** 031 260 4557 or mohunp@ukzn.ac.za

DECLARATION

I …… (Full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in this research project. I understand that I am free to withdraw from the project at any time, should I so desire.

…… ……
SIGNATURE OF PARTICIPANT **DATE**

APPENDIX C ETHICS APPROVAL LETTER FROM UKZN

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

24 May 2017

Ms Lynelda Pillay (211501442)
School of Agricultural, Earth & Environmental Sciences
Pietermaritzburg Campus

Dear Ms Pillay,

Protocol reference number: HSS/00358/017M
Project title: Dietary supplement use among Dietetics students at the University of KwaZulu-Natal

Approval Notification – Expedited Application

In response to your application received on 19 April 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr Shenuka Singh (Chair)

/ms

Cc Supervisor: Dr Kirthee Pillay
Cc Academic Leader Research: Professor O Mutanga
Cc School Administrator: Ms Marsha Manjoo

Humanities & Social Sciences Research Ethics Committee
Dr Shenuka Singh (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
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Website: www.ukzn.ac.za

APPENDIX D GATEKEEPERS APPROVAL FROM UKZN

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

3 May 2017

Miss Lynelda Pillay (SN 211501442)
School of Agricultural, Earth and Environmental Sciences
College of Agriculture, Engineering and Science
Pietermaritzburg Campus
UKZN
Email: lyneldapillay@gmail.com

Dear Miss Pillay

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN), towards your postgraduate degree, provided Ethical clearance has been obtained. We note the title of your research project is:

"Dietary supplement use among Dietetics students at the University of KwaZulu-Natal".

It is noted that you will be constituting your sample by handing out questionnaires to students who are registered for the Bachelor of Science in Dietetics degree and Post Graduate Diploma in Dietetics on Pietermaritzburg campus.

Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using 'Microsoft Outlook' address book. Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

MR SS MOKOENA
REGISTRAR