



**UNIVERSITI PUTRA MALAYSIA**

***FACTORS ASSOCIATED WITH NUTRITIONAL  
SUPPLEMENTATION INTAKE AMONG ATHLETES IN  
UNIVERSITI PUTRA MALAYSIA***

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FPSK3 2019 15**

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INTAKE AMONG ATHLETES IN UNIVERSITI PUTRA MALAYSIA**



**BY**

**SITI MAIZURA BINTI MOHD DAUD**

**A project submitted as a partial fulfillment of the requirement for the  
degree of Bachelor of Science (Nutrition and Community Health) from the  
Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.**

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## ABSTRACT

### FACTORS ASSOCIATED WITH NUTRITIONAL SUPPLEMENTATION INTAKE AMONG ATHLETES IN UNIVERSITI PUTRA MALAYSIA

**Siti Maizura Binti Mohd Daud**

Interest in nutritional supplementation intake among athletes and physically active population had been growing in the research field of sports nutrition. However, there were still inconsistent findings and limited studies conducted on nutritional supplementation intake among Malaysian. Therefore, the aim of this study was to determine factors associated with nutritional supplementation intake among athletes in Universiti Putra Malaysia. A cross-sectional study was carried out among athletes in UPM. A validated self-administered questionnaire was used to determine socio-demographic characteristics, sports characteristics, nutritional supplementation intake, sports nutritional knowledge and physical activity level of the athletes. Weight, height and body fat percentage were measured, then BMI and fat-free mass were calculated. A 24-hour dietary recall was used in interview session to determine athletes' dietary intake. A total of 165 of athletes in UPM (73.9% male and 26.1% female), with a mean age  $22.48 \pm 1.95$  years participated in this study. Majority of the participants were Malay (84.9%), undergraduate (95.8%), with the mean monthly allowance of  $RM590.61 \pm 421.65$  and mean household income of  $RM4123.70 \pm 1903.38$ . Most of the participants had a moderate sports nutritional knowledge (81.8%) and had high physical activity level (55.2%). The prevalence of nutritional supplement intake among athletes in UPM was 43% with energy supplement (80.3%) being the most popular supplement used followed by protein supplement (45.1%) and vitamin/mineral supplement (39.4%). The most common reasons for using nutritional supplement were to increase energy level (64.8%), for health (52.1%) and for weight/muscle gain (45.1%). The participants were most likely to get information about nutritional supplement from their coach (54.9%), fellow students athletes (50.7%) and from the internet (45.1%). Result showed monthly allowance ( $r=0.328$ ;  $p<0.001$ ), household income ( $r=0.243$ ;  $p=0.002$ ), types of sport ( $\chi^2=15.64$ ;  $p=0.008$ ), category of event ( $\chi^2=18.25$ ;  $p<0.001$ ), number of years of participation ( $\chi^2=4.90$ ;  $p=0.027$ ), sports nutritional knowledge ( $r=0.232$ ;  $p=0.003$ ), physical activity level ( $r=0.210$ ;  $p=0.007$ ) and fat-free mass for male ( $r=0.201$ ;  $p=0.026$ ) and female ( $r=0.359$ ;  $p=0.018$ ) were significantly associated with nutritional supplementation intake. In conclusion, the prevalence of supplementation intake among athletes in UPM was lower than previous study. Majority of them had moderate level of sports nutritional knowledge. Therefore, intervention program to educate on sports nutritional supplement is needed to ensure healthy nutritional intake among the athletes.

## ABSTRAK

### FAKTOR-FAKTOR YANG BERKAITAN DENGAN PENGGUNAAN SUPLEMENTASI MAKANAN DALAM KALANGAN ATLET DI UNIVERSITI PUTRA MALAYSIA

Siti Maizura Binti Mohd Daud

Minat dalam pengambilan suplementasi makanan dalam kalangan atlet dan populasi yang aktif telah semakin meningkat dalam bidang pemakanan sukan. Walau bagaimanapun, masih terdapat hasil kajian yang tidak konsisten dan terhad dalam pengambilan suplementasi makanan dalam kalangan rakyat Malaysia. Oleh itu, tujuan kajian ini adalah untuk menentukan faktor-faktor yang berkaitan dengan penggunaan suplementasi makanan dalam kalangan atlet di Universiti Putra Malaysia. Satu kajian keratan rentas telah dijalankan pada atlet-atlet di UPM. Soal selidik yang telah divalidasi digunakan untuk menentukan ciri-ciri sosio-demografi, ciri-ciri sukan, penggunaan suplementasi, pengetahuan pemakanan sukan dan tahap aktiviti fizikal para atlet. Berat, tinggi dan peratusan lemak diukur, kemudian BMI dan jisim bebas lemak dikira. Pengambilan pemakanan 24-jam telah ditentukan dalam soal selidik berdasarkan temu bual untuk menentukan pengambilan makanan atlet. Seramai 165 orang atlet di UPM (73.9% lelaki dan 26.1% perempuan), dengan umur purata  $22.48 \pm 1.95$  tahun telah mengambil bahagian dalam kajian ini. Majoriti peserta adalah Melayu (84.9%), pelajar pra-siswazah (95.8%) dengan purata elaun bulanan sebanyak  $RM590.61 \pm 421.65$  dan purata pendapatan isi rumah sejumlah  $RM4123.70 \pm 1903.38$ . Kebanyakan daripada peserta mempunyai tahap pengetahuan sukan sederhana (81.8%) dan aktiviti fizikal yang tinggi (55.2%). Kelaziman penggunaan suplementasi makanan dalam kalangan atlet di UPM adalah 43.0% dengan suplemen tenaga (80.3%) menjadi pilihan yang paling popular diikuti oleh suplemen protein (45.1%) dan suplemen vitamin/mineral (39.4%). Antara sebab utama peserta menggunakan suplemen adalah untuk meningkatkan tahap tenaga (54.8%), untuk tujuan kesihatan (52.1%) dan untuk meningkatkan otot atau berat badan (45.1%). Kebanyakan peserta cenderung untuk mendapatkan maklumat mengenai suplemen daripada jurulatih (54.9%), rakan atlet (50.7%) dan internet (45.1%). Hasil kajian mendapati elaun bulanan ( $r=0.328$ ;  $p<0.001$ ), pendapatan isi rumah ( $r=0.243$ ;  $p=0.002$ ), jenis sukan ( $\chi^2=15.64$ ;  $p=0.008$ ), kategori pertandingan ( $\chi^2=18.25$ ;  $p<0.001$ ), bilangan tahun penyertaan ( $\chi^2=4.90$ ;  $p=0.027$ ), pengetahuan pemakanan sukan ( $r=0.232$ ;  $p=0.003$ ), tahap aktiviti fizikal ( $r=0.210$ ;  $p=0.007$ ) dan jisim bebas lemak bagi lelaki ( $r=0.201$ ;  $p=0.026$ ) dan perempuan ( $r=0.359$ ;  $p=0.018$ ) mempunyai perkaitan yang signifikan dengan penggunaan suplementasi makanan. Kesimpulannya, kadar kelaziman penggunaan suplemen dalam kalangan atlet di UPM adalah lebih rendah berbanding kajian terdahulu. Majoriti daripada mereka mempunyai tahap pengetahuan pemakanan sukan yang sederhana. Oleh itu, program intervensi bagi pendidikan suplementasi diperlukan bagi memastikan pemakanan yang sihat dikalangan atlet.

# CHAPTER 1

## INTRODUCTION

### 1.1. Background

Sports supplementation and ergogenic aids as an additional source of nutrients other than food sources to enhance athletic performance and to improve body composition had become readily available worldwide and can be easily got over the counter. Interest in sports supplementation and ergogenic aids intake among athletes and the active population had become dramatically increased recently in the research field of sports nutrition. Nutritional supplement and ergogenic aids in the sports industry can be divided into few classifications which were sports food, energy drinks, protein supplements, vitamins and minerals, and other nutritional ergogenic aids (Keat et al., 2017; Braub et al., 2009).

Some of the known reasons of supplementation intake among athletes includes performance or endurance enhancement, prevention of nutritional deficiencies, improved physical appearance, maintaining muscle strength, boosting immune system, and recovery from training and injury (Heikkinen et al., 2011; Parnell et al., 2015; Salgado et al., 2014). In other areas, nutritional supplements were being marketed as weight loss agents, analgesics or health, energy, cognitive, and physical performance boosters (Knapik et al., 2018; Knapik et al., 2016). However, between 38-99% of athletes continue to consume them despite the apparent lack of scientific evidence to demonstrate and support many of their alleged

benefits and effectiveness (Outram et al., 2013; Tawfik et al., 2016; Duvenage et al., 2015).

Based on the analysis done by Kantor et al. (2017) from the National Health and Nutrition Examination Survey (NHANES) supplementation intake data, about 52% of US adult consume nutritional supplements from the year 2011 to 2012. Compared to the normal population, the prevalence of supplementation consumption was higher with nearly half among athletes with some studies reported up to 90% of supplementation usage among them with variety of sports types, cultural background, ages and sports performance (Sousa et al, 2016; Porrini & Del Bo, 2016). Among Malaysian athletes, when compared to Western countries and Singapore prevalence, Keat et al. (2017) reported that nutritional ergogenic aids consumption among team sports athlete in National Sports Institute Malaysia was much lower which was 59.7%.

Recently, the nutritional supplements industry was also growing rapidly in the Malaysian market. According to the findings from Malaysian Adult Nutrition Survey, MANS (2014), the prevalence of vitamin and mineral supplements intake among Malaysian adults was 28.1% with a higher percentage among the urban population (30.9%). A higher number of Malaysian female in the urban area consume vitamin and mineral supplements (32.1%) compared to men (24.3%). This survey also shows that higher numbers of Malaysian consuming supplements were among those with higher education level and higher monthly income. Significant numbers of adolescents or young Malaysian adults were also consuming nutritional supplements. For instance, a study conducted by Al-Naggar and Chen (2011) at Management & Science University (MSU) found that about 43% of the students participated in the study consume supplements. Another study conducted in Asia

region among university athletes in Singapore by Tian et al. (2009) also reported a high prevalence of university athletes consuming nutritional supplements which were about 76.8% with 20 different products were reported to be used.

Another factor associated with supplementation intake among athletes was the knowledge about the supplement, perception or belief on the nutritional supplementation intake. Based on a cross-sectional study in Australia conducted by Dascombe et al. (2010), 61.9% of the sports institute athletes did not know the active ingredients in their supplements and 57.1% did not know the side effects. Many of the athletes had a positive perception and good belief in supplementation intake which mainly believed that sports supplements had a large impact on their sports performance and stopping the intake may cause poor performance (Saeedi et al., 2013). A study conducted by Dascombe et al. (2010) also reported that half of the athletes being studied believed that balanced diet was not required when nutritional supplements were being consumed. Therefore, knowledge about the supplement and belief on supplementation intake could also be linked to the consumption of supplementation intake among athletes.

Other than that, physical activity level and body weight status could also be associated with supplementation intake. A study conducted by Žeželj et al., (2018) reported that 37.7% of physically active Croatian university students consume supplements which majority of them were with normal BMI (61.5%). Another study conducted on ergogenic aids usage among athletes and its association with physical activity by Keat et al. (2017) also found that there was a significant weak positive correlation between physical activity level with the number of nutritional supplements intake ( $r=0.231$ ,  $p=0.05$ ). Some studies also reported that lower BMI associated with higher nutritional supplement usage which mainly taking

multivitamins (Sousa et al., 2016; Al-Naggar & Chen, 2011). Thus, previous study also proved that physical activity level and body weight status could also be linked with supplementation intake among athletes.

Prevalence of supplementation intake among public population and athletes were increasing. This can be associated with a few factors such as socio-demographic, nutritional knowledge, physical activity level and body weight status. Other factors that might be associated with nutritional supplementation intake among athletes that can be studied were sports nutritional knowledge and dietary intake. Although the prevalence of supplement consumption among athletes had been evaluated in other research worldwide, there was still a lack of research conducted to assess the factors associated with nutritional supplementation intake among Malaysian athlete. Therefore this study was conducted to assess the factors associated with nutritional supplementation intake which were socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake among university athletes in Malaysia.

## **1.2. Problem Statement**

The marketing field of supplementation industry had increased in recent years with product sales reached \$219 billion in 2016 (Moloughney et al., 2017). This shows that there was high demand from the population worldwide especially active person due to several associated factors. The known associated factors that causes increase in prevalence of nutritional supplementation intake among athlete in many scientific research includes socio-demographic factors such as age, gender, monthly income, self-perception on the effectiveness and the needs of the supplements to enhance their performance, physical activity level and level of general nutritional

knowledge (Keat et al, 2017; Sousa et al 2015; Saeedi et al 2013). However, some of the available findings vary among other studies and there were other associated factors that can be further studied.

In the association of socio-demographic with nutritional supplementation intake, several findings revealed that sex was associated with nutritional supplements consumption with some studies reported that there was higher prevalence among men than women (Diehl et al., 2012; Jawadi et al., 2017; Tsitsimpikou et al., 2011). However, these studies were contradicted with researches by Dascombe et al. (2010) and Žeželj et al. (2018) where there was no significant difference between male and female for supplementation intake while a study reported by Knapik et al. (2016) wrote that female was significantly associated with dietary supplement intake than male. Nutritional supplements intake was also reported to be associated with age with some study found that older age consumed more supplements (Parnell et al., 2015). These studies were contradicted with other studies that revealed the association between age and supplementation intake was not significant (Jawadi et al., 2017; Kim et al., 2011; Muwonge et al., 2017). Therefore, further study needs to be conducted to investigate the association between socio-demographic factors such as age, sex, ethnicity, educational level and monthly income with nutritional supplementation intake.

Other than that, the characteristics of sports the athletes were involved in were also being considered where the findings for association with supplement consumption were varied. A study conducted among German elite adolescents athlete found that those involved in endurance and power sports were more likely to consume supplement (Diehl et al., 2012) while a study conducted in Australia by Dascombe et al. (2010) stated that kayakers consumed more supplements than

swimmers, athletics and netball player. This was also different from a study conducted by Muwonge et al. (2017) among professional Ugandan athletes where the prevalence of nutritional supplement was higher among rugby and basketball player. Overall, sports characteristics which are the types of sports played were also varied among studies and needed more investigation to reveal their association with nutritional supplementation intake.

Furthermore, the association of body weight status with supplementation intake among athlete were also varied between different studies. Studies conducted by Knapik et al. (2016) and Al-Naggar and Chen (2011) reported that those with higher BMI were more likely to consume a higher number of dietary supplements. Another study by Žeželj et al. (2018) however revealed that having normal BMI was more significantly associated with supplementation intake. This was also contradicted with a study conducted among Portuguese high-performance athletes where lower BMI was more associated with nutritional supplementation intake (Sousa et al., 2016). All of the studies showed different findings on body weight status association with supplement intake where further study needs to be conducted to look at whether this variable was statistically associated.

Although some factors associated with nutritional supplementation intake among athletes had been reported by many researchers across the world, there were few other associated factors that need to be evaluated. There were limited researches on the association between supplementation intake and sports nutritional knowledge and also dietary intake. Based on previous studies, only general nutritional knowledge was being assessed in association with supplementation intake and was not specified to sports nutrition. Athletes' dietary intake could also be associated with their decision for the consumption of nutritional supplementation or ergogenic aids

which only a few findings could be found from the previous study. Therefore, the prevalence and the two factors linked to consumption of such ergogenic supplements need to be assessed to add knowledge on sports supplementation among athletes.

Numerous researches regarding the factors associated with supplementation intake among athletes had been conducted in Western countries. However, there was still a lack of research done on this topic among athletes in Malaysia especially among university athletes. Therefore this study aims to evaluate the factors associated with nutritional supplementation intake among athletes in Malaysia in which the factors that are going to be focused on are socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake. The study addresses the following research questions:

1. What is the prevalence of nutritional supplementation intake among athletes in Universiti Putra Malaysia?
2. What are the type, frequency, reason of usage and sources of information of nutritional supplementation intake among athletes in Universiti Putra Malaysia?
3. What are the socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake among athletes in Universiti Putra Malaysia?
4. What are the association between socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake with nutritional supplementation intake among athletes in Universiti Putra Malaysia?

### **1.3. Significance of the study**

This study is important to determine the association between socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake among athletes in Universiti Putra Malaysia. Findings of this study can be used to add knowledge on sports supplementation intake among young adult athlete and current issues regarding this area of study. In addition, the findings can also be compared to previous studies that had been conducted regarding the prevalence of supplementation intake among athletes and the factors associated.

A better understanding of supplementation intake with socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake could detect any underlying issues and further research can be done among athlete in Malaysia. Furthermore, there were limited studies conducted on the factors associated with supplementation intake among athlete in Malaysia. Hence, the findings of the study can be used as a baseline data for future studies on socio-demographic factors, sports characteristics, sports nutritional knowledge, physical activity level, body weight status and dietary intake with nutritional supplementation intake among athletes.

Other than generating new knowledge, this study could also fill the gaps in existing knowledge in past research. It will act as a baseline for future research to find updated information on the factors that had been linked with supplementation intake. The study also can provide beneficial information for the policymakers as guidelines and also to develop an intervention program associated with supplementation. This study could also assist and give additional guidelines to Malaysian sports nutritionist or dietitians to address nutritional aspects of athletes.

## **1.4 Objectives**

### **1.4.1 General objectives**

To determine factors associated with nutritional supplementation intake among athletes in Universiti Putra Malaysia.

### **1.4.2 Specific objectives**

1. To determine the prevalence of nutritional supplementation intake among athletes in Universiti Putra Malaysia.
2. To determine the type, frequency, reason of usage and sources of information of nutritional supplementation intake among athletes in Universiti Putra Malaysia.
3. To determine the socio-demographic factors (sex, age, ethnicity, monthly allowance, household income and educational level), sports characteristics (types of sports, category of event and years of participation), sports nutritional knowledge, physical activity level, body weight status and dietary intake among athletes in Universiti Putra Malaysia.
4. To determine association between socio-demographic factors (sex, age, ethnicity, monthly allowance, household income and educational level), sports characteristics (types of sports, category of event and years of participation), sports nutritional knowledge, physical activity level, body weight status and dietary intake with nutritional supplementation intake among athletes in Universiti Putra Malaysia

### **1.5 Hypotheses Null hypotheses**

1. There is no significant association between nutritional supplementation intake and socio-demographic factors (sex, age, ethnicity, monthly allowance, household income and educational level) among athletes in Universiti Putra Malaysia.
2. There is no significant association between nutritional supplementation intake and sports characteristics (types of sports, category of event and years of participation) among athletes in Universiti Putra Malaysia.
3. There is no significant association between nutritional supplementation intake and sports nutritional knowledge among athletes in Universiti Putra Malaysia.
4. There is no significant association between nutritional supplementation intake and physical activity level among athletes in Universiti Putra Malaysia.
5. There is no significant association between nutritional supplementation intake and dietary intake among athletes in Universiti Putra Malaysia.
6. There is no significant association between nutritional supplementation intake and body weight status among athletes in Universiti Putra Malaysia.

## 1.6 Conceptual framework

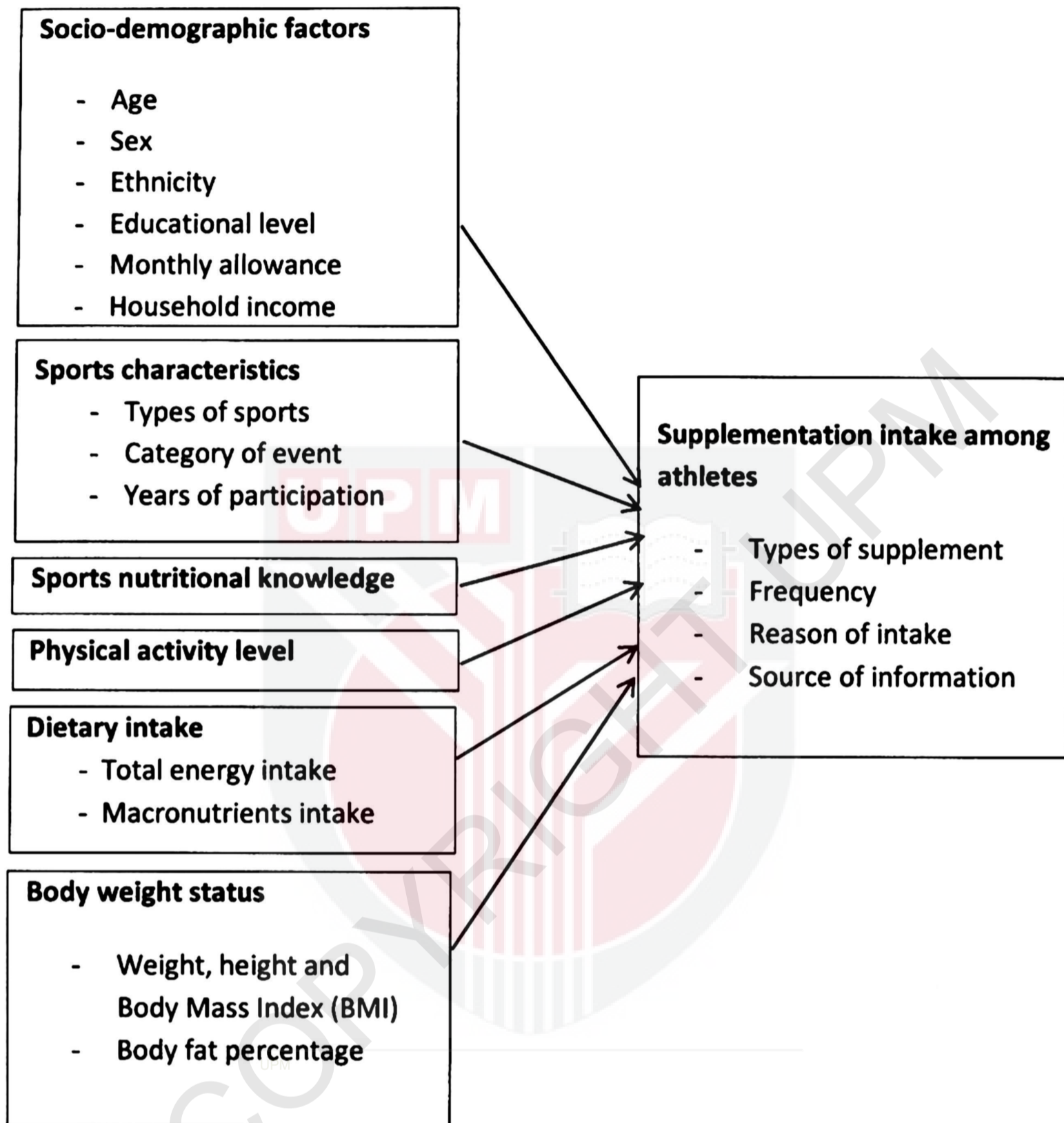


Figure 1.1 Research conceptual framework

In this study, the independent variables were socio-demographic factors (sex, age, ethnicity, monthly allowance, household income and educational level), sports characteristics (types of sports, category of event and years of participation), sports nutritional knowledge, physical activity level, body weight status and dietary intake while the dependent variable was nutritional supplementation intake among athletes in Universiti Putra Malaysia.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1. Definition of nutritional supplement**

There was no single definition of nutritional supplement and it was varied depending on its usage and the types or forms of supplement. Dietary supplement, health supplement, food supplement and nutraceutical supplement were also classified as nutritional supplement where they were consumed to supplement the diet. According to the U.S. Food and Drug Administration FDA, (2017), nutritional supplement was defined as any products taken by mouth that contains 'dietary ingredients' serve as additional nutritional value to supplement a person's diet and it can be found in various forms such as capsule, powders, energy bars, liquid and tablet. The term 'dietary ingredients' in nutritional supplements were being further defined by FDA (2017) as one or any combinations of vitamins, minerals, herbs or botanicals, amino acid, substances such as concentrates, metabolites, constituents or extracts which were consumed to further increase the total dietary intake. FDA (2017) also stated that nutritional supplements may not be safe for all people as they had strong biological effects and suggested to consult a health care professional before taking one. Nutritional supplements were not intended to diagnose, treat, cure or to reduce the effects of diseases and consuming supplements improperly might be harmful.

The U.S. Congress defined nutritional supplements in the Public Law, Dietary Supplements Health and Education Act of 1994, DSHEA as a product, other than tobacco, which serve to supplement the diet and contains one or more of dietary

ingredients such as vitamin, mineral, herb or other botanical, amino acid, dietary substance for use by man to supplement the diet by increasing the total daily intake, or concentrate, metabolite, constituent, extract, or combinations of these ingredients. Under this Act, manufacturers and distributors were responsible to ensure the safety and labeling of the products were following the DSHEA 1994 and FDA regulations before marketing. FDA was not authorized to review all nutritional supplements products for safety and effectiveness before they were marketed instead, FDA's role will only begin after the products were already in the marketplace.

According to Maughan et al. (2018), dietary supplements was defined as a food component, nutrient, or non-food compound that was purposefully ingested in addition to the habitually consumed diet with the aim of achieving a specific health and/or performance benefit which they come in various forms such as functional foods, formulated foods or sports foods, single nutrients and multi-ingredient products. In Malaysia, nutritional supplement products were regulated under National Pharmaceutical Control Bureau (NPCB) where the Ministry of Health Malaysia (2011) defined nutritional supplement as product that was ingested to supplement a diet and to maintain, enhance and improve the health function of human body where it was presented in a small unit dosage forms such as pills, capsules, liquids, tablets or powders and shall not include any sterile preparations. It may also contain one or more or the combinations of vitamins, minerals, amino acids, fatty acids, enzymes, probiotics and other bioactive substance, substances derived from natural sources, including animal, mineral and botanical materials in the forms of extract, isolated, concentrates, metabolites and other synthetic sources that had been proven safe.

Under Malaysian Variation Guideline for Natural (Traditional Medicine & Homeopathy) and Health Supplement Products (Abridged Evaluation) 2016, health supplements or nutrition supplements were needed to be registered under the Ministry of Health before entering the marketplace and make amendments to the registration based on technical and scientific progress regarding the products which will be approved by the NPCB.

## **2.2. Prevalence of nutritional supplementation intake**

According to the Nutrition Business Journal (2017), the global supplement sales were projected to increase from \$50 billion in 1999 to \$150 billion in 2020 with the highest sales among weight management supplements, herbal, combination or traditional supplements and sports supplements. The prevalence of supplementation intake among the general population was also increased from year to year. According to National Health and Nutrition Examination Survey (NHANES) collected data, the prevalence of supplement intake among the U.S. adults population increased from 49% between the years 1999-2000 to 54% between the years 2011-2012. This was also supported by the Council for Responsible Nutrition (CRN) data where it was reported that the prevalence of supplement intakes from the CRN Consumer Survey on Dietary Supplements between the years 2007 to 2011 to be 66% and had increased to 71% on the year 2017.

In Malaysia, the prevalence of nutritional supplement intake among adults population reported in the Malaysian Adult Nutrition Survey, MANS (2014) was 28.05% which was lower than other countries such as Australia with the prevalence of 40.5% reported in the National Nutrition and Physical Activity Survey, NNPAS (2017). The prevalence of nutrition supplement intake among Malaysian adults was

also lower than other Asian countries such as Thailand adults with 45% of prevalence and 60% among Korean adults (Ock et al., 2010; Tangkiatkumjai et al., 2014). A study conducted by Al-Naggar & Chen, (2011) among Management and Science University, Malaysia, the prevalence of supplement intake among university or college students between the age 18 to 25 years old was 43% which was higher than the prevalence of 16.8% among Japanese college students (Kobayashi, Sato, Umegaki, & Chiba, 2017) and lower than the prevalence of 66% among the U.S. college student (Lieberman et al., 2015).

Compared to the general population, athletes or physically active population had a higher prevalence of nutritional supplement intake with several studies reported the prevalence between 38% up to 99% of nutrition supplement intake among the athletes (Braun et al., 2009; Casey et al., 2014; Dascombe et al., 2010; Kristiansen et al., 2005; Sousa et al., 2016). A study conducted among Malaysian athletes by Balaravi et al. (2017) shows high prevalence of 72% among Malaysian National Sports Institute elite athletes which is higher than prevalence of 64% among Portuguese elite athletes (Sousa et al., 2016) and prevalence of 43.7% among Japanese elite athletes (Sato et al., 2015). Other study conducted among Malaysian team sports athlete by Keat et al. (2017) reported 59.7% prevalence of supplementation intake among the athletes. Both studies among Malaysian athletes show lower prevalence compared to previous studies conducted in Western countries and even in Asia which the prevalence of supplementation intake among Korean was 80.5% (Kim et al., 2011).

Findings from previous several studies showed a different prevalence of supplementation intake among the athletes. This might be due to differences in socio-demographic backgrounds, geographical area, total population and the usage and

definition of nutrition supplement from the studies conducted. Furthermore, the difference in data collection method and the lack of clarification of the definition and types of nutritional supplements might also cause the difference and varied results.

### 2.3. Common types of nutritional supplements used

Table 2.1: Common type of nutritional supplements used

Author, Year	Focus	Sample	Findings
Aljaloud & Ibrahim (2013)	Use of dietary supplements among professional athletes in Saudi Arabia.	105 professional football players from 3 teams in Saudi Arabia.	Sports drinks (88.7%); Vitamin C (82.6%); Calcium (68.3%); Health bars (59.1%); Multivitamins (52.0%); Omega 6 fatty acid (18.3%); Creatine (16.3%); Ginkgo biloba (10.3%).
Dascombe et al. (2010)	Nutritional supplementation habits and perceptions of elite athletes	72 athletes from a state-based sports institute in Australia.	Minerals (45.8%); Vitamins (43.1%); Iron (30.6%); Caffeine (22.2%); Protein (16.7%); Protein-carbohydrate mix (13.9%); Creatine (12.5%); Glucosamine (4.2%).
Saeedi et al., 2013	Nutritional supplement use among fitness club participants in Tehran, Iran	1,625 participants from 24 fitness club participants in Tehran, Iran	Multivitamin-mineral (43.8%); Iron tablet (30.5%); Vitamin E (23.0%); Creatine (22.4%); Calcium (21.3%)
Diehl et al. (2012)	Characteristics, opinions, and sources of supply and information of elite adolescent athlete' use of	1,138 German elite adolescent athletes	Magnesium (68.6%); Dextrose (64.0%); Energy drinks (63.9%); Vitamin C (56.1%); Calcium (46.2%).

dietary supplements

Knapik et al. (2018)	Dietary supplement use in a large, representative sample of the US Armed Forces	39,877 US Armed Forces personnel	Multivitamin or multimineral (50%); Antioxidants (34%); Individual vitamins or minerals (33%); Bodybuilding supplements (27%); Fish oils (26%); Herbals (16%); Weight-loss supplements (16%).
Lieberman et al. (2015)	Patterns of dietary supplement use among college students	1, 228 college students from five U.S. universities.	Multivitamin/multimineral (42%); Sports drinks (35%); Vitamin C (18%); Protein/amino acids (17%); Calcium (13%); Sport bar or gel (11%); Herbals (9%); Vitamin D (7%); Iron (7%), and Vitamin E (6%).
Lun et al. (2012)	Dietary supplementation practices in Canadian high-performance athletes	440 high-performance Canadian athletes.	Sports drink (24.1%); Multi-vitamin and mineral (16.1%); carbohydrate sport bar (11.0%); Protein powder (9.8%); Meal-replacement products (4.9%); Vitamin C (4.3%); Protein bar (3.0%); Energy drink (1.0%).

Table 2.1 showed the common type of nutritional supplements used among athletes and active person as reported in previous studies. Generally, multi-vitamins or multi-minerals were the most common type of nutritional supplement used by the athletes. However, this was also different from gender. Male were more likely to consume protein and creatine-based supplement product while female was more likely to consume iron supplement or vitamins and minerals (Kristiansen et al., 2005; Wiens et al., 2014).

#### **2.4. Reasons for nutritional supplementation intake**

Scientific evidence had shown several reasons for nutritional supplementation intake. A study conducted among the general population in Netherland shows that the highest reason for supplementation intake was for maintaining health followed by to improve physical performance with the highest types of supplement consumption was multi-vitamin or multi-minerals (Wardenaar et al., 2016). This study also reported that a higher number of women taking supplements for health reason, while men were higher for physical performance reason. This finding was supported by a data collected from MANS 2014 study which the highest reason for supplementation intake among Malaysian adults was for health purposes followed by due to doctor's prescription and to boost up energy.

Reasons for supplementation intake among college or university students were also similar to the general populations. The highest reported reason for supplementation intake among university students was to promote or maintain general health and other reasons include to ensure nutritional adequacy, to lose weight, to enhance physical appearance and for beauty benefits (Al-Naggar & Chen., 2011; Kobayashi et al., 2017; Lieberman et al., 2015). Compared to the general population, athletes had other different reasons for supplementation intake. Previous studies conducted had shown that the highest reason for supplementation intake among athletes was to enhance performance or energy and other reasons include to aid in recovery from training, to improve health, as nutrient replacement, for physical performance and to prevent cramps (Heikkinen et al., 2011; Jawadi et al., 2017; Lun et al., 2012; Parnell et al., 2016; Salgado et al., 2014)

The reasons for supplementation intake were varied depending on the specific types of supplement consumed. For example, a previous study conducted among

Swiss adults by Hartmann and Siegrist (2016) reported that the highest reason for protein supplement intake was to increase muscles mass followed by to regulate weight and to promote recovery after exercise while a study conducted by Attila et al. (2011) among college students on energy drink consumption showed that highest reason was to boost up energy and performance. The highest reason for single vitamins or minerals and multi-vitamins or multi-mineral consumption was for maintaining health and to prevent nutritional deficiencies (Al-Naggar & Chen, 2011; Lun et al., 2012; Wardenaar et al., 2016).

## **2.5. Sources of nutritional supplement information**

Increased in awareness on health and supplementary diet had led to an increasing demand for nutritional supplements products among the general population including active persons and athletes. Since athletes involved in much strenuous training and competition in sporting events, they believed that nutrition supplements had become one of their needs. Previous study conducted among Australian athletes by Dascombe et al. (2010) had found that 61.9% of the athletes did not know their supplements active ingredients, 57.1% did not know the side effect, 54% did not know the mechanism of action for the supplement intake and 57% of the athletes admitted to wanting for additional information on the supplements they were taking. This led them to seek information on supplementation intake to help them choose the correct type of supplement suitable for their condition and to consider the necessity.

According to the recent study conducted by Muwonge et al. (2017) among Ugandan professional athletes, their common source of supplement intake was from nutritionist or dietitian followed by webpage, social media, friends and coaches.

Other studies also showed that health care professionals and physicians to be one of their sources for supplementation intake (Sato et al., 2015; Jawadi et al., 2017; Saeedi et al., 2013; Tian et al., 2009) which indicates a good practice among the athletes. Consulting to health care professionals may prevent other consequences of consuming supplements and serve as a credential source on supplementation intake for them.

However, there were other previous studies highlighted that the main source of supplementation intake among the athletes were from the person closed to them such as parents, family and friends (Kim et al., 2011; Lieberman et al., 2015; Lun et al., 2012) with some reported their primary source of supplement intake were from their coaches or trainers (Sato et al., 2015; Tsitsimpikou et al., 2011). Other than that, unreliable sources such as the internet, social media or webpage were also one of their common references to seek information for supplementation intake. This had led to a rise in concern of athletes' safety in consuming nutritional supplements without prescription and recommendation of the health care professionals.

When separating gender, male athletes were more likely to seek information regarding nutrition supplements from coaches, friends, magazines, educational materials and internet compared to female athletes which commonly referring to their parents, family, healthcare professionals and television where younger athletes reported parents and teammates as their common source and coaches as most often source for older athletes (Kim et al., 2011; Lieberman et al., 2015). Since credential information on nutritional supplements was important, athletes need to equip themselves with nutritional knowledge by referring to valid and sound evidence before using any kinds of supplements to ensure safety in enhancing their performance in sports.

## **2.6. Factors associated with nutritional supplement intake**

### **2.6.1. Socio-demographic characteristics**

Scientific investigations had indicated that some of the socio-demographic characteristics had a significant association with nutritional supplementation intake among athletes. Differences in nutritional supplementation intake depend on age, gender, race, monthly income and educational level (Al-Naggar & Chen, 2011; Sedek et al., 2018; Tsitsimpikou et al., 2011). A cross-sectional study on supplementation intake among German track and field athletes during 12<sup>th</sup> IAAF World Championships 2009 in Berlin conducted by Tscholl et al. (2010) reported that there was a significant association between gender and nutritional supplementation intake with higher prevalence among female athletes. This was also supported by other findings by Knapik et al. (2018) among US Armed forces and by Burnett et al. (2017) among Australian adults which had found that female was more likely to consume nutritional supplement compared to men. While a study in German revealed that male athletes were more likely to consume nutritional supplement (Diehl et al., 2012). However, these findings were contradicted by other studies which reported that gender does not significantly associate with nutritional supplementation intake (Dascombe et al., 2010; Muwonge et al., 2017; Salgado et al., 2014; Tavani et al., 2014). In terms of association between types of supplement with gender, a study conducted among numerous number of fitness club participants in Tehran by Saedi et al. (2013) reported that male was more likely to consume creatine, amino acid, whey powder and vitamin E supplement whilst women were more likely to take iron tablets, vitamin D, calcium and zinc.

Other than that, age was also associated with supplementation intake with older athletes were more likely to consume nutritional supplements (Sedek et al., 2018; Sousa et al., 2016; Tavani et al., 2014). This finding was supported by the NHANES 2007-2010 where the examined data by Bailey et al. (2013) revealed that older adults more than 60 years old were more likely to consume nutritional supplement with some reason to improve health for specific health problems such as bones and joints problems and heart diseases. Nevertheless, these studies were contradicted with several other findings which revealed that age does not significantly associated with supplement intake (Al-Naggar & Chen, 2011; Muwonge et al., 2017).

Next, some studies also found that race was associated with supplementation intake. A study among adults in a selected gym in Kuala Lumpur had found that the prevalence of supplement users among Malay was highest followed by Chinese and Indian (Sedek et al., 2018). However, the study by Al-Naggar & Chen. (2011) reported contrasting results where race does not influence the practice of consuming supplements significantly among students of Management and Science University, Malaysia.

Besides, educational level was also being associated with supplement intake practices. A study by Muwonge et al. (2017) among Ugandan professional athletes had found a significant relationship between educational level and supplement intake supported by Tsitsimpikou et al. (2011) among recreational athletes. Some studies reported higher educational levels were more associated with supplementation intake practices which most of them had tertiary education level (Burnett et al., 2017; Karimian & Esfahani, 2011; Knapik et al., 2016).

Nutritional supplementation intake had been shown to be significantly associated with household income (Al-Naggar & Chen, 2011; Knapik et al., 2018). Both studies had reported that nutritional supplement intake practices were more prevalence among the high-income people. Inconsistently, a study conducted among gym user in Kuala Lumpur revealed that there was no significant association between supplements use with household income (Sedek et al., 2018). The contradictions between these findings might be due to the population background as people in Kuala Lumpur mostly had a high income in order to join for a gym membership thus the results were not significant.

#### **2.6.2. Sports characteristics**

Consistent with many other findings, nutritional supplementation intake had been shown to be significant with the types of sports (Diehl et al., 2012; Giannopoulou et al., 2013; Lun et al., 2012; Shaw et al., 2016; Tscholl et al., 2010). Several studies had reported that endurance athletes to be more prevalence in nutritional supplementation intake than athletes from other sports categories (Lun et al., 2012; Shaw et al., 2016) while other studies found that power sports athletes were more likely to consume nutritional supplements (Solheim et al., 2017; Tscholl et al., 2010). Nevertheless, other study conducted among German athletes reported higher proportion of both endurance and power sports to consume supplements (Diehl et al., 2012) whilst a study by Heikkinen et al. (2011) showed speed and power athletes to significantly more often consuming nutritional supplements than team sport athletes among Olympic athletes in the years 2002 and 2009. The previous study among Athens athletes revealed that higher intake of nutritional supplements among individual athletes compared to team sports athlete

(Giannopoulou et al., 2013) which was supported by a study by Darvishi et al., (2013) among Iran male collegiate athletes.

Other than the type of sports, the level of sports participation was also associated with supplementation intake. According to a study conducted by Erdman et al. (2006) among elite Canadian athletes, international or professional level athletes were more likely to take nutritional supplements to facilitate their recovery and to enhance immunity compared to other levels of athletes. This was also the same as a study among the Athens athlete which those that were in the national and international team reported a greater prevalence of supplement intake than those that won no medals or that were in the provincial group.

Few studies had been found in associating the number of year participation in sports with nutritional supplementation intake. A study conducted among team sports athletes in Malaysian National Sports Institute had reported a significant moderate positive correlation between the years of participation in sports with the number of nutritional ergogenic aids taken by the athletes. This finding was also aligned with previous studies by Salgado et al. (2014) which found a positive strong correlation between the number of years the sport had been practiced and consumption of supplements among Brazilian road racer. The previous study among Ugandan athletes also found a significant relationship between the length of time competing and supplement intake with highest among athletes that had been actively playing or competing in sports for 5 to 10 years (Muwonge et al., 2017).

### **2.6.3. Knowledge of supplement intake and general nutritional knowledge**

Research on the association between nutritional knowledge specifically in sports nutritional knowledge with nutritional supplementation intake was still very limited. Most studies conducted to assess knowledge on the supplement and their belief or perception of supplementation intake. According to Dascombe et al. (2010), a study conducted among Australian athletes from a state-based sports institute had reported low knowledge on the supplements they were taken. Half of the athletes believed that supplements not required with a balanced diet. While a study conducted by Tian et al. (2009) among university athletes in Singapore had found that more than one-third of the supplements user reported either no or minimal knowledge on the supplement they were taking.

A study on the relationship between energy drink consumption and nutrition knowledge conducted among students athletes in National Collegiate Athletic Association, NCAA by Hardy et al. (2017) reported that non-users of supplements to had a greater nutritional knowledge compared to users. Other studies also found the association between knowledge about the supplements with nutritional supplement intake which some studies revealed that greater knowledge on supplements was associated with less supplement intake among bodybuilder athletes in Iran (Karimian & Esfahani, 2011) which also supported by a study by Molinero and Márquez (2009). A study among university active graduates in Malaysia was shown to consume more nutritional supplement compared to their knowledge about the supplement (Mustafa et al., 2017). However, there was a contradict finding with research among students in Croatia which shows no association between knowledge and supplementation intake (Žeželj et al., 2018). Additionally, there was no study conducted to find the association between sports nutritional knowledge and

nutritional supplementation intake. Therefore, further study needed to be conducted to find the association.

#### **2.6.4. Physical activity level**

There were also limited studies conducted on the association between physical activity level and supplementation intake. A study among Malaysian sports athlete conducted by Keat et al. (2017) had found a significant weak positive correlation between physical activity and the number of nutritional supplement intake. This was also supported with a study conducted by Žeželj et al., (2018) among Croatian university students where there was a significant association between physical activity and supplement intake with the prevalence of dietary supplements intake higher among physically active students.

Previous study conducted among U.S. Armed forces had found that as the duration of vigorous and moderate physical activity and frequency of strength training increased, the use of types of dietary supplements was also increased up to seven categories of dietary supplements which were multiple vitamin and minerals, individual vitamins or minerals, antioxidants, bodybuilding products, herbal supplements, weight-loss products and fish oil. Although few findings reported the association of physical activity with supplementation intake, a study among Swiss adults was opposed to these studies which Hartmann et al. (2016) had found that supplement intake frequency was weakly negatively correlated with physical activity level, therefore, it was not a significantly associated factor for nutritional supplement intake. Varies in findings for physical activity level might be due to the method of data collection and the types of the questionnaire being used to assess physical activity level.

### **2.6.5. Body weight status**

The body weight status of the athletes was also associated with nutritional supplementation intake among several previous studies (Al-Naggar & Chen, 2011; Sedek et al., 2018). Overall findings had reported that higher BMI was associated with nutritional supplementation intake compared to lower BMI. The previous study among US Armed forces by Knapik et al. (2018) had found that higher BMI was associated with higher use of dietary supplements which was about more or equal to five categories of supplements including individual vitamins and minerals, herbal, weight-loss supplements and fish oils. Another study by Bailey et al. (2011) reported that normal and overweight gym users in KL were likely more tend to take dietary supplements whilst underweight gym users were less likely to take dietary supplements. This was different from the findings among Portuguese high-performance athlete which had reported lower BMI to had more association with higher intake of nutritional supplement. Only one study found to be contradicted with these findings which a study among Brazilian athlete by Nabuco et al. (2016) revealed no significant association can be found between BMI and the use of nutritional supplements.

A study by Lieberman et al. (2015) had reported a higher prevalence of male college students were taking protein or amino acids with BMI  $\geq 25$  kg/m<sup>2</sup> was trying to gain weight and increase their muscle mass. This was also the same as in the study reported by Knapik et al. (2018) which had found that those with BMI between 25.0 to 29.0 kg/m<sup>2</sup> had a higher intake of multi-vitamins or multi-minerals and bodybuilding products. However, higher supplementation intake among athletes with higher BMI might be due to their high muscle mass and not due to excess fat (Sedek

et al., 2018). Very limited study assess on athletes' body fat percentage and their body mass. Since athletes had different body composition than the normal population, measuring their body fat percentage and calculating their fat-free mass was also important to assess the association and not only depends on BMI.

#### **2.6.6. Dietary intake**

From the reviewed literature, it was found that dietary patterns were significantly associated with nutritional supplementation intake (Lieberman et al., 2015). Data from the National Nutrition and Physical Activity Survey, NNPAS conducted among Australian adults had shown that supplements user were more likely to take fiber and most vitamins and minerals which their recommended dietary intake (RDI) was found to be reaching the upper limit for magnesium while exceeding the RDI for zinc, vitamin C, vitamin E and vitamin B12 when total intakes were considered (Burnett et al., 2017).

Other types of foods that had been shown to be associated with nutritional supplementation intake were protein based foods such as meat, eggs, milk and yogurt (Sousa et al., 2016). Findings from the previous study conducted among U.S. college students in 5 universities had supported this association by revealing that those who consumed high protein diet were more likely to take dietary supplements more than five times per week (Lieberman et al., 2015). Additionally, a study by Bianco et al. (2011) had reported that supplements users among regular fitness center attendees in Italy consumed significantly more tuna, egg fish, legumes, meat, milk and yogurt compared to non-users. Supplement users were found to be consuming milk for more than three days per week whilst the non-user were reported to consumed significantly more snacks and bakery products than the users (Bianco et al., 2011). A study by

Sousa et al. (2016) also had also found that more supplement users were significantly consuming a lower daily intake of olive, vegetable oils, margarine and chips and consuming more protein based foods instead of plant-based foods.

It can be inferred that those who were consuming supplements had a healthier dietary intake as they were more aware of their daily consumption. Awareness in health might have driven them to consume supplements to further enhance their diet for maintaining health. Nevertheless, there were still limited studies conducted on the relationship between dietary intake and nutritional supplement use among athletes and needed further investigation.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 Study Design**

This was a cross-sectional study that aims to determine the associations between socio-demographic factors (sex, age, ethnicity, monthly allowance, household income and educational level), sports characteristics (types of sports, category of event and years of participation), sports nutritional knowledge, physical activity level, body weight status and dietary intake with nutritional supplementation intake among athletes in Universiti Putra Malaysia.

#### **3.2 Study Location**

The research was conducted in Universiti Putra Malaysia which located in Serdang, Selangor. UPM main campus in Serdang encompasses approximately 1,245 hectares of land located in Petaling District of Selangor state. Based on the data from student affairs division of UPM in December 2017, there was a total of 22, 330 students studying in UPM which consists of undergraduate and postgraduate students. The study was conducted among UPM athletes from various courses and graduate studies in which all the data were obtained from the Sports Academy of UPM.

### 3.3. Sample size determination

Sample size of this study was determined using sample size calculation method by Hulley (2013):

$$\text{Sample size, } N = [(Z\alpha + Z\beta)/C]^2 + 3$$

$$C = 0.5 * \ln[(1+r)/(1-r)]$$

Where:

The standard normal deviate for  $\alpha = Z\alpha = 1.96$  The standard normal deviate for  $\beta = Z\beta = 0.84$   $r$  = the expected correlation coefficient

Table 3.1 Calculation of sample size

Correlation studies	Correlation, $r$	Sample size, $N$
Nutritional supplement intake with age. (Tsitsimpikou et al., 2011)	$r = 0.456$	$C = 0.5 * \ln [(1+0.456)/(1-0.456)] = 0.347$ $N = [(1.96+0.84)/0.347]^2 + 3$ $= 68$
Nutrition ergogenic aids intake with physical activity level (Keat et al., 2017)	$r = 0.231$	$C = 0.5 * \ln [(1+0.231)/(1-0.231)] = 0.235$ $N = [(1.96+0.84)/0.235]^2 + 3$ $= 145$
Nutrition ergogenic aids intake with age. (Keat et al., 2017)	$r = 0.415$	$C = 0.5 * \ln [(1+0.415)/(1-0.415)] = 0.297$ $N = [(1.96+0.84)/0.297]^2 + 3$ $= 92$
Nutritional ergogenic aids intake with years of participation in sports (Keat et al., 2017)	$r = 0.446$	$C = 0.5 * \ln [(1+0.446)/(1-0.446)] = 0.480$ $N = [(1.96+0.84)/0.480]^2 + 3$ $= 37$

In this study, the sample size was determined using correlation,  $r$  between nutritional supplement intake with physical activity level from a study conducted by Keat et al. (2017) with  $r = 0.231$  which was the highest sample size calculated,  $N=145$  subjects. Additional 20% of subjects were added for non-response, missing data, unavailability of subjects or refusal to participate. Therefore, the total sample size of this study was calculated as below:

$$\text{Total sample size, } N = 145 + [145 \times (20/100)]$$

$$= 174$$

Hence, the estimated total number of participants in this study was **174 subjects**.

### 3.4 Sampling

#### 3.4.1. Subjects

Subjects for this study were the athletes in Universiti Putra Malaysia. They were selected based on the inclusion and exclusion criteria as shown in Table 3.2 below:

Table 3.2 Criteria of the subject selection

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"><li>• Student-athletes aged 18-29 years old</li><li>• All types of sports</li><li>• Male or female</li><li>• Malaysian</li></ul>	<ul style="list-style-type: none"><li>• Non-athlete students</li><li>• Physically disable</li><li>• Pregnant students</li><li>• International students</li></ul>

#### 3.4.2. Sampling design

The sampling design that had been chosen for this study was cluster sampling. Figure 2 shows the sampling design flow chart for this study. The sample was chosen from the database of UPM athletes from the Sports Academy UPM of which there were six types of sports categories consist of endurance and strength, skill sports, aquatic, team sports, racket and combat. By using cluster sampling, all of the 332 athletes in each category of sports were invited to join this study.

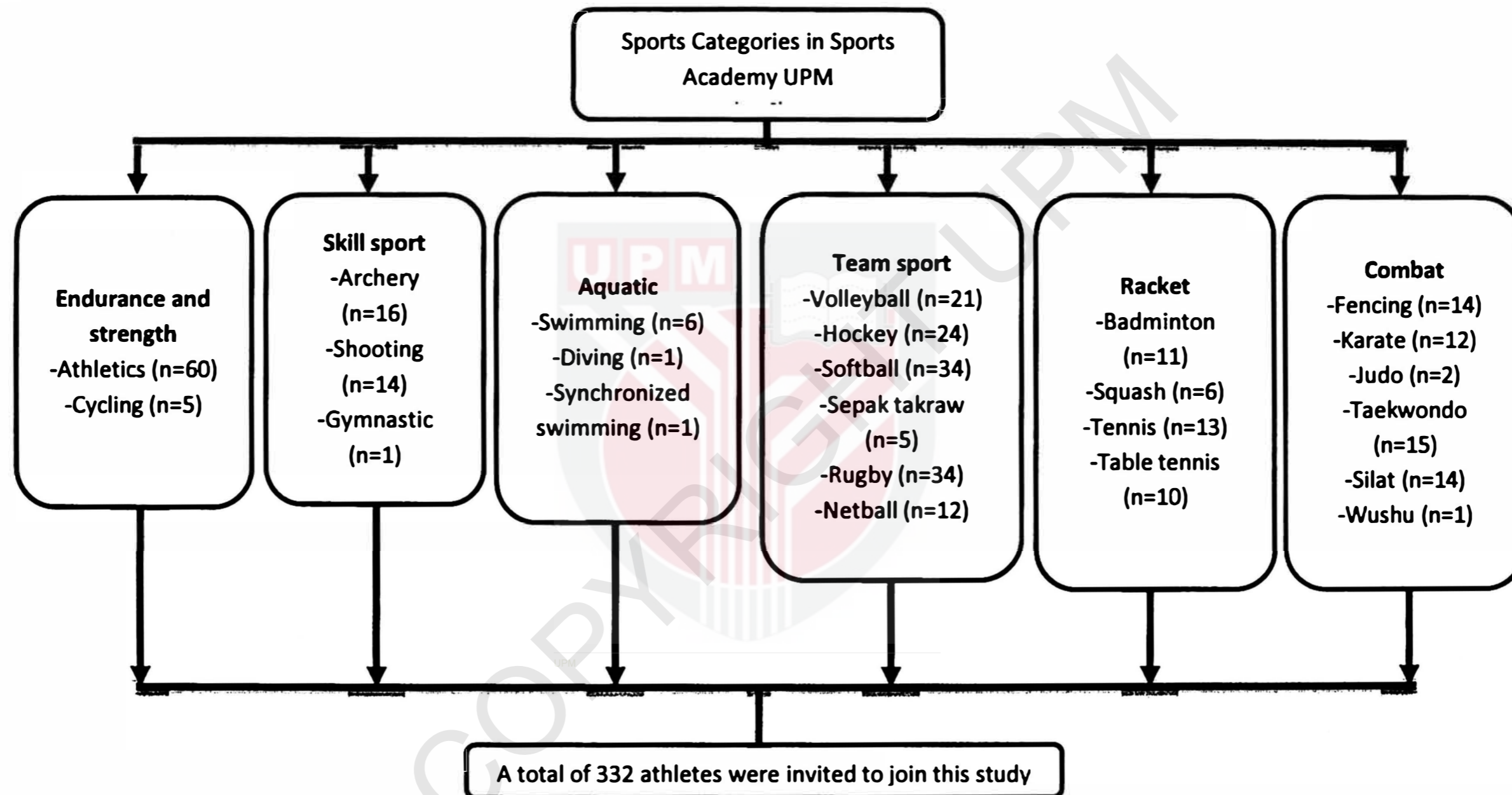


Figure 3.1 Flow chart of sampling design

### **3.5 Measures**

The instruments used in this study included self-administered questionnaire (combined items of socio-demographic characteristics, sports characteristics, nutritional supplementation intake, sports nutritional knowledge and physical activity level) and interview-based questionnaire (dietary intake). For body weight status, anthropometric measurements were measured towards the subjects which include weight, height and body fat percentage.

#### **Socio-demographics factors**

A self-administered questionnaire developed by the researcher was used to collect socio-demographic data for this study. Data on socio-demographic characteristics were either open-ended or multiple choices answer which include age, sex, ethnicity, religion, educational level, monthly allowance and household income.

#### **Sports characteristics**

Sports characteristics of the athletes which include the type of sports played, the category or level of sports event and years of participation in the competition for specific event category were asked through a self-administered questionnaire developed by the researcher. The type of sports and years of participation was asked in an open-ended question while the category of sports event was asked in a close-ended question. Choices for the category of sports event includes inter-college, university, district, national and international level of sports competition event.

### **Nutritional supplement intake**

Validated questionnaire from the previous study by Kobryner (2009) on dietary supplement use among athletes at a British University was used to assess subjects' characteristics of supplementation intake. The subjects were first asked on their current consumption of the nutritional supplement to get the prevalence of nutritional supplementation intake among athletes in UPM. Those who do not consume any supplement will need to skip this section and was defined as 'non-users'. While those who answered 'yes' for this section was categorized as 'users'. There were two parts in this questionnaire in which for Part 1, the type, frequency and reason of nutritional supplement use were being asked and for Part 2, the sources of information they gain on nutritional supplement were being assessed. Part 1 was divided into five main categories of nutritional supplements which consist of energy supplement, protein supplements/weight gainers, vitamin and mineral supplements, herbals and other substances. Under each category, various types of nutritional supplement were listed and the subjects need to identify which types of supplement they consume. The reasons for supplementation intake were listed with specific codes provided which will be used by the subjects to answer the questionnaire.

### **Sports nutritional knowledge**

A self-administered questionnaire of sports nutritional knowledge developed by Hornstrom et al. (2011) was used with permission from the author, Carol Friesen. The questionnaire consists of basic and sports nutrition knowledge and feelings towards sports nutrition statements. There were 25 items on basic and sports nutrition statement in which the participants need to respond to the statement by answering "True" or "False". Each question will be coded as "correct" or "incorrect". The

correct answer will be given 1 mark while an incorrect answer will be given 0 mark. A total score calculated by summing the marks obtained from item 1 to 25. The classification was done by dividing a possible maximum score of the 25 items into three as there were three categories of knowledge. Low level was categorised from 0 to 8 marks that were less than or equal to 32% of correct answers. Moderate level of knowledge categorised from 9 to 17 marks that were from 36% to 68% of the score. High level was categorised by marks more than 17 which the total score was more than 72% correct. The highest score associated with good sports nutritional knowledge. The scores of the subjects' sports nutritional knowledge in this study were compared with the supplementation intake to find any association. The score for sports nutritional knowledge was classified as follows:

Table 3.3 Classification of the score for sports nutritional knowledge.

Classification	Percentage (%)	Knowledge score
Low	≤32%	0-8
Moderate	36-68%	9-17
High	≥72%	18-25

### Physical activity level

The physical activity level was measured by using the Global Physical Activity Questionnaire (GPAQ) developed by the World Health Organization, WHO (2013). It was a self-administered questionnaire which comprised of 16 questions on physical activity participation during the subjects' typical week. It was divided into three domains which were activity at work, travel to and from places and recreational activities. These domains were broken down into six different groups which were

work vigorous, work moderate, travel moderate, recreational vigorous, recreational moderate and sitting for analysis purposes. MET (Metabolic Equivalents of Task) level for moderate activity and vigorous activity were 4.0 METs and 8.0 METs respectively. The total METs levels from the activities in domains were calculated to express the total physical activity level. Computation of the total MET level score was a summation of a multiple between MET level, duration (in minutes) and frequency (days) for all types of activities. Total METs value less than or equal to 600 METs were categorised as low physical activity while more than or equal to 3000 METs were categorised as high physical activity level. In between 600 and 3000 METs value were categorised as moderate.

### **Body weight status (BMI)**

Body weight status consists of height, weight, body mass index (BMI), body fat percentage and fat-free mass. Subject's height and weight were measured using SECA stadiometer and Tanita weighing scale and then the BMI were calculated by the researcher. BMI of the subjects were categorized into few categories according to WHO BMI classification 2000 which include underweight ( $<18.5 \text{ kg/m}^2$ ), normal ( $18.5 - 24.99 \text{ kg/m}^2$ ), overweight ( $25.0 - 29.99 \text{ kg/m}^2$ ), and obese ( $>30.0 \text{ kg/m}^2$ ). The body fat percentage was measured by using Omron handheld fat analyser. The fat-free mass was also calculated by subtracting fat mass from total body mass. Fat mass was calculated by multiplying the body fat percentage with total weight. The body fat percentage of the athletes were classified according to Turocy et al., (2011) as follows:

Table 3.4 Body fat standard reference for male and female athletes.

<b>Body fat standard</b>	<b>Males</b>	<b>Females</b>
Lowest reference body fat (adults), %	5	12
Healthy body fat ranges, %	10-22	20-32

### **Dietary intake**

To assess the dietary intake of the subjects, a 24-hour dietary recall was conducted by a short interview session. During the interview, subjects were required to recall back their dietary consumption on the previous 24-hours and the interviewer recorded the information given including time of consumption, location, types of foods and beverages and also the detailed description of the portion sizes. In addition, subjects were required to record any supplements taken during the recall. Aids such as picture of household equipment and also the household measurements tools were used during the interview to improve the accuracy in estimating the portion sizes of the dietary intake consumption. The total energy intake and macronutrients (carbohydrates, proteins and fats) intake were calculated and analysed using Nutritionist Pro software. Prior to dietary intake analysis, prevalence of under-reporting and over-reporting was determined by using the Goldberg method whereas the BMR was calculated by using the Harris-Benedict equation. The ratio of energy intake to BMR less than 1.2 was considered as under-reporting whilst ratio over 1.9 was considered as over-reporting. The distribution of the total energy intake was also being analysed to include under-reporting and over-reporting data that were in the acceptable range.

### **3.6 Pre-testing**

Pre-testing was carried out on approximately 10% of the actual sample sizes (174 subjects) which was among 18 subjects. The actual sample of the questionnaire was distributed among university athletes and the questionnaire was completed. The pre-testing was conducted to identify the duration of the subjects to complete the questionnaire and to assess if the instruction given was clear and direct which can be easily understood by the subjects. This process was guided by the researcher to clarify any information misunderstood by them and identify any flaws in the developed questionnaire.

After the pre-testing, the questionnaire was re-assessed so that appropriate and sufficient information was obtained during the real data collection. The subjects who had participated in the pre-testing were not included in the actual study.

### **3.7 Data collection**

The data collection process was conducted from February 2019 until March 2019. The subjects who meet the study criteria and volunteer to take part in the study were interviewed. The self-administered questionnaire was in the English version which consists of six sections. The first four sections were about socio-demographic characteristics and sports characteristics, supplements use, sports nutritional knowledge and physical activity level. The fifth section was on the anthropometry measurement of weight, height and body fat percentage that was measured by the researcher. The Body Mass Index (BMI) and fat-free mass were calculated and recorded in the questionnaire. The final section was an interview session with the researchers to record the subject's dietary intake in the past 24 hours. After subjects completed the questionnaires, the questionnaires were collected for data analysis.

### **3.8 Ethics Approval**

Ethical clearance was sought from UPM's Ethics Committee for Research Involving Human Subjects (JKEUPM) prior to the commencement of the study. The permission to conduct the study among athletes in Sports Academy UPM was obtained prior to data collection.

Subjects were given an information sheet that consist of the detailed description on the purpose of the study and they were required to sign on an informed consent form to take part in the study voluntarily without being forced prior to the administration of the questionnaire. Subject's information were kept confidentially by ensuring no personal details being written on the questionnaire booklet.

### **3.9 Data Analysis**

All data were keyed in and the statistical analysis was performed using IBM SPSS software. Univariate analysis was used to analyse descriptive data. The results for categorical data were presented as frequencies and percentages, and as mean and standard deviations for continuous variables. To test the correlation between continuous variables, Pearson's product moment correlation was used while the chi-square test of independence was used to test the associations between categorical variables. The level of statistical significance was set at  $p < 0.05$ .

## CHAPTER 4

### RESULTS AND DISCUSSION

#### 4.1. Socio-demographic characteristics

This study involved a total of 165 athletes from UPM. Smaller sample size was due to unavailability of the athletes during the period of data collection. Table 4.1 showed the socio-demographic characteristics of the respondents with the mean age of  $22.48 \pm 1.95$ . The mean age was almost the same as for users and non-users with  $22.85 \pm 1.94$  and  $22.21 \pm 1.93$  of age respectively. The highest proportion of age was among 21-23 of age group for total respondents (58.8%; n: 97). The result showed that the respondents consisted of 73.9% (n=122) male and 26.1% (n=43) of female. However, the proportions of users and non-users for both gender were about the same which were 74.6% (n=53) users and 73.4% (n=69) non-users for male whereas 25.4% (n: 18) users and 26.6% (n=25) non-users for female. Among 165 respondents, majority of them were Malay which consisted of 84.9% (n 140), followed by Chinese (9.1%; n: 15), Indian (3.0%; n: 5) and others (3.0%; n: 5).

Since all of the athletes were in tertiary educational level, most of them were undergraduate students which proportioned for 95.8% (n=158) whereas postgraduate level was just about 4.2% (n: 7) from the total respondents. Results also showed that the percentage was not much different with both users and non-users with the proportion of 95.8% (n=68) undergraduate and 4.2% (n=3) postgraduate for users and 95.7% (n=90) undergraduate and 4.3% (n=4) postgraduate for non-users. Based on the year of study, the differences of the proportions were not much from the 1<sup>st</sup> year until the 4<sup>th</sup> year of study. However, the proportions of respondents slightly

differed for users and non-users with the highest year of study for users was among 4<sup>th</sup> year students with a percentage of 29.6% (n=21) while highest non-users was among 1<sup>st</sup> year students with 30.9% (n=29) proportion.

Other than that, this study also analysed the financial characteristics of the respondents. The mean a monthly allowance for total respondents was RM590.61±421.65 with the highest proportion of respondents had a monthly allowance of RM300-RM499 which was 30.9% (n=51). The monthly allowance was significantly higher for users than non-users with the mean of RM852.81±505.88 and RM392.55±169.59 respectively. Among the users, the highest proportion consisted of 36.6% (n=26) had monthly allowance of RM700-RM899. This was also clearly differed from non-users with the highest proportion of monthly allowance lower than user which was 51.1% (n=48) among range RM300-RM499. Parental household income was also being considered in this study with the mean household income of total respondents was about RM4123.70±1903.38. The household income was higher among users than non-users with a mean income of RM4862.11±1582.77 for users and RM3565.96±1942.26 for non-users. The proportion of respondents was highest among those with a household income of RM3000-4999 for total respondents which was about 47.9% (n=79) and also for non-users with 51.1% (n=48). However, highest proportion of users had higher household income per month which were between RM5000 and RM6999 with proportion of 45.1% (n=32) supplements users.

**Table 4.1: Socio-demographic characteristics of the respondents.**

Characteristics	Mean±SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
Age (years)	22.85±1.94	22.21±1.93	22.48±1.95
Monthly allowance (RM)	852.81±505.88	392.55±169.59	590.61±421.65
Household income (RM)	4862.11±1582.77	3565.96±1942.26	4123.70±1903.38

**Table 4.1: Socio-demographic characteristics of the respondents (cont.)**

Characteristics	n (%)		
	Users (n=71)	Non-users (n=94)	Total (n=165)
<b>Age (Years)</b>			
18-20	9 (12.7)	12 (12.8)	21 (12.7)
21-23	38 (53.5)	59 (62.8)	97 (58.8)
24-26	23 (32.4)	21 (22.3)	44 (26.7)
27-29	1 (1.4)	2 (2.1)	3 (1.8)
<b>Sex</b>			
Male	53 (74.6)	69 (73.4)	122 (73.9)
Female	18 (25.4)	25 (26.6)	43 (26.1)
<b>Ethnicity</b>			
Malay	56 (78.9)	84 (89.4)	140 (84.9)
Chinese	11 (15.5)	4 (4.3)	15 (9.1)
Indian	1 (1.4)	4 (4.3)	5 (3.0)
Others	3 (4.2)	2 (2.1)	5 (3.0)
<b>Educational level</b>			
Undergraduate	68 (95.8)	90 (95.7)	158 (95.8)
Postgraduate	3 (4.2)	4 (4.3)	7 (4.2)
<b>Year of study</b>			
1 <sup>st</sup> year	19 (26.8)	29 (30.9)	48 (29.1)
2 <sup>nd</sup> year	16 (22.5)	27 (28.7)	43 (26.1)
3 <sup>rd</sup> year	10 (14.1)	12 (12.8)	22 (13.3)
4 <sup>th</sup> year	21 (29.6)	25 (26.6)	46 (27.9)
5 <sup>th</sup> year	3 (4.2)	1 (1.1)	4 (2.4)
6 <sup>th</sup> year	2 (2.8)	0 (0.0)	2 (1.2)
<b>Monthly allowance</b>			
RM100-RM299	0 (0.0)	20 (21.3)	20 (12.1)
RM300-RM499	3 (4.2)	48 (51.1)	51 (30.9)
RM500-RM699	24 (33.8)	19 (20.2)	43 (26.1)
RM700-RM899	26 (36.6)	6 (6.4)	32 (19.4)
≥RM900	18 (25.4)	1 (1.1)	19 (11.5)
<b>Household income</b>			
<RM1000	1 (1.4)	0 (0.0)	1 (0.6)
RM1000-2999	3 (2.8)	30 (31.9)	32 (19.4)
RM3000-4999	31 (43.7)	48 (51.1)	79 (47.9)
RM5000-6999	32 (45.1)	5 (5.3)	37 (22.4)
RM7000-8999	2 (2.8)	8 (8.5)	10 (6.1)
≥RM9000	3 (4.2)	3 (3.2)	6 (3.6)

## 4.2. Sports characteristics

In this study, sports characteristics of the respondents such as types of sports, category of event and number of years of participation in the event were also being analysed. Based on table 4.2, majority of the respondents were team sports athletes which consisted of 42.2% (n=70) of the participants followed by speed and endurance athletes (20.0%; n: 33), racket (13.9%; n=23), skill (11.0%; n=18), combat (9.7%; n: 16) and aquatic (3.0%; n: 5). The highest proportion of users were from team sports athletes with 47.9% (n=34) of total users followed by speed and endurance athletes (26.8%; n: 19). For non-users, the highest proportion was among team sports athletes (38.3%; n: 36) whereas the second highest proportion was among skill sports athletes with a percentage of 17.0% (n: 16).

The highest category of event the respondents had ever participated in was highest at university level which was about 40.6% (n: 67) of total respondents. However, the difference in the highest proportion for category of event they had participated in among users and non-users was significant. A larger proportion which was 49.3% (n: 35) of total users was at international level category of event whereas for non-users, the highest proportion was among university level athletes which accounted for 55.3% (n: 52) of total non-users. The mean number of years of participation in sports competition for total respondents was  $3.15 \pm 2.32$  years. Slightly longer mean years of participation among users than non-users which were  $3.77 \pm 2.50$  years among users and  $2.68 \pm 2.06$  years among non-users.

**Table 4.2: Spots characteristics of the respondents.**

Characteristics	Mean±SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
Number of years of participation	3.77±2.50	2.68±2.06	3.15±2.32
Characteristics	Users (n=71) n (%)	Non-users (n=94) n (%)	Total (n=165) n (%)
<b>Types of sports</b>			
Team	34 (47.9)	36 (38.3)	70 (42.4)
Speed and endurance	19 (26.8)	14 (15.0)	33 (20.0)
Racket	10 (14.1)	13 (13.8)	23 (13.9)
Skill	2 (2.8)	16 (17.0)	18 (11.0)
Combat	3 (4.2)	13 (13.8)	16 (9.7)
Aquatic	3 (4.2)	2 (2.1)	5 (3.0)
<b>Category of event</b>			
University	15 (21.1)	52 (55.3)	67 (40.6)
District	2 (2.8)	2 (2.1)	4 (2.4)
National	19 (26.8)	24 (25.6)	43 (26.1)
International	35 (49.3)	16 (17.0)	51 (30.9)
<b>Number of years of participation</b>			
	3.77±2.50	2.68±2.06	3.15±2.32
1-3 years	39 (54.9)	70 (74.5)	109 (66.1)
4-6 years	21 (29.6)	20 (21.3)	41 (24.8)
7-9 years	10 (14.1)	2 (2.1)	12 (7.3)
10-12 years	1(1.4)	1 (1.1)	2 (1.2)
≥13 years	0 (0.0)	1 (1.1)	1 (0.6)

### **4.3. Nutritional supplementation intake**

Table 4.3 showed the characteristics of nutritional supplementation intake of the respondents which consists of the status of supplementation intake, the number of types of nutritional supplement taken, duration of the respondents were using the supplements and frequency of intake per week. This study had found that the prevalence rate of nutritional supplementation intake among athletes in UPM was 43.0% (n=71). The mean number of types of nutritional supplement taken by the users was  $3.65 \pm 3.41$  in which most of them consumed 1-3 types of nutritional supplement with the percentage of 66.2% (n=47). In addition, most of the users had taken supplement for years with the proportion of 81.7% (n: 58) rather than for months 14.1% (n: 10) and for weeks 4.2% (n: 3). Other than that, the mean frequency of nutritional supplement taken per week was  $4.11 \pm 1.98$  days with most of them (33.9%; n: 24) taken supplement for 3-4 days per week. Therefore, it can be concluded that most of the users taken 1-3 types of supplements with the frequency of 3-4 days per week and had at least consume the supplements for one year.

When compared to other studies, the prevalence of nutritional supplementation intake among athletes in UPM was similar with a study by Al-Naggar and Chen (2011) where the prevalence of vitamins and minerals supplementation intake was also 43.0% among university students. Other studies had reported the prevalence of athletes consuming supplements to be between 40% and 90% (Garthe et al., 2018; Porrini & Del Bo, 2016; Sousa et al., 2016). It can be concluded that the prevalence of supplementation intake in this study was much lower than other studies conducted in Malaysia among athletes in Malaysian National Sports Institute by Balaravi et al. (2017) and Keat et al. (2017) with a prevalence of 72% and 59.7% respectively. The possible reason of the difference in the prevalence might be due to different

definition of supplements among other studies and also due to varied characteristics of participants. Different instrument used in measuring the nutritional supplementation intake as well as different understanding of the exact definition of supplement among target population might cause potential respondents biased.

**Table 4.3: Nutritional supplementation intake of the respondents.**

<b>Characteristics</b>	<b>Mean±SD</b>	<b>Number/percentage of respondents n (%)</b>
<b>Nutritional supplement intake</b>		
Yes		71 (43.0)
No		94 (57.0)
<b>Number of types of nutritional supplement taken</b>		
1-3	3.65±3.41	47 (66.2)
4-6		15 (21.2)
7-9		2 (2.8)
10-12		5 (7.0)
13-15		0 (0.0)
16-18		2 (2.8)
<b>Duration had been using nutritional supplement</b>		
Weeks		3 (4.2)
Months		10 (14.1)
Years		58 (81.7)
<b>Frequency of nutrition supplement taken per week</b>		
1-2	4.11±1.98	16 (22.5)
3-4		24 (33.9)
5-6		16 (22.5)
7		15 (21.1)

#### **4.3.1. Types of nutritional supplement taken**

This study had found that the most popular type of nutritional supplement taken among athletes in UPM was energy supplements which accounted for 80.3% (n=57) of total users, followed by protein supplements (45.1%; n: 32), vitamins and minerals (39.4%; n: 28), others substances (9.9%; n: 7) and herbal supplements (2.8%; n: 2). The highest nutritional supplement taken by the users was energy drink which consisted of 77.5% (n: 55) of total users followed by whey protein with the percentage of 33.8% (n: 24).

Under the category of energy supplements, majority of the users consumed energy drinks (77.5%; n: 55) followed by caffeine and calorie replacement with the same proportion which were 22.5% (n: 16). While only one person out of 71 users was found to take Medium Chain Triglyceride (MCT) oils. This finding was also supported by the previous study by Golshanraz et al. (2012) in which energy drinks to be the most regularly consumed by athletes. A study by Hardy et al. (2017) on energy drinks consumption among student athletes had reported that majority of the users (64%) felt that they had benefited from drinking energy drinks including an increase in alertness, increase productivity and better focus. Energy drinks usually contain caffeine which had been proven by many studies that it might improve athletic performance by improving endurance, strength and power in high-intensity team sports activities if it was consumed about 2-6 mg/kg body weight before exercise (Ganio et al., 2009; Goldstein et al., 2010; Mora-Rodriguez & Pallarés, 2011).

**Table 4.4: Types of nutritional supplements taken by the respondents.**

<b>Types of nutritional supplements</b>	<b>Nutritional supplement users n (%)</b>
<b>Energy</b>	57 (80.3)
Energy drinks	55 (77.5)
Caffeine	16 (22.5)
Calorie replacement	16 (22.5)
Medium Chain Triglyceride (MCT) Oils	1 (1.4)
<b>Protein</b>	32 (45.1)
Whey protein	24 (33.8)
Creatine	12 (16.9)
Branch Chain Amino Acid (BCAA)	10 (14.1)
Protein powder	8 (11.3)
Glutamine	6 (8.5)
Soy protein	5 (7.0)
Weight gainer powder	5 (7.0)
Amino acids	2 (2.8)
Hydoxy beta-methylbutyric	1 (1.4)
<b>Vitamin and Minerals</b>	28 (39.4)
Vitamin C	21 (29.6)
Multi-vitamin	12 (16.9)
Calcium	6 (8.5)
Vitamin E	4 (5.6)
Vitamin B Complex	2 (2.8)
Magnesium	2 (2.8)
Vitamin D	1 (1.4)
Multi-vitamin	1 (1.4)
Zinc	1 (1.4)
Iron	1 (1.4)
Potassium	1 (1.4)
<b>Herbal</b>	2 (2.8)
Green tea extract	2 (2.8)
Wheat grass	1 (1.4)
<b>Other</b>	7 (9.9)
Glucosamine	4 (5.6)
Fat burner	1 (1.4)
Nicotine	1 (1.4)

Next, the highest type of protein supplement taken by users was whey protein which consisted of 33.8% (n=24) users, followed by creatine supplement (16.9%; n= 12), branch chain amino acid (BCAA) (14.1%; n= 10) and protein powder (11.3%; n=8). Similarly, a study conducted among soldiers by Casey et al. (2014) had reported that protein-based supplements to be consumed by 66% of the army. A possible explanation for this finding might be due to the same characteristics of respondents in which this study had a higher proportion of rugby sports athlete that usually needed to build more muscles for better performance. Protein supplementation such as creatine had been proven by numerous clinical trials that it might optimised muscle training response during exercise and subsequent recovery period but does not give much of value for endurance sports (Cooper et al., 2012; Kreider et al., 2017; Larson-Meyer et al., 2000; Salomons et al., 2012). Therefore since most of the respondents in this study were team sports athlete, it might affect the finding on prevalence of protein supplementation intake.

Besides, vitamin and mineral supplement were also popular among the respondents. The highest proportion of vitamin or mineral taken was vitamin C with percentage of 19.6% (n 21) followed by multi-vitamin (16.9%; n=12), calcium (8.5%; n= 6) and vitamin E (5.6%; n=4). Many other studies supported the findings that vitamins and minerals supplement to be the most consumed by athletes and active person with percentage from 40% to 70% (Dascombe et al., 2010; Diehl et al., 2012; Knapik et al., 2018; Lieberman et al., 2015; Saedi et al., 2013). The purpose of the mechanism of action for vitamin or minerals supplements was to reduce muscle fatigue, inflammation and soreness by minimising free-radical damage to skeletal muscle (Merry & Ristow, 2016). These antioxidants supplements might usually perceived by the athletes as a dietary supplement to improve their health (Wardenaar

et al., 2016). However, only a little research supports the use of antioxidants supplements which contain a greater amount of vitamins/minerals available from a nutritionally adequate diet since an excess intake of them might lead to other side effects.

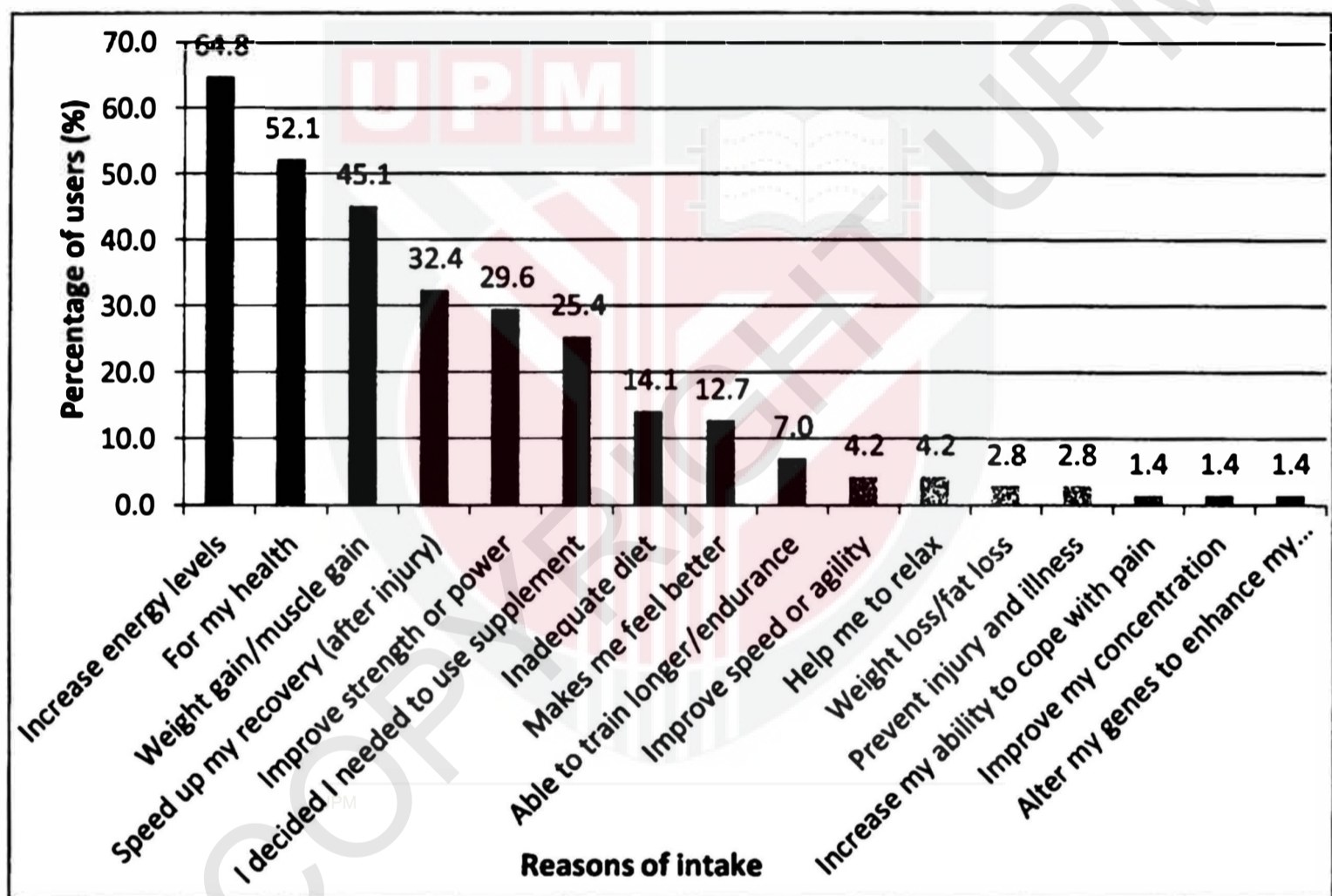
Lastly, supplement under 'herbal' and 'other' categories had much lower consumption among users. There were only two types of herbal used which were green tea extracts (2.8%; n=2) and wheat grass (1.4%; n: 1). Other type of supplement used includes glucosamine (5.6%; n: 4), fat burner and nicotine with the same percentage of 1.4% (n: 1). Lower intake of herbal and other types of supplement category could also be found in other study with percentage between 5% and 20% (Aljaloud & Ibrahim, 2013; Knapik et al., 2018; Lieberman et al., 2015).

#### **4.3.2. Reasons of supplementation intake**

As shown in figure 4.1, there was a wide variety of reasons of nutritional supplementation intake among the athletes in UPM. The most given reason of supplementation consumption was to increase energy level which accounted for 64.8% of total users followed by for health (52.1%), weight gain or muscle gain (45.1%), to speed up recovery (32.4%), to improve strength or power (29.6%), their own decision (25.4%), inadequate diet (14.1%) and to make them feel better (12.7%). Less than 10% of the users reported other reasons such as to be able to train longer/endurance, improve speed or agility, help to relax, weight loss or fat loss, to prevent injury and illness, to increase ability to cope with pain, to improve concentration and to alter genes to enhance performance.

Other studies also showed that to increase in energy levels, for health and for weight or muscle gain as one of the highest reasons of supplementation intake among

the athletes with percentage between 30% and 80% of the respondents (Al-Naggar & Chen, 2011; Hartmann et al., 2016; Jawadi et al., 2017; Kobayashi et al., 2017; Lieberman et al., 2015; Lun et al., 2012; Salgado et al., 2014; Wardenaar et al., 2016). The reasons of supplementation intake might vary depending on the characteristics of the respondents, types of sports and also the nutritional supplements being studied.



**Figure 4.1: Reasons of nutritional supplementation intake among the users.**

### **4.3.3. Sources of information on nutritional supplement**

Based on figure 4.2, majority of supplement users gained source of nutritional supplement information from their coach which consisted of 54.9% of total users. This finding was also supported by previous literatures by Sato et al. (2015) and Tsitsimpikou et al. (2011) with percentage of 49.8% and 31.6%. Second highest source of information on nutritional supplement was from fellow student athletes which contributed to 50.7% of the proportion. From previous studies by Kim et al. (2011), Lun et al. (2012), Muwonge et al. (2017) and Tian et al. (2009) also supported that fellow student athletes or teammate were one of the greatest contributors to their sources of information on nutritional supplements. Athletes might be more comfortable to ask for opinion and advice on supplementation intake from anyone near to them such as coaches and fellow student athletes. Hence, it is important to ensure that coaches, trainer and all of the athletes received a great nutritional knowledge to secure a reliable information on supplements.

However, internet being the higher source of information (45.1%) than doctor (32.4%) indicated that more education about supplementation needed to be disseminated among the athletes. This finding was also similar to study by Tian et al. (2009) among university athletes in Singapore with 40% of the respondents reported online media as their sources of information on supplements. Internet provides great sources of information. However, it can also provide unreliable sources of information which may lead to wrong decision on nutritional supplementation intake (Žeželj et al., 2018). This should raise concern among sports nutritionist or dietitian in supplementation intake decision of the athletes. Possible explanation to this finding might be due to the easier access to the internet instead of seeking information from healthcare professionals. Diehl et al. (2012) suggested that

nutrition experts on sports should be made available to athletes at the beginning of their sports career and better education on sports nutrition should be provided to them sufficiently.

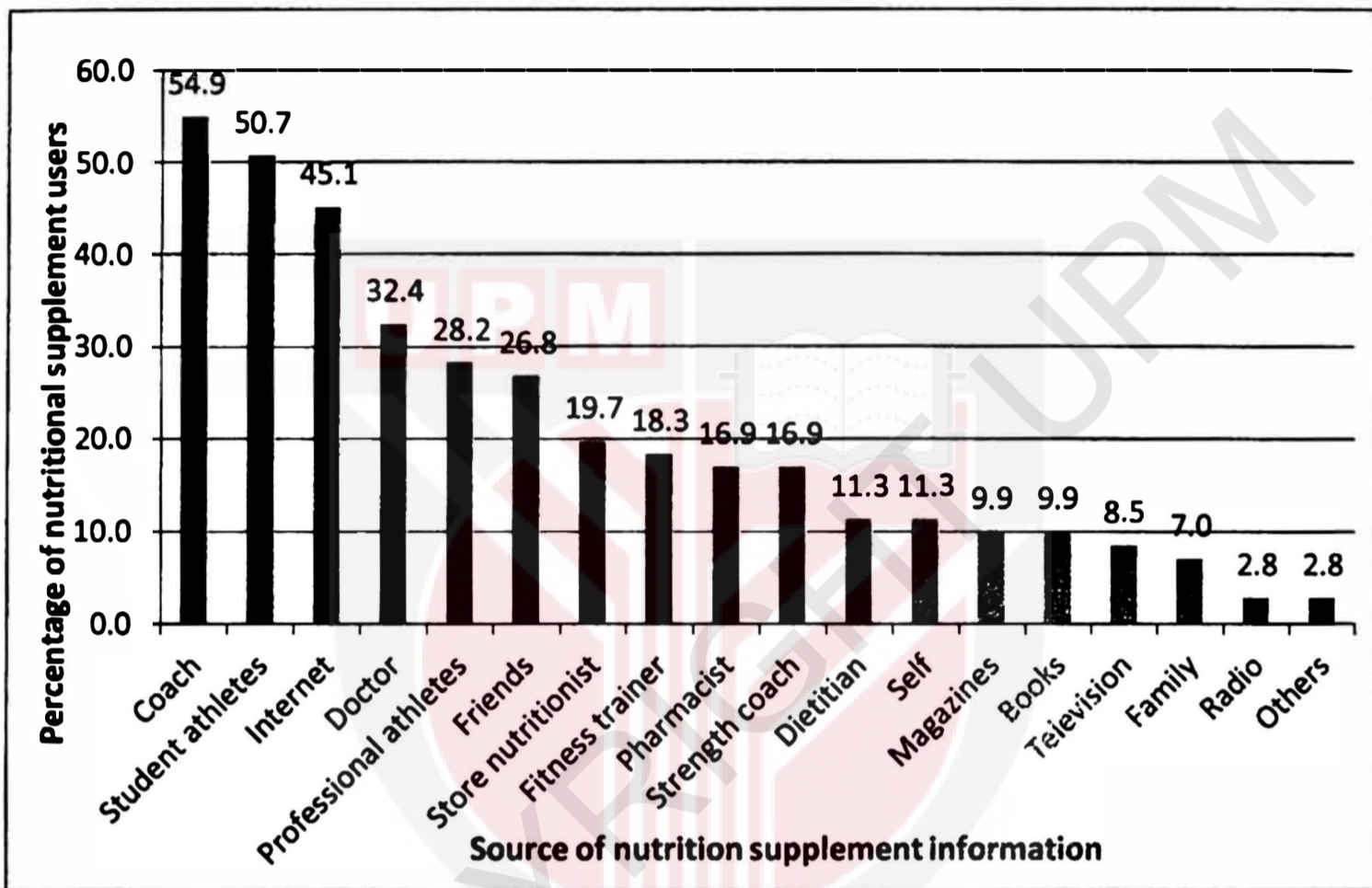


Figure 4.2: Sources of nutritional supplement information by the users.

#### 4.4. Sports nutritional knowledge

In this study, sports nutritional knowledge was also being assessed to know the level of knowledge among athletes in UPM. The mean score of sports nutritional knowledge among total respondents was  $12.18 \pm 3.36$ . Comparing the mean score of sports nutritional knowledge among users and non-users, users had slightly higher score than non-users which were about  $13.17 \pm 3.05$  mean score for users and  $11.44 \pm 3.41$  for non-users. This was also shown on the distribution of proportion for the level of sports nutritional knowledge among the respondents. Most of the respondents had a moderate level of sports nutritional knowledge with a proportion of 81.8% (n=135) from total respondents, 88.7% (n=63) from total users and 76.6% (n=72) of non-users. However, higher proportion of users had a high level of sports nutritional knowledge compared to non-users which was 9.9% (n=7) whereas higher proportion of non-users had low level of sports nutritional knowledge which was about 19.1% (n=18).

**Table 4.5: Mean score and level of sports nutritional knowledge of the respondents.**

Sports nutritional knowledge	Mean±SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
Sports nutritional knowledge total score	13.17±3.05	11.44±3.41	12.18±3.36
Sports nutritional knowledge category	Users n (%)	Non-users n (%)	Total n (%)
Low	1 (1.4)	18 (19.1)	19 (11.5)
Moderate	63 (88.7)	72 (76.6)	135 (81.8)
High	7 (9.9)	4 (4.3)	11 (6.7)

#### 4.5. Physical activity level

Table 4.6 showed the level of physical activity of the respondents. The mean total MET-min/week for total respondents was  $4142.30 \pm 3033.81$  MET-min/week which considered as high level category of physical activity level. However, the difference in mean total MET-min/week between users and non-users can be seen significantly in which users had higher score higher ( $5190.99 \pm 3215.99$  MET-min/week) than non-users ( $3350.21 \pm 2640.51$  MET-min/week).

Majority of the respondents had high level of physical activity level might be due to their weekly training for upcoming events. However, the difference can be seen among users and non-users in which higher proportion of users can be observed to had high level of physical activity (73.2%; n=52) compared to non-users (41.5%; n=39). In contrast, higher proportion of non-users had a moderate physical activity level (52.1%; n=49) than users (25.4%; n=18). Therefore it can be concluded that majority of users had a high physical activity level whilst majority of non-users had moderate physical activity level.

**Table 4.6: Mean MET-min value and level of physical activity level of the respondents.**

Physical activity level	Mean $\pm$ SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
Physical activity level (MET-minutes/week)	5190.99 $\pm$ 3215.99	3350.21 $\pm$ 2640.51	4142.30 $\pm$ 3033.81
Physical activity level	Users n (%)	Non-users n (%)	Total n (%)
Low	1 (1.4)	6 (6.4)	7 (4.2)
Moderate	18 (25.4)	49 (52.1)	67 (40.6)
High	52 (73.2)	39 (41.5)	91 (55.2)

#### 4.6. Body weight status

The body weight status of the respondents which consisted of BMI, body fat percentage and fat-free mass were also being analysed. Based on table 4.7, the mean BMI for total respondents was  $23.97 \pm 4.81 \text{ kg/m}^2$  which was categorised as normal. The mean BMI of total respondents was not much differ than users and non-users which were about  $24.38 \pm 4.98 \text{ kg/m}^2$  and  $23.66 \pm 4.68 \text{ kg/m}^2$  respectively. This was also reflected on the proportion of respondents' BMI category in which the highest proportion was at normal BMI category accounted for 55.8% (n=92) for total respondents, 55.0% (n=39) for users and 56.4% (n=53) for non-users.

**Table 4.7: Mean BMI and distribution of BMI category of the respondents.**

Body weight status	Mean±SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
BMI (kg/m <sup>2</sup> )	24.38±4.98	23.66±4.68	23.97±4.81
Body weight status	Users n (%)	Non-users n (%)	Total n (%)
<b>BMI category</b>			
Underweight	5 (7.0)	9 (9.6)	14 (8.5)
Normal	39 (55.0)	53 (56.4)	92 (55.8)
Overweight	16 (22.5)	23 (24.5)	39 (23.6)
Obese Class I	8 (11.3)	7 (7.4)	15 (9.1)
Obese Class II	3 (4.2)	1 (1.1)	4 (2.4)
Obese Class III	0 (0.0)	1 (1.1)	1 (0.6)

Table 4.8 showed the body fat percentage and fat-free mass distribution of the respondents separating male and female. For male athletes, there was not much of difference in the mean body fat percentage with  $19.24 \pm 6.01$  percent in total,  $18.28 \pm 5.64$  percent for users and  $19.98 \pm 6.21$  percent for non-users. Most of the male athletes were in normal body fat category (67.2%; n=82). However, higher proportion of male non-users had a high body fat category which consisted about 60.0% (n=24) whereas male users had highest proportion of normal body fat category (69.8%; n=37). The fat-free mass of male respondents was also slightly different between users and non-users. Mean fat-free mass of male users was higher than total and non-users with the mean of  $60.95 \pm 11.15$  kg compared to  $57.42 \pm 9.94$  kg for total male respondents and  $54.71 \pm 7.98$  kg for non-users.

**Table 4.8: Mean and category of body fat percentage and fat-free mass of the respondents.**

Body weight status	Mean±SD					
	Users (n=71)		Non-users (n=94)		Total (n=165)	
	M (n=53)	F (n=18)	M (n=69)	F (n=122)	M (n=122)	F (n=43)
Body fat percentage (%)	$18.28 \pm 5.64$	$26.08 \pm 7.98$	$19.98 \pm 6.21$	$28.64 \pm 6.58$	$19.24 \pm 6.01$	$27.57 \pm 7.22$
Fat-free mass (kg)	$60.95 \pm 11.15$	$44.56 \pm 8.94$	$54.71 \pm 7.98$	$41.83 \pm 6.63$	$57.42 \pm 9.94$	$42.97 \pm 7.70$
Body weight status	Users n (%)		Non-users n (%)		Total n (%)	
<b>Body fat</b>						
Low	4 (7.6)	5 (27.8)	2 (5.0)	2 (8.0)	6 (4.9)	7 (16.3)
Normal	37 (69.8)	9 (50.0)	14 (35.0)	18 (72.0)	82 (67.2)	27 (62.8)
High	12 (22.6)	4 (22.2)	24 (60)	5 (20.0)	34 (27.9)	9 (20.9)

As for female athletes, there was a slight difference of the mean body fat percentage among total female respondents, users and non-users. Users had a slightly lower mean body fat percentage than total female respondents and non-users with the mean of  $26.08 \pm 7.98$  percent compared to  $27.57 \pm 7.22$  percent for total respondents and  $28.64 \pm 6.58$  percent body fat for non-users. Most of the respondents had a normal body fat category with proportion of 62.8% (n=27). However, higher proportion of female users had low body fat category which accounted for 27.8% (n=5) of total female users compared to non-users with only 5.0% (n=2) of female athletes with low body fat. In terms of the fat-free mass of female athletes, the mean fat-free mass of users was slightly higher than total respondents and non-users with mean mass of  $44.56 \pm 8.94$  kg of fat-free mass compared to  $41.83 \pm 6.63$  kg for non-users and  $42.97 \pm 7.70$  kg for total female respondents.

#### 4.7. Dietary intake

Table 4.9 showed the mean daily intake of energy ( $1834.13 \pm 738.20$  kcal), carbohydrate ( $257.32 \pm 103.02$  g), protein ( $72.10 \pm 103.02$  g) and fat ( $57.39 \pm 33.04$  g) by the respondents. Generally, there were not much of difference in the mean carbohydrate intake ( $254.31 \pm 106.23$  vs  $259.59 \pm 101.04$  g), protein intake ( $73.22 \pm 40.80$  vs  $71.26 \pm 37.94$  g) and fat intake ( $58.61 \pm 38.20$  vs  $56.46 \pm 28.71$  g) between users and non-users.

**Table 4.9: Mean intake of energy, carbohydrate, protein and fat by the respondents.**

Dietary intake	Mean $\pm$ SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
Energy (kcal/day)	1837.63 $\pm$ 792.41	1831.49 $\pm$ 698.80	1834.13 $\pm$ 738.20
Carbohydrate (g/day)	254.31 $\pm$ 106.23	259.59 $\pm$ 101.04	257.32 $\pm$ 103.02
Protein (g/day)	73.22 $\pm$ 40.80	71.26 $\pm$ 37.94	72.10 $\pm$ 39.09
Fat (g/day)	58.61 $\pm$ 38.20	56.46 $\pm$ 28.71	57.39 $\pm$ 33.04

Next, table 4.10 showed the distribution of respondents by percentage of energy from carbohydrate, protein and fat. The mean percentage of energy from carbohydrate among athletes in UPM was  $57.16 \pm 9.37$  percent with majority of them consumed  $>55\%$  of energy from carbohydrate ( $55.8\%$ ;  $n=92$ ). Mean percentage intake of energy from carbohydrate among user ( $56.95 \pm 9.98$  percent) was slightly lower than non-users ( $57.33 \pm 8.93$  percent) with majority of both group consumed  $>55\%$  of energy from carbohydrate which was  $53.5\%$  ( $n=38$ ) and  $57.4\%$  ( $n=54$ ) respectively.

**Table 4.10: Distribution of respondents by percentage of energy from carbohydrate, protein and fat.**

Dietary intake	Mean $\pm$ SD		
	Users (n=71)	Non-users (n=94)	Total (n=165)
% of energy from carbohydrate	56.95 $\pm$ 9.98	57.33 $\pm$ 8.93	57.16 $\pm$ 9.37
% of energy from protein	16.08 $\pm$ 4.56	15.67 $\pm$ 4.48	15.84 $\pm$ 4.51
% of energy from fat	26.97 $\pm$ 9.07	27.00 $\pm$ 7.96	29.99 $\pm$ 8.43

Dietary intake	Users	Non-users	Total
	(n=71) n (%)	(n=94) n (%)	(n=165) n (%)
<b>% of energy from carbohydrate</b>			
<45%	6 (8.5)	7 (7.4)	13 (7.9)
45%-55%	27 (38.0)	33 (35.2)	60 (36.4)
>55%	38 (53.5)	54 (57.4)	92 (55.8)
<b>% of energy from protein</b>			
<10%	3 (4.2)	1 (1.1)	4 (2.4)
10%-15%	30 (42.3)	47 (50.0)	77 (46.7)
>15%	38 (53.5)	46 (48.9)	84 (50.9)
<b>% of energy from fat</b>			
<25%	27 (38.0)	36 (38.3)	63 (38.2)
25%-35%	27 (38.0)	41 (43.6)	68 (41.2)
>35%	17 (24.0)	17 (18.1)	34 (20.6)

Besides, the mean percentage of energy intake from protein among total respondents was  $15.84 \pm 4.51$  percent from total energy intake. Users of nutritional supplements had slightly higher percentage of energy intake from protein ( $16.08 \pm 4.56$  percent) than non-users ( $15.67 \pm 4.48$  percent). This was also shown on the proportion where higher percentage of users (53.5%; n=38) used >15% of protein compared to non-users. On the other hand, higher proportion of non-users used 10%-15% of energy from protein (50.0%; n=47) compared to users.

Mean percentage of energy from fat among the athletes in UPM was  $29.99 \pm 8.43$  percent of total energy intake. Non-users had slightly higher percentage of energy from fat ( $27.00 \pm 7.96$  percent) compared to users ( $26.97 \pm 9.07$  percent). About 43.6% (n=41) of non-users consumed 25%-35% of energy from fat whereas users had the same proportion of percentage of energy intake for <25% and 25%-35% which was about 38.0% (n: 17).

## **4.8. Hypothesis testing**

### **4.8.1. Association between socio-demographic characteristics (age, sex, ethnicity, educational level, monthly allowance and household income) and nutritional supplementation intake among athletes in UPM.**

Based on table 4.11, findings of this study showed that there was no significant association between age and nutritional supplementation intake among athletes in UPM ( $r=0.043$ ,  $p=0.582$ ;  $\chi^2=1.30$ ,  $p=0.254$ ). This is consistent with previous study conducted among athletes in few other countries in Uganda, Saudi Arabia and Korea that does not found any association between age and supplementation intake (Jawadi et al., 2017; Kim et al., 2011; Muwonge et al., 2017). However, other studies had found significant association between age and supplementation intake (Keat et al., 2017; Saedi et al., 2013; Sedek et al., 2018). These inconsistent findings might be due to different sample size and target population. Besides in this study, there was high percentage of users and non-users fall between the ages of 18 to 23 years old since all of them were university students.

This study also found that there was no significant association between sex and nutritional supplementation intake among the athletes ( $\chi^2=0.03$ ,  $p=0.857$ ). This result was consistent with many other studies conducted among athletes and active population (Dascombe et al., 2010; Muwonge et al., 2017; Salgado et al., 2014; Tavani et al., 2014; Žeželj et al., 2018). Nevertheless, it was also contradicted with few other studies by Burnett et al. (2017), Knapik et al. (2016) and Tscholl et al. (2010) in which female athletes was significantly associated with nutritional supplement intake than male. The possible explanation might be due to smaller sample size and unbalance proportions of male and female respondents in this study. Data from research by Knapik et al. (2016) also suggested that female athletes tend

to consume iron supplements while male athletes consume more vitamin E, protein and creatine. However, the prevalence of supplementation intake among both sexes was still similar.

Next, there was also no association between ethnicity and nutritional supplementation intake among the respondents ( $\chi^2=2.69$ ,  $p=0.101$ ). There was still limited study conducted to analyses the association on ethnicity and supplementation intake worldwide. Two previous studies conducted in Malaysia among university students by Suraya and Nawi (2014) and Al-Naggar and Chen (2011) had supported this finding. However, another recent study conducted among adult gym users in KL had reported that there was significant association between race and supplements intake with Malay had the highest prevalence compared to Chinese and Indian respondents. In this study, proportions of non-Malays (Chinese, Indian and others) were much lower compared to Malay which might cause the result to be not significant.

**Table 4.11: Associations between socio-demographic factors and nutritional supplementation intake among athletes in UPM.**

Variables	Frequency of nutritional supplement intake per week (days)		$r$	$p$ -value
	Users	Non-users		
Age <sup>a</sup>			0.043	0.582
Monthly allowance <sup>a</sup>			0.328	<0.001*
Household income <sup>a</sup>			0.243	0.002*
Variables	Nutritional supplement intake		$\chi^2$	$p$
	Users n (%)	Non-users n (%)		
Age <sup>b</sup>			1.30	0.254
18-23 years	47 (66.2)	71 (75.5)		
24-29 years	24 (33.8)	23 (24.5)		
Sex <sup>b</sup>			0.03	0.857
Male	53 (74.6)	69 (73.4)		
Female	18 (25.4)	25 (26.6)		
Ethnicity <sup>b</sup>			2.69	0.101
Malay	56 (78.9)	84 (89.4)		
Non-Malay	15 (21.1)	10 (10.6)		
Educational level <sup>b</sup>				0.999 <sup>c</sup>
Undergraduate	68 (95.8)	90 (95.7)		
Postgraduate	3 (4.2)	4 (4.3)		
Year of study <sup>b</sup>			1.91	0.591
1 <sup>st</sup> year	19 (26.8)	29 (30.9)		
2 <sup>nd</sup> year	16 (22.5)	27 (28.7)		
3 <sup>rd</sup> year	10 (14.1)	12 (12.8)		
≥ 4 <sup>th</sup> year	26 (36.6)	26 (27.7)		
Monthly allowance <sup>b</sup>			85.92	<0.001*
RM100-RM399	3 (4.2)	68 (72.3)		
RM400-RM699	24 (33.8)	19 (20.2)		
RM700-RM999	29 (40.9)	6 (6.4)		
>RM1000	15 (21.1)	1 (1.1)		
Household income <sup>b</sup>			8.18	0.017*
≤RM5000	50 (70.4)	73 (77.7)		
>RM5000	20 (28.2)	13 (13.8)		

<sup>a</sup> Data analysed using Pearson correlation

<sup>b</sup> Data analysed using Chi-square test

<sup>c</sup> Data analysed using Fisher's exact test

\* Significant association at  $p < 0.05$

The educational level and year of study also do not significantly associated with nutritional supplementation intake among the athletes ( $p=0.999$ ;  $\chi^2=1.91$ ,  $p=0.591$ ). This finding is supported by other literature Dietz et al. (2014) which showed that there was no significant difference between users and non-users with regard to educational level among young German athletes. Nevertheless, there were studies conflicting with this finding where there was a significant association between educational level and nutritional supplementation intake Burnett et al., 2017; Knapik et al., 2018; Knapik et al., 2016). Since all of the respondents were in tertiary level of education, over 95% of users and non-users were undergraduates and less than 5% of them were postgraduates which the analysis between the unbalanced proportions of these two groups might affect the result to be not significant.

Among other socio-demographic characteristics, only monthly allowance and household income were significantly associated with nutritional supplementation intake among athletes in UPM with positive medium correlation for monthly allowance ( $r=0.328$ ,  $p<0.001$ ;  $\chi^2=85.92$ ,  $p<0.001$ ) and positive weak correlation for household income ( $r=0.243$ ,  $p=0.002$ ;  $\chi^2=8.18$ ,  $p=0.017$ ). This finding was also supported by other studies in Malaysia by Al-Naggar and Chen (2011) and Sedek et al. (2018) among university students and active gym users. A study by Tian et al. (2009) and Rodek et al. (2012) had revealed that one of the reasons for not taking any supplements was due to the cost and supplements were expensive. Maughan et al. (2018) explain that expensive supplements do not represent a good financial investment for average athletes.

#### **4.8.2. Association between sports characteristics (types of sports, category of event and years of participation) and nutritional supplementation intake among athletes in UPM.**

Several literature reviews had reported that sports characteristics of the athletes also associated with nutritional supplementation intake. Therefore in this study, the types of sports, category of event they had ever participated in and the number of years of participation in the events were also being analysed. Based on table 4.12, the types of sports was significantly associated with nutritional supplementation intake among athletes in UPM ( $\chi^2=15.64, p=0.008$ ). This result was also supported by study conducted among Malaysian team sports athletes in National Sports Institute by Keat et al. (2017). Various studies had found different types of sports to be associated with supplementation intake. Research by Diehl et al. (2012) and Shaw et al. (2016) reported that endurance and power sports athletes were more likely to consume supplements whereas study by Giannopoulou et al. (2018) had found that individual athletes had significantly higher intake than team sports athletes. Previous literature by Weins et al. (2014) explains that prevalence of supplementation intake to build muscle or increase energy was highest among strength athletes due to motivation to increase or maintain muscle mass, strength and power.

**Table 4.12: Associations between sports characteristics and nutritional supplementation intake among athletes in UPM.**

Characteristics	Frequency of nutritional supplement intake per week (days)			
	<i>r</i>		<i>p</i> -value	
Number of years of participation <sup>a</sup>	0.170		0.029*	
Characteristics	Users (n=71) n (%)	Non-users (n=94) n (%)	$\chi^2$	<i>p</i>
Types of sports <sup>b</sup>			15.64	0.008*
Team	34 (47.9)	36 (38.3)		
Speed and endurance	19 (26.8)	14 (15.0)		
Racket	10 (14.1)	13 (13.8)		
Skill	2 (2.8)	16 (17.0)		
Combat	3 (4.2)	13 (13.8)		
Aquatic	3 (4.2)	2 (2.1)		
Category of event <sup>b</sup>			18.25	<0.001*
Local	36 (50.7)	78 (83.0)		
International	35 (49.3)	16 (17.0)		
Number of years of participation <sup>b</sup>			4.90	0.027*
1-6 years	60 (84.5)	90 (95.7)		
7-13 years	11 (15.5)	4 (4.3)		

<sup>a</sup> Data analysed using Pearson correlation

<sup>b</sup> Data analysed using Chi-square test

\* Significant association at  $p < 0.05$

Next, the category of event the respondents had participated in was also significantly associated with nutritional supplementation intake ( $\chi^2=18.25$ ,  $p < 0.001$ ). Previous study by Giannopoulou et al. (2018) had reported that athletes in the national and international team were more likely to consume supplements compared to those who never won any medal and in the local team. This was also supported by Garthe et al. (2018) which stated that elite athletes at higher level of sports event used more supplements than non-elite athletes. It can be explained that international or professional level athletes were more likely to consume nutritional supplements

because they need to facilitate their recovery and to enhance immunity more compared to local and average athletes (Erdman et al., 2006).

Other than that, there was positive weak correlation and significant association between number of years of participation in the events and nutritional supplementation intake among the athletes in UPM ( $r=0.17$ ,  $p=0.029$ ;  $\chi^2=4.90$ ,  $p=0.027$ ). A study conducted by Muwonge et al. (2017) reported that longer years of participation in sports competition were statistically significant with supplementation intake. Similarly, a study in Malaysia conducted by Keat et al. (2017) also found a moderate positive correlation between years of participation in sports with supplement intake while a study among Brazilian athletes by Salgado et al. (2014) found a positive strong correlation.

#### **4.8.3. Association between sports nutritional knowledge and nutritional supplementation intake among athletes in UPM.**

Based on table 4.13, sports nutritional knowledge was significantly associated with nutritional supplementation intake among athletes in UPM with positive weak correlation ( $r=0.232$ ,  $p=0.003$ ;  $\chi^2=13.70$ ,  $p=0.001$ ). There was still limited study on the association between sports nutritional knowledge and nutritional supplementation intake among athletes. However, previous study had found positive and significant correlation between general nutritional knowledge and nutritional supplementation intake among university athletes in Singapore (Tian et al., 2009). Study by Kobayashi et al. (2017) conducted among college students in Japan also found that higher dietary education was more likely to consume supplements than those with lower dietary education. Whilst, a study conducted among student athletes in National Collegiate Athletic Association (NCAA) found that number of energy

drinks consumed per week was positively and significantly correlated with nutritional knowledge score (Hardy et al., 2017).

**Table 4.13: Association between sports nutritional knowledge and nutritional supplementation intake among athletes in UPM.**

Variables	Frequency of nutritional supplement intake per week (days)	
	<i>r</i>	<i>p</i> -value
Sports nutritional knowledge total score <sup>a</sup>	0.232	0.003*

Variables	Nutritional supplement intake		$\chi^2$	<i>p</i>
	Users n (%)	Non-users n (%)		
Sports nutritional knowledge category <sup>b</sup>			13.70	0.001*
Low	1 (1.4)	18 (19.1)		
Moderate	63 (88.7)	72 (76.6)		
High	7 (9.9)	4 (4.3)		

<sup>a</sup>Data analysed using Pearson correlation

<sup>b</sup>Data analysed using Chi-square test

\* Significant association at  $p < 0.05$

Inconsistently, a study among university athletes on relationship between sports drinks consumption and nutritional knowledge by Hardy et al. (2017) had found that non-users were having greater nutritional knowledge than users. This was due to the awareness on the health risk of consuming energy drinks which might lead to adverse effect such as enamel erosion, risk of getting cardiovascular diseases and type 2 diabetes (Astorino et al., 2012; Gwachem & Wagner, 2012; Rath, 2012). Kerpinski (2012) also suggested that nutritional knowledge that students had learnt in academic courses was not necessarily reflected their dietary behaviour. Therefore, further study needed to determine the relationship between sports nutritional knowledge and behavioural in supplementation intake among the athletes.

#### 4.8.4. Association between physical activity level and nutritional supplementation intake among athletes in UPM.

Based on table 4.14, there was positive weak and significant association between physical activity level and nutritional supplementation intake among the respondents ( $r=0.210$ ,  $p=0.007$ ;  $\chi^2=15.23$ ,  $p<0.001$ ). Previous literature also supported this finding in which study by Keat et al. (2017) conducted among team sports athletes in National Sports Institute had found positive and significant correlation between physical activity and the number of nutritional supplement intake which was also supported by study by Žeželj et al., (2018) among Croatian university students. This might be because people who had higher level of physical activity level tend to had other favourable health habits due to their higher level of health awareness. More active people may perceive nutritional supplementations to be additional way to improve their health and performance and to aids in their dietary intake (Knapik et al., 2018).

**Table 4.14: Association between physical activity level and nutritional supplementation intake among athletes in UPM.**

Variables	Frequency of nutritional supplement intake per week (days)		$\chi^2$	$p$
	$r$	$p$ -value		
Physical activity level (MET-minutes/week) <sup>a</sup>	0.210	0.007*		
Variables	Nutritional supplement intake		$\chi^2$	$p$
	Users n (%)	Non-users n (%)		
Physical activity level <sup>b</sup>			15.23	<0.001*
Low and moderate	19 (26.8)	55 (58.5)		
High	52 (73.2)	39 (41.5)		

<sup>a</sup> Data analysed using Pearson correlation

<sup>b</sup> Data analysed using Chi-square test

\* Significant association at  $p<0.05$

**4.8.5. Association between body weight status (BMI, body fat percentage and fat-free mass) and nutritional supplementation intake among athletes in UPM.**

Table 4.15 showed that there was no association between BMI and nutritional supplementation intake among athletes in UPM ( $r=0.063$ ,  $p=0.424$ ;  $\chi^2=1.55$ ,  $p=0.670$ ). Similarly, study conducted among German elite athletes and Brazilian athletes by Dietz et al. (2014) and Nabuco et al. (2016) also found no association between these two variables. This finding was contradicted with many other studies by Al-Naggar and Chen (2011), Knapik et al. (2018) and Sedek et al. (2018) where they had found association between BMI and supplement intake. Based on this finding, the prevalence of overweight and obesity among athletes in UPM was high because athletes had higher muscle mass compared to normal population and it was not due to the weight of excess fat (Sedek et al., 2018). To access their body composition, body fat percentage and fat-free mass were also being considered in the analysis although there were no other studies found to analyse these variables.

**Table 4.15: Association between BMI and nutritional supplementation intake among athletes in UPM.**

Variables	Frequency of nutritional supplement intake per week (days)		$\chi^2$	$p$
	$r$	$p$ -value		
BMI (kg/m <sup>2</sup> ) <sup>a</sup>	0.063	0.424		

Variables	Nutritional supplement intake		$\chi^2$	$p$
	Users n (%)	Non-users n (%)		
BMI category <sup>b</sup>			1.55	0.670
Underweight	5 (7.0)	9 (9.6)		
Normal	39 (54.9)	53 (56.4)		
Overweight	16 (22.5)	23 (24.5)		
Obese	11 (15.5)	9 (9.6)		

<sup>a</sup>Data analysed using Pearson correlation

<sup>b</sup>Data analysed using Chi-square test

Based on table 4.16, there was no association between male athletes body fat percentage and nutritional supplementation intake ( $r=0.101$ ,  $p=0.472$ ;  $\chi^2=4.27$ ,  $p=0.119$ ) which was also the same for female athletes ( $r=-0.418$ ,  $p=0.085$ ;  $\chi^2=13.70$ ,  $p=0.001$ ). In contrast, this study had found that there was significant association between fat-free mass and nutritional supplementation intake among athletes in UPM in which there was positive weak correlation for male athletes ( $r=0.201$ ,  $p=0.026$ ) and positive medium correlation for female athletes ( $r=0.359$ ,  $p=0.018$ ). There was no other latest literature found to study the association of body fat percentage and fat-free mass with nutritional supplementation intake among athletes. However, study by Cermak et al. (2012) had found that protein supplementation significantly augmented the gain in fat-free mass during prolonged resistance type of training which explains why there was association between supplementation intake among athletes in UPM.

**Table 4.16: Association of body fat percentage and fat-free mass with nutritional supplementation intake among athletes in UPM.**

Variables	Frequency of nutritional supplement intake per week (days)			
	M		F	
	<i>r</i>	<i>p</i> -value	<i>r</i>	<i>p</i> -value
Body fat percentage (%) <sup>a</sup>	0.101	0.472	-0.418	0.085
Fat-free mass (kg)	0.201	0.026*	0.359	0.018*

Variables	Nutrition supplement intake		$\chi^2$	<i>p</i>
	Users	Non-users		
	n (%)	n (%)		
	M	F		
Body fat <sup>b</sup>			4.27	0.119
Low	4 (7.6)	5 (27.8)	2 (5.0)	2 (8.0)
Normal	37 (69.8)	9 (50.0)	14 (35.0)	18 (72.0)
High	12 (22.6)	4 (22.2)	24 (60)	5 (20.0)

<sup>a</sup> Data analysed using Pearson correlation

<sup>b</sup> Data analysed using Chi-square test

\* Significant association at  $p<0.05$

#### **4.8.6. Association between dietary intake and nutritional supplementation intake among athletes in UPM.**

Based on table 4.17, there was no significant association between total energy intake and nutritional supplementation intake among athletes in UPM ( $r=0.063$ ,  $p=0.423$ ). Generally, there were also no significant association of daily carbohydrate intake ( $r=0.060$ ,  $p=0.445$ ), protein intake ( $r=0.027$ ,  $p=0.730$ ) and fat intake ( $r=0.059$ ,  $p=0.453$ ) with nutritional supplementation intake. In addition, the association between percentage of energy from each macronutrients and nutritional supplementation intake were also being analysed. However, there were no significant associations found in this study between percentage of energy from carbohydrate ( $r=0.018$ ,  $p=0.821$ ;  $\chi^2=0.26$ ,  $p=0.879$ ), percentage of energy from protein ( $r=-0.012$ ,  $p=0.882$ ;  $\chi^2=0.34$ ,  $p=0.560$ ) and percentage of energy from fat ( $r=-0.013$ ,  $p=0.863$ ;  $\chi^2=0.98$ ,  $p=0.612$ ) with nutritional supplementation intake among athletes in UPM.

There was still limited study on the association between dietary intake and nutritional supplementation intake among athletes and active population. This result was inconsistent with previous study by Ishihara et al. (2003) where there were significant differences in protein and fat intake between users and non-users. However, dietary intake might be influenced by societal factors in and around the campus and also social environmental factors which influence food preferences and selection (Kabir et al., 2018).

However in this study, more than half of the respondents (58.8%) were under-reporting of their dietary intake while 6.1% of the respondents were over-reporting. Wrong estimation of portion size, memory lapses, biased by the respondents or coding error by the researcher might be the possible explanation of the high under-reporting cases. Therefore, this might affect the analysis since only less than half of

respondents were not under- or over-reporting of their dietary intake. However, all of the data still be included in the analysis since the distribution of total energy intake was in the acceptable range.

**Table 4.17: Association between dietary intake and nutritional supplementation intake among athletes in UPM.**

Dietary intake	Users (n=71)	Non-users (n=94)	Total (n=165)	$r/\chi^2$	p-value
	Mean±SD / n (%)				
<b>Energy (kcal/day)<sup>a</sup></b>	1837.63±792.41	1831.49±698.80	1834.13±738.20	0.063	0.423
<b>Carbohydrate (g/day)<sup>a</sup></b>	254.31±106.23	259.59±101.04	257.32±103.02	0.060	0.445
% of energy from carbohydrate <sup>a</sup>	56.95±9.98	56.95±9.98	57.16±9.37	0.018	0.821
<45% <sup>b</sup>	6 (8.5)	7 (7.4)	13 (7.9)	0.26	0.879
45%-55%	27 (38.0)	33 (35.2)	60 (36.4)		
>55%	38 (53.5)	54 (57.4)	92 (55.8)		
<b>Protein (g/day)<sup>a</sup></b>	73.22±40.80	71.26±37.94	72.10±39.09	0.027	0.730
% of energy from protein <sup>a</sup>	16.08±4.56	15.67±4.48	15.84±4.51	-0.012	0.882
<15% <sup>b</sup>	33 (46.5)	48 (51.1)	81 (49.1)	0.34	0.560
≥15%	3 (53.5)	46 (48.9)	84 (50.9)		
<b>Fat (g/day)<sup>a</sup></b>	58.61±38.20	56.46±28.71	57.39±33.04	0.059	0.453
% of energy from fat <sup>a</sup>	26.97±9.07	27.00±7.96	29.99±8.43	-0.013	0.863
<25% <sup>b</sup>	27 (38.0)	36 (38.3)	63 (38.2)	0.98	0.612
25%-35%	27 (38.0)	41 (43.6)	68 (41.2)		
>35%	17 (24.0)	17 (18.1)	34 (20.6)		

<sup>a</sup> Data analysed using Pearson correlation

<sup>b</sup> Data analysed using Chi-square test

## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1. Conclusion**

The aim of this cross-sectional study was to determine the factors associated with nutritional supplementation intake among athletes in UPM. This study had shown that the prevalence of supplementation intake among athletes in UPM was 43.0% of total respondents. Majority of nutritional supplement users was among those with higher monthly allowance and household income. It shows that supplementation intake was also contributed by the cost and financial status. The prevalence of supplementation intake among athletes in UPM was much lower than other study. However, there was still a concern on the effectiveness and safety of nutritional supplements product for their health and performance.

The most type of nutritional supplement taken among athletes in UPM was energy supplement with more than half of them claimed to be consuming supplements to increase their energy level. Highest source of information on nutritional supplementation was from their coach followed by fellow student athletes and internet. This should also raise a serious concern since most of them seek information from unreliable sources instead of from healthcare professionals. This might causes misleading information on nutritional supplements. Therefore, healthcare professionals such as sports nutritionist or dietitian, physician, pharmacist

and athletic trainer should disseminate knowledge on supplementation intake among the young athletes.

Other than that, users had significantly higher sports nutritional knowledge than non-users. This was also a concern since the higher knowledge on sports nutrition should lead to lower intake of nutritional supplements. Athletes with better knowledge on nutrition should know how to manage their dietary intake to fuel and replenish their energy and nutrients intake especially during in-seasons training. Therefore, other confounding factors should also be analysed such as their belief, perspective and behaviour towards nutritional supplements product in the market.

Next, athletes who consumed nutritional supplement were associated with higher physical activity level which showed that active person was associated with supplementation intake. Strenuous training which includes long duration and higher intensity might cause the athletes to lose more energy and nutrients from their body. To replenish the energy and nutrients loss, they had chosen to consume supplements as alternative nutrients sources. This should also raise concern among sports nutritionist or dietitian to consider physical activity of athletes or active person and their dietary intake to supply sufficient energy and nutrients for their performance and recovery instead of taking nutrition supplements as alternative.

Fat-free mass was also significantly associated with nutritional supplementation intake among athletes in UPM. BMI and body fat percentage might not reflect athletes true body composition due to their higher muscle mass than normal population. Although this study had shown that there was association between fat-free mass and nutritional supplementation intake, further study needed to be conducted to analyse the association between supplementation intake and its effect on fat-free mass or muscle development. Gain in fat-free mass might be caused

by other factors such as physical activity level or the types of exercise training done by the athletes.

## **5.2. Limitations**

Several limitations were found in this study. Since this is a cross-sectional study, it was a two ways relationship which cannot determine the causality relationship between the variables. The sample size was also small and only focused on one group of athlete thus the results cannot be generalised to all athletes in Malaysia. The proportion of respondents according to the types of sports was also not balance due to limitation in gaining response and unavailability of the target population especially individual athletes. However, the prevalence of nutritional supplementation intake among athletes in UPM can still be used as a baseline reference for future studies on supplementation intake among athletes or other related fields.

The other notable limitation in this study was different definition of nutritional supplements between other studies. Some studies only focused on certain types of supplement and types of sports while some studies limit the definition of supplements in their study to a smaller range of category. Thus, this might interfere with the results and could cause confusion on the comparison between the studies.

Other than that, self-administered questionnaire method in collecting data might increase the risk of misreporting and inaccurate data. There might be respondents biased in which dishonest answer from the respondents cause lower validity and accuracy of the results. In addition, lack of understanding of the item by some respondents could also affect accuracy of the data since the questionnaire was being made in the English language only instead of Bahasa Malaysia. As for the 24-

hour dietary recall, there were high prevalence of underreporting which might be due to incorrect estimation of portion size, memory lapses by the respondents or might be due to coding errors in analysing the dietary intake by the researcher. The interviewer skill in conducting the interview session to collect information of the respondents 24hour dietary intake might also differ between each individual. The data on daily dietary intake was not sufficient enough to be analysed since it was measured solely depending on 1-day diet recall. Therefore, more accurate association cannot be analysed.

Next, most of the data collection was made during athletes' training time and place. This might cause the place and time to be not conducive for the athletes to answer the questionnaire truthfully. Time constraint in answering the questionnaire might cause biased in their answers thus causing under- or over-reporting of the data. Furthermore the body fat percentage was measured using BIA machine in which the results depend on the subject's body hydration status. Due to time constraint, some of the measurements were taken after the athletes' training session which might cause the body fat percentage to be overestimated when the subject was dehydrated after strenuous training.

### **5.3. Recommendations**

There were some recommendations to improve the study for future research. Although there were many studies had provided latest findings on nutritional supplementation intake among active population or athletes, there were still other perspectives needed to be analysed and to be studied. Instead of cross-sectional study, longitudinal study was strongly recommended to determine the causality of the relationships. Further study should be conducted by using larger sample size and

wider athletes' population and location to generate better result and more generalised population.

Other perspectives such as athletes' belief, perspective and attitude towards nutritional supplements product in the market could also being studied to understand more on their behaviour towards consumption of supplements. Study on the relationship between sports nutritional knowledge and behaviour on nutritional supplementation consumption should also be analysed in future studies. In addition, further studies needed to find the association between types of sports played, types of supplement taken and also the reasons of intake for better understanding on the factors associated with nutritional supplementation intake among athletes. It was also recommended to analyse the physical activity level, body weight status and dietary intake according to the types of sports since different sports had different types of training and body composition needed for their performance. The difference in nutritional supplementation intake among different types of sports could also be analysed to add up more to the knowledge in sports nutrition.

It was also suggested to conduct interview-administered questionnaire instead of self-administered questionnaire to improve on the reliability of the data. Besides, data on the dietary intake of respondents could also be improved by increasing 24-hours dietary recall to 2-days dietary recall or more with addition of food frequency questionnaire for more sufficient data and improved findings. Next, it was recommended to do data collection in a more conducive time and place instead of during athletes' training period for more convenient time to answer the questionnaire. This could help the athletes to focus in answering the questionnaire and thus reduce respondents biased.

To add extra understanding on nutritional supplementation intake among athletes and active population, it was also suggested to analyse the non-users' reason of not taking any supplements, their perspective, belief and attitude towards nutritional supplements products. The differences between users and non-users could be analysed to determine the factors associated and to add more on the knowledge of sports nutrition field and consumerism.

There were also few recommendations based on the findings in this study. It was suggested to conduct more intervention program on sports nutrition among athletes, coach, trainers and any personnel related to athletic management and training to strengthen their awareness and knowledge on sports nutrition and supplementation. Better understanding on sports nutrition might help them to improve their dietary intake and thus avoiding any unnecessary nutritional supplementation intake. Other than that, healthcare professionals such as sports nutritionist or dietitian should be made available within athletes' reach so that they may refer directly to the professionals for more reliable sources on supplementation and to seek for a proper individual dietary plan or advices. Specific nutritional plan should also be provided depending on the individual's types of sports, body weight status and physical activity level to help them improving their performance, better recovery from injury and maintaining health.

## REFERENCES

- Al-Naggar, R. A., & Chen, R. (2011). Prevalence of vitamin-mineral supplements use and associated factors among young Malaysians. *Asian Pacific Journal of Cancer Prevention, 12*, 1023–1029.
- Aljaloud, S. O., & Ibrahim, S. A. (2013). Use of dietary supplements among professional athletes in Saudi Arabia. *Journal of Nutrition and Metabolism, 2013*. <https://doi.org/10.1155/2013/245349>
- Attila, S., & Çakir, B. (2011). Energy-drink consumption in college students and associated factors. *Nutrition, 27*(3), 316–322. <https://doi.org/10.1016/j.nut.2010.02.008>
- Austin, K. G., Carvey, C. E., Farina, E. K., Lieberman, H. R. (2013). Predictors of the relationships between nutritional supplement use and weight-modification goals of U.S. Army soldiers. *International Journal of Sport Nutrition and Exercise Metabolism, 23*(4), 322-335.
- Bailey, R. L., Gahche, J. J., Thomas, P. R., & Dwyer, J. T. (2013). Why US adults use dietary supplements. *Pediatric Research, 74*(6), 737–741. <https://doi.org/10.1038/pr.2013.160>
- Balaravi, B., Chin, M. Q., Karppaya, H., Chai, W. J., Samantha Quah, L. W., & Ramadas, A. (2017). Knowledge and attitude related to nutritional supplements and risk of doping among national elite athletes in Malaysia. *Malaysian Journal of Nutrition, 23*(3), 409–423. [https://doi.org/10.1016/S0045-7825\(02\)00649-7](https://doi.org/10.1016/S0045-7825(02)00649-7)
- Braun, H., Köhler, K., & Geyer, H. (2009). Evidence Central: Dietary supplement use among elite young German athletes. *Int J Sport Nutr Exerc Metab, 19*(1), 97–109. <https://doi.org/10.1123/ijsnem.19.1.97>
- Burnett, A. J., Livingstone, K. M., Woods, J. L., & McNaughton, S. A. (2017). Dietary supplement use among Australian adults: Findings from the 2011–2012 national nutrition and physical activity survey. *Nutrients, 9*(11), 1–12. <https://doi.org/10.3390/nu9111248>
- Casey, A., Hughes, J., Izard, R. M., & Greeves, J. P. (2014). Supplement use by UK-based British Army soldiers in training. *British Journal of Nutrition, 112*(7), 1175–1184. <https://doi.org/10.1017/S0007114514001597>
- Cermak, N. M., Res, P. T., Groot, L. C. De, Saris, W. H. M., & Loon, L. J. C. Van. (2012). Protein supplementation augments the adaptive response of skeletal muscle to resistance-type exercise training : a meta-analysis 1 – 3, 1454–1464.
- Darvishi, L., Askari, G., Hariri, M., Bahreynian, M., Ghiasvand, R., Ehsani, S., Mashhadi, N. S., Rezai, P., & Khorvash, F. (2013). The use of nutritional supplements among male collegiate athletes. *Int J Prev Med, 4*(Suppl 1), S68-72.
- Dascombe, B. J., Karunaratna, M., Cartoon, J., Fergie, B., & Goodman, C. (2010). Nutritional supplementation habits and perceptions of elite athletes within a state-based sporting institute. *Journal of Science and Medicine in Sport, 13*(2),

274–280. <https://doi.org/10.1016/j.jsams.2009.03.005>

- Diehl, K., Thiel, A., Zipfel, S., Mayer, J., Schnell, A., & Schneider, S. (2012). Elite adolescent athletes' use of dietary supplements: Characteristics, opinions, and sources of supply and information. *International Journal of Sport Nutrition and Exercise Metabolism*, 22(3), 165–174. <https://doi.org/10.1123/ijsnem.22.3.165>
- Duvenage K. M., Meltzer ST, Chantler SA. Initial investigation of nutrition and supplement use, knowledge and attitudes of under-16 rugby players in south africa. *South African Journal of Sports Medicine*, 27(3), 67–71. doi:10.7196/SAJSM.8092
- Food and Drug Administration. (2017). Dietary supplements. Food Facts. 1-2. Retrieved on December 9, 2018 from <http://www.fda.gov/Food/DietarySupplements/default.htm>
- Giannopoulou, I., Noutsos, K., Apostolidis, N., Bayios, I., & Nassis, G. P. (2013). Performance level affects the dietary supplement intake of both individual and team sports athletes. *Journal of Sports Science and Medicine*, 12(1), 190–196.
- Golshanraz, A., Hakemi, L., Pourkazemi, L., Dadgostar, E., Moradzandi, F., Tabatabaee, R., Moradi, F., Hosseinihajiagha, K., Jazayeri, N., Abedifar, H., Fouladi, R., Khooban, M., Kiani, M., Sajedi, M., Karooninejad, E., Moeen, S., Ghavam, M., Beiranvand, F., Mansoori, S., Gheisari, F., & Barzegari, H. (2012). Patterns of Sports Supplement Use among Iranian Female Athletes, 6(9), 2480–2483.
- Hardy, R., Kliemann, N., Evansen, T., & Brand, J. (2017). Relationship Between Energy Drink Consumption and Nutrition Knowledge in Student-Athletes. *Journal of Nutrition Education and Behavior*, 49(1), 19-26.e1. <https://doi.org/10.1016/j.jneb.2016.08.008>
- Hartmann, C., & Siegrist, M. (2016). Benefit beliefs about protein supplements: A comparative study of users and non-users. *Appetite*, 103, 229–235. <https://doi.org/10.1016/j.appet.2016.04.020>
- Heikkinen, A., Alaranta, A., Helenius, I., & Vasankari, T. (2011a). Dietary supplementation habits and perceptions of supplement use among elite Finnish athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 21(4), 271–279. <https://doi.org/10.1123/ijsnem.21.4.271>
- Heikkinen, A., Alaranta, A., Helenius, I., & Vasankari, T. (2011b). Use of dietary supplements in Olympic athletes is decreasing: A follow-up study between 2002 and 2009. *Journal of the International Society of Sports Nutrition*, 8, 1–8. <https://doi.org/10.1186/1550-2783-8-1>
- Hornstrom, G. R., Friesen, C. A., Ellery, J. E., & Pike, K. (2011). Nutrition knowledge, practices, attitudes, and information sources of Mid-American Conference college softball players. *Food and Nutrition Sciences*, 2, 109-117.
- Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D., Newman, T. B. (2013) *Designing clinical research: an epidemiologic approach*. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins. Appendix 6C, 79.

- Ishihara, J., Sobue, T., Yamamoto, S., Sasaki, S., & Tsugane, S. (2003). Demographics, lifestyles, health characteristics, and dietary intake among dietary supplement users in Japan. *International Journal of Epidemiology*, 32(4), 546-553.
- Jawadi, A. H., Addar, A. M., Alazzam, A. S., Alrabieah, F. O., Al Alsheikh, A. S., Amer, R. R., ... Badri, M. (2017). Prevalence of dietary supplements use among gymnasium users. *Journal of Nutrition and Metabolism*, 2017. <https://doi.org/10.1155/2017/9219361>
- Kabir, A., Miah, S., & Islam, A. (2018). Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLoS ONE* 13(6): e0198801. <https://doi.org/10.1371/journal.pone.0198801>
- Kantor, E. D., Rehm, C. D., Du, M., White, E., & Giovannucci, E. L. (2017). HHS Public Access, 316(14), 1464–1474. <https://doi.org/10.1001/jama.2016.14403>. Trends
- Karimian, J., & Esfahani, P. S. (2011). Supplement consumption in body builder athletes. *Journal of Research in Medical Sciences*, 16(10), 1347–1353. <https://doi.org/10.1016/j.gecco.2018.e00426>
- Keat, L. L., Saad, H. A., & Phing, C. H. (2017). Intake of Nutritional Ergogenic Aids among Malaysian Team Sport Athletes. *International Research Journal of Education and Sciences*, 1(1), 40–46.
- Kelly, V. G., Leveritt, M. D., Brennan, C. T., Slater, G. J., & Jenkins, D. G. (2017). Prevalence, knowledge and attitudes relating to  $\beta$ -alanine use among professional footballers. *Journal of Science and Medicine in Sport*, 20(1), 12-16.
- Kim, J., Kang, S. K., Jung, H. S., Chun, Y. S., Trilk, J., & Jung, S. H. (2011). Dietary supplementation patterns of Korean Olympic athletes participating in the Beijing 2008 Summer Olympic Games. *International Journal of Sport Nutrition and Exercise Metabolism*, 21(2), 166–174. <https://doi.org/10.1123/ijsnem.21.2.166>
- Knapik, J. J., Trone, D. W., Austin, K. G., Steelman, R. A., Farina, E. K., & Lieberman, H. R. (2016). Prevalence, Adverse Events, and Factors Associated with Dietary Supplement and Nutritional Supplement Use by US Navy and Marine Corps Personnel. *Journal of the Academy of Nutrition and Dietetics*, 116(9), 1423–1442. <https://doi.org/10.1016/j.jand.2016.02.015>
- Kobayashi, E., Sato, Y., Umegaki, K., & Chiba, T. (2017). The prevalence of dietary supplement use among college students: A nationwide survey in Japan. *Nutrients*, 9(11). <https://doi.org/10.3390/nu9111250>
- Kobryner, M. A. (2009). Dietary supplement use by athletes at a British university. *Leeds: Leeds Metropolitan University*.
- Kristiansen, M., Levy-Milne, R., Barr, S., & Flint, A. (2005). Dietary supplement use by varsity athletes at a Canadian University. *International Journal of Sport*

*Nutrition and Exercise Metabolism*, 15(2), 195–210.  
<https://doi.org/10.1123/ijsnem.15.2.195>

- Lieberman, H. R., Marriott, B. P., Williams, C., Judelson, D. A., Glickman, E. L., Geiselman, P. J., Dotson, L., & Mahoney, C. R. (2015). Patterns of dietary supplement use among college students. *Clinical Nutrition*, 34(5), 976–985. <https://doi.org/10.1016/j.clnu.2014.10.010>
- Lun, V., Erdman, K. A., Fung, T. S., Reimer, R. A. (2012). Dietary supplementation practices in canadian high-performance athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 22(1), 31–37. <https://doi.org/10.1123/ijsnem.22.1.31>
- Malaysian Adult Nutrition Survey (2014). *Dietary supplement use among adults in Malaysia*. Retrieved on October 16, 2018 from <http://www.e-mjm.org/2015/v70s1/mjm-sept-suppl-2087.html>
- Malaysian Adult Nutrition Survey (2014). *Food supplement intake among adults*. Retrieved on October 16, 2018 from <http://www.e-mjm.org/2015/v70s1/mjm-sept-suppl-2192.html>
- Maughan, R. J., Greenhaff, P. L., & Hespel, P. (2011). Dietary supplements for athletes: Emerging trends and recurring themes. *Journal of Sports Sciences*, 29(SUPPL. 1), 37–41. <https://doi.org/10.1080/02640414.2011.587446>
- Maughan, Ronald J., Burke, L. M., Dvorak, J., Larson-Meyer, D. E., Peeling, P., Phillips, S. M., ... Engebretsen, L. (2018). IOC consensus statement: Dietary supplements and the high-performance athlete. *International Journal of Sport Nutrition and Exercise Metabolism*, 28(2), 104–125. <https://doi.org/10.1123/ijsnem.2018-0020>
- Molinero, O., & Márquez, S. (2009). Revisión use of nutritional supplements in sports: Risks, knowledge, and behavioural-related factors. *Nutricion Hospitalaria*, 24(2), 128–134. <https://doi.org/S0212-16112009000200003>
- Muwonge, H., Zavuga, R., Kabenge, P. A., & Makubuya, T. (2017). Nutritional supplement practices of professional Ugandan athletes: A cross-sectional study. *Journal of the International Society of Sports Nutrition*, 14(1), 41. <https://doi.org/10.1186/s12970-017-0198-3>
- Outram S, Stewart B. Doping through supplement use: a review of the available empirical data. *Int J Sport Nutr Exerc Metab*, 25(1), 54–9.
- Parnell, J. A., Wiens, K., & Erdman, K. A. (2015). Evaluation of congruence among dietary supplement use and motivation for supplementation in young, Canadian athletes. *Journal of the International Society of Sports Nutrition*, 12(1), 49. <https://doi.org/10.1186/s12970-015-0110-y>
- Parnell, J. A., Wiens, K. P., & Erdman, K. A. (2016). Dietary intakes and supplement use in pre-adolescent and adolescent Canadian athletes. *Nutrients*, 8(9), 1–13. <https://doi.org/10.3390/nu8090526>
- Porrini, M., & Del Bo, C. (2016). Ergogenic Aids and Supplements. *Frontiers of Hormone Research*, 47, 128–152. <https://doi.org/10.1159/000445176>

- Saeedi, P., Mohd Nasir, M. T., Hazizi, A. S., Vafa, M. R., & Foroushani, R. A. (2013). Nutritional supplement use among fitness club participants in Tehran, Iran. *Appetite*, *60*, 20–26. <https://doi.org/10.1016/j.appet.2012.09.011>
- Salgado, J. V. V., Lollo, P. C. B., Amaya-Farfan, J., & Chacon-Mikahil, M. P. (2014). Dietary supplement usage and motivation in Brazilian road runners. *Journal of the International Society of Sports Nutrition*, *11*(1), 41. <https://doi.org/10.1186/s12970-014-0041-z>
- Sato, A., Kamei, A., Kamihigashi, E., Dohi, M., Akama, T., & Kawahara, T. (2015). Use of supplements by Japanese elite athletes for the 2012 Olympic games in London. *Clinical Journal of Sport Medicine*, *25*(3), 260–269. <https://doi.org/10.1097/JSM.0000000000000118>
- Sedek, R., Li, T. Z., Kambli, N. Z., & Kasim, Z. M. (2018). Food Science and Nutrition Technology The Use of Supplements among Adults in Selected Gymnasium in.
- Shaw, G., Slater, G., & Burke, L. M. (2016). Supplement use of elite Australian swimmers. *International Journal of Sport Nutrition and Exercise Metabolism*, *26*(3), 249–258. <https://doi.org/10.1123/ijsnem.2015-0182>
- Solheim, S. A., Nordsborg, N. B., Ritz, C., Berget, J., Kristensen, A. H., & Mørkeberg, J. (2017). Use of nutritional supplements by Danish elite athletes and fitness customers. *Scandinavian Journal of Medicine and Science in Sports*, *27*(8), 801–808. <https://doi.org/10.1111/sms.12704>
- Sousa, M., Fernandes, M. J., Carvalho, P., Soares, J., Moreira, P., & Teixeira, V. H. (2016). Nutritional supplements use in high-performance athletes is related with lower nutritional inadequacy from food. *Journal of Sport and Health Science*, *5*(3), 368–374. <https://doi.org/10.1016/j.jshs.2015.01.006>
- Sousa, M., Fernandes, M. J., Soares, J., Moreira, P., & Teixeira, V. H. (2016). Nutritional supplement-usage associated characteristics of high-performing athletes. *British Food Journal*, *118*(1), 26–39. <https://doi.org/10.1108/BFJ-03-2015-0088>
- Tavani, A., Colombo, P., Scarpino, V., Zuccaro, P., Pacifici, R., & La Vecchia, C. (2014). A survey of dietary supplement use among Italian sporting club athletes. *Nutrafoods*, *13*(1), 29–34. <https://doi.org/10.1007/s13749-014-0003-8>
- Tawfik, S., El-Koofy, N., & Moawad, E. M. (2016). Patterns of Nutrition and Dietary Supplements Use in Young Egyptian Athletes: A Community-Based Cross-Sectional Survey. *PLoS One*, *11*(8). doi:10.1371/journal.pone
- Tian, H. H., Ong, W. S., & Tan, C. L. (2009). Nutritional supplement use among university athletes in Singapore. *Singapore Medical Journal*, *50*(2), 165–172. <http://smj.sma.org.sg/5002/5002a8.pdf%5Chttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=2009154737>
- Tscholl, P., Alonso, J. M., Dollé, G., Junge, A., & Dvorak, J. (2010). The use of drugs and nutritional supplements in top-level track and field athletes. *American Journal of Sports Medicine*, *38*(1), 133–140.

<https://doi.org/10.1177/0363546509344071>

- Tsitsimpikou, C., Chrisostomou, N., Papalexis, P., Tsarouhas, K., Tsatsakis, A., & Jamurtas, A. (2011). The use of nutritional supplements among recreational athletes in Athens, Greece. *International Journal of Sport Nutrition and Exercise Metabolism*, 21(5), 377–384. <https://doi.org/10.1123/ijsnem.21.5.377>
- Turocy, P. S., Bernard, F., Horswill, C. A., Laquale, K. M., Martin, T. J., Perry, A. C., Somova, M. J., & Utter, A. C. (2011). National Athletic Trainers' Association Position Statement: Safe Weight Loss and Maintenance Practices in Sport and Exercise, 46(3), 322–336.
- Wardenaar, F., van den Dool, R., Ceelen, I., Witkamp, R., & Mensink, M. (2016). Self-Reported Use and Reasons among the General Population for Using Sports Nutrition Products and Dietary Supplements. *Sports*, 4(2), 33. <https://doi.org/10.3390/sports4020033>
- Wiens, K., Erdman, K. A., Stadnyk, M., & Parnell, J. A. (2014). Dietary supplement usage, motivation, and education in young Canadian athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 24(6), 613–622. <https://doi.org/10.1123/ijsnem.2013-0087>
- Žeželj, S. P., Tomljanović, A., Jovanović, G. K., Krešić, G., Peloza, O. C., Dragaš-Zubalj, N., & Prokurica, I. P. (2018). Prevalence, knowledge and attitudes concerning dietary supplements among a student population in Croatia. *International Journal of Environmental Research and Public Health*, 15(6). <https://doi.org/10.3390/ijerph15061058>

## APPENDIX B: CONSENT FORM



**JAWATANKUASA ETIKA UNIVERSITI UNTUK  
PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)  
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,  
SELANGOR, MALAYSIA**

### FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

#### 1. STUDY TITLE :

Factors Associated with Nutritional Supplementation Intake among Athletes in Universiti Putra Malaysia.

#### 2. INTRODUCTION:

Sports nutritional supplementation or ergogenic aids as additional source of nutrients other than food sources has become readily available worldwide and can be easily get over the counter. Compared to normal population, athletes and active person has higher consumption of supplement to enhance their sports performance and to improve body composition. However, the actual effects of supplementation intake on health are still not scientifically proven and safety issue of this product still under concern. This study aims to determine the factors associated with nutritional supplementation intake among athletes in Universiti Putra Malaysia.

#### 3. WHAT WILL YOU HAVE TO DO?

You need to read and understand about the study which was stated in Respondent's Information Sheet. If you voluntarily agree to participate in this study, you are required to sign the respondent's informed consent form. After completing the respondent's informed consent form, please return it to the researcher.

Things that you need to do are as follows;

- a) Fill in the questionnaire provided which comprises section for socio-demographics, nutritional supplementation intake, sports nutritional knowledge and physical activity level.
- b) The researcher will measure your height, weight and body fat percentage.
- c) Respondents will be interviewed to assess the dietary intake.

You have the right to withdraw from this study at any time without giving any reasons and no penalty will be applied upon your withdrawal.

#### 4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Individuals who are age less than 18 or more than 29 years old, non-athlete university students, physical disability and pregnant women will be excluded from this study.

**i. WHAT WILL BE THE BENEFITS OF THE STUDY:**

**(a) TO YOU AS THE SUBJECT?**

Information about nutritional supplementation intake among public university athletes may contribute to education improvement in this area. The findings of this study will enable health professionals develop strategies to educate the athletes on the advantages and disadvantages of supplementation intake.

**(b) TO THE INVESTIGATOR?**

This study will provide updated information on the factors associated with nutritional supplementation intake among public university athletes. Moreover, the information obtained may be useful for future research in the related field.

**6. WHAT ARE THE POSSIBLE RISKS?**

The respondents will not face any risks by taking part in this study.

**7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?**

All the information obtained from the respondents will remain strictly confidential. Any publication or result obtained will be reported in general (collectively) while respondent's identity will not be identified.

**8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?**

If there are any enquiries regarding this study, you may contact as follow;

**Researcher**

Siti Maizura binti Mohd Daud  
H/P: 017-3115582  
Email: maizuradaud95@gmail.com

Department of Nutrition and Dietetics,  
Faculty of Medicine and Health Sciences,  
Universiti Putra Malaysia,  
43400, UPM Serdang,  
Selangor Darul Ehsan.

**Supervisor**

Assoc. Prof. Dr. Hazizi Abu Saad  
H/P: 012-2126020  
Email: hazizi@upm.edu.my

Department of Nutrition and Dietetics  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
43400, UPM Serdang,  
Selangor Darul Ehsan.

*Please initial here if you have read and understood the contents of this page\_\_\_\_\_*

**9. CONSENT**

I ..... Identity Card No. ....  
address.....  
.....hereby voluntarily agree to take part in the  
research stated above \*(clinical /drug trial/video recording/ focus group/interview-based/  
questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse  
effects and complications (as written in the Respondent's Information Sheet). I understand that I  
have the right to withdraw from this research at any time without giving any reason whatsoever. I  
also understand that this study is confidential and all information provided with regard to my  
identity will remain private and confidential.

I\* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be  
used in any form of publication or presentation (if applicable)

\* delete where necessary

Signature ..... Signature .....  
(Respondent) (Witness)

Date :..... Name :.....

I/C No. :.....

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned  
research.

Date ..... Signature .....  
(Researcher)

**APPENDIX C: QUESTIONNAIRE**

Reference No:



**UPM**  
UNIVERSITI PUTRA MALAYSIA  
BERILMU BERBAKTI

**FACULTY OF MEDICINE AND HEALTH SCIENCES  
DEPARTMENT OF NUTRITION AND DIETETICS**

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**Questionnaire Form**

***“CONFIDENTIAL”***

**Research Title:**

**FACTORS ASSOCIATED WITH NUTRITIONAL  
SUPPLEMENTATION INTAKE AMONG ATHLETES IN  
UNIVERSITI PUTRA MALAYSIA**

**Researchers' Name : SITI MAIZURA BINTI MOHD DAUD**

**Supervisors' Name : ASSOC. PROF. DR. HAZIZI ABU SAAD**

**Date of Data Collection : / / 2019**

---

**This study is conducted for academic propose only. All information will be kept private and confidential. Thank you for your cooperation in answering this questionnaire.**

## SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

Instruction: Please write or tick (✓) your answer in the column provided.

1	Date of birth	____/____/____
2	Age	_____ Years old
3	Sex	<input type="checkbox"/> Male <input type="checkbox"/> Female
4	Ethnicity	<input type="checkbox"/> Malay <input type="checkbox"/> Chinese <input type="checkbox"/> Indian <input type="checkbox"/> Others, please specify: _____
5	Current educational level	<input type="checkbox"/> Undergraduate <input type="checkbox"/> Postgraduate
6	Course of study	Please specify: _____
7	Current year of study	<input type="checkbox"/> 1 <sup>st</sup> year <input type="checkbox"/> 2 <sup>nd</sup> year <input type="checkbox"/> 3 <sup>rd</sup> year <input type="checkbox"/> 4 <sup>th</sup> year <input type="checkbox"/> 5 <sup>th</sup> year <input type="checkbox"/> Others, please specify: _____
8	Monthly expenses (estimated)	Please specify: RM _____
9	Parents household income	Please specify: RM _____
10	Type of sport(s) played (you may tick more than one).	<input type="checkbox"/> Athletics <input type="checkbox"/> Swimming <input type="checkbox"/> Archery <input type="checkbox"/> Rugby <input type="checkbox"/> Badminton <input type="checkbox"/> Taekwondo <input type="checkbox"/> Others, please specify: _____
11	Level of sports event played (you may tick more than one).	<input type="checkbox"/> Inter-college <input type="checkbox"/> University <input type="checkbox"/> District <input type="checkbox"/> National <input type="checkbox"/> International <input type="checkbox"/> Others, please specify: _____
12	Number of year(s) of participation in the competition. Please state.	<input type="checkbox"/> Inter-college : _____ years <input type="checkbox"/> University : _____ years <input type="checkbox"/> District : _____ years <input type="checkbox"/> National : _____ years <input type="checkbox"/> International : _____ years <input type="checkbox"/> Others, please specify, _____ : _____ years

## SECTION B: SUPPLEMENT USE

Do you currently taking any form of nutritional supplement?

- Yes      → Please complete Part 1 and 2  
 No        → Skip to Section C

### PART 1

Instruction: Please write or tick (✓) your answer in the column provided.

<b>Category 1: Energy Supplement</b>			
Tick (✓) which nutritional supplement you are currently taking	How long have you been taking supplement? (Weeks/Months/ Years)	How many days per week?	**Fill in alphabets for reason of usage (Refer table below)
Yes	No		
<input type="checkbox"/>	<input type="checkbox"/>		<b>Energy Drinks</b>
<input type="checkbox"/>	<input type="checkbox"/>		Calorie Replacements (e.g. energy bars, recovery bar)
<input type="checkbox"/>	<input type="checkbox"/>		<b>Caffeine</b>
<input type="checkbox"/>	<input type="checkbox"/>		ATP
<input type="checkbox"/>	<input type="checkbox"/>		<b>MCT oils</b>
<input type="checkbox"/>	<input type="checkbox"/>		Pyruvate
<input type="checkbox"/>	<input type="checkbox"/>		<b>Other: Please Specify:</b>

\*\*

Reason of usage	Alphabet
I decided I needed to use supplement	A
Inadequate diet	B
Improve speed or agility	C
Improve strength or power	D
Weight gain/muscle gain	E
For my health	F
Able to train longer/endurance	G
Speed up my recovery (after injury)	H
Weight loss/fat loss	I
Makes me feel better	J
Increase energy levels	K
Prevent injury and illness	L
Increase my ability to cope with pain	M
Improve my concentration	N
Alter my genes to enhance my performance	O
Help me to relax	P

**Category 2: Protein Supplements/Weight Gainers**

Tick (✓) which nutritional supplement you are currently taking		How long have you been taking supplement? (Weeks/Months/ Years)	How many days per week?	**Fill in alphabets for reason of usage (Refer table below)
Yes	No			
<input type="checkbox"/>	<input type="checkbox"/>	Whey protein		
<input type="checkbox"/>	<input type="checkbox"/>	Weight gainer powders		
<input type="checkbox"/>	<input type="checkbox"/>	Protein powder		
<input type="checkbox"/>	<input type="checkbox"/>	Branched Chain Amino Acids (BCAA)		
<input type="checkbox"/>	<input type="checkbox"/>	Amino acids		
<input type="checkbox"/>	<input type="checkbox"/>	Creatine		
<input type="checkbox"/>	<input type="checkbox"/>	Arginine		
<input type="checkbox"/>	<input type="checkbox"/>	Aspartic acid		
<input type="checkbox"/>	<input type="checkbox"/>	Glutamine		
<input type="checkbox"/>	<input type="checkbox"/>	Hydroxy beta-methylbutyric		
<input type="checkbox"/>	<input type="checkbox"/>	Soy protein and isoflavones		
		Other: Please specify _____		

\*\*

Reason of usage	Alphabet
I decided I needed to use supplement	A
Inadequate diet	B
Improve speed or agility	C
Improve strength or power	D
Weight gain/muscle gain	E
For my health	F
Able to train longer/endurance	G
Speed up my recovery (after injury)	H
Weight loss/fat loss	I
Makes me feel better	J
Increase energy levels	K
Prevent injury and illness	L
Increase my ability to cope with pain	M
Improve my concentration	N
Alter my genes to enhance my performance	O
Help me to relax	P

**Category 3: Vitamins and Mineral Supplements**

Tick (✓) which nutritional supplement you are currently taking		How long have you been taking supplement? (Weeks/Months/Years)	How many days per week?	**Fill in alphabets for reason of usage (Refer table below)
Yes	No			
<input type="checkbox"/>	<input type="checkbox"/>	Multi-vitamin		
		Vitamin E		
<input type="checkbox"/>	<input type="checkbox"/>	Vitamin C		
		Beta-Carotene		
<input type="checkbox"/>	<input type="checkbox"/>	Folic Acid		
		B 6		
<input type="checkbox"/>	<input type="checkbox"/>	B 12		
		Biotin		
<input type="checkbox"/>	<input type="checkbox"/>	Pantothenic Acid		
		Niacin		
<input type="checkbox"/>	<input type="checkbox"/>	B-Complex Vitamins		
		Vitamin D		
<input type="checkbox"/>	<input type="checkbox"/>	Multi-vitamin with mineral		
		Iron		
<input type="checkbox"/>	<input type="checkbox"/>	Calcium		
		Phosphorus		
<input type="checkbox"/>	<input type="checkbox"/>	Zinc		
		Potassium		
<input type="checkbox"/>	<input type="checkbox"/>	Selenium		
		Sodium Bicarbonate		
<input type="checkbox"/>	<input type="checkbox"/>	Copper		
		Magnesium		
<input type="checkbox"/>	<input type="checkbox"/>	Cobalt		

\*\*

Reason of usage	Alphabet
I decided I needed to use supplement	A
Inadequate diet	B
Improve speed or agility	C
Improve strength or power	D
Weight gain/muscle gain	E
For my health	F
Able to train longer/endurance	G
Speed up my recovery (after injury)	H
Weight loss/fat loss	I
Makes me feel better	J
Increase energy levels	K
Prevent injury and illness	L
Increase my ability to cope with pain	M
Improve my concentration	N
Alter my genes to enhance my performance	O
Help me to relax	P

**Category 4: Herbals**

Tick (✓) which nutritional supplement you are currently taking		How long have you been taking supplement? (Weeks/Months/ Years)	How many days per week?	**Fill in alphabets for reason of usage (Refer table below)
Yes	No			
<input type="checkbox"/>	<input type="checkbox"/>	Ginseng		
<input type="checkbox"/>	<input type="checkbox"/>	Ginkgo biloba		
<input type="checkbox"/>	<input type="checkbox"/>	Green Tea Extract		
<input type="checkbox"/>	<input type="checkbox"/>	St. John's Wart		
<input type="checkbox"/>	<input type="checkbox"/>	Echinacea		
<input type="checkbox"/>	<input type="checkbox"/>	Ma Huang (Ephedra)		
<input type="checkbox"/>	<input type="checkbox"/>	Saw-Palmeto		
<input type="checkbox"/>	<input type="checkbox"/>	Wheat grass/ barley grass		
<input type="checkbox"/>	<input type="checkbox"/>	Yohimbine		
<input type="checkbox"/>	<input type="checkbox"/>	Herbal mix		
<input type="checkbox"/>	<input type="checkbox"/>	Other: Please specify _____		

\*\*

Reason of usage	Alphabet
I decided I needed to use supplement	A
Inadequate diet	B
Improve speed or agility	C
Improve strength or power	D
Weight gain/muscle gain	E
For my health	F
Able to train longer/endurance	G
Speed up my recovery (after injury)	H
Weight loss/fat loss	I
Makes me feel better	J
Increase energy levels	K
Prevent injury and illness	L
Increase my ability to cope with pain	M
Improve my concentration	N
Alter my genes to enhance my performance	O
Help me to relax	P



## PART 2

Where have you heard or learned about nutritional supplement. Please tick (√) your answer in the column provided.

<b>Sources of information</b>	<input checked="" type="checkbox"/>
Doctor	
<b>Pharmacist</b>	
Registered Dietitian	
<b>Fellow students athletes</b>	
Professional athletes	
<b>Family</b>	
Friends	
<b>Coach</b>	
Fitness trainer	
<b>Strength coach</b>	
Magazines	
<b>Television</b>	
Radio	
<b>Books</b>	
Internet	
<b>Store nutritionist</b>	
Self	
<b>Other</b>	

## SECTION C: SPORTS NUTRITIONAL KNOWLEDGE

To respond to this section, please indicate your answer to each statement by selecting the alternative that best corresponds to what YOU know about that statement.

NO	T = True    F = False    DK = Don't Know	T	F	DK
1	Carbohydrates are not as easily and rapidly digested as protein and fat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Eggs and legumes are examples of protein sources other than meats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Protein is the primary source of muscular energy for the athlete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	No more than 15% of calories in the diet should be provided by fat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Protein is not stored in the body; therefore, it needs to be consumed every day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Excess vitamin supplementation may harm the physically active person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Vitamin supplementation is recommended for all physically active persons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Vitamins are a good source of energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Carrots are a good source of vitamin A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	The body can synthesis vitamin D upon exposure to the sun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Alcohol has more calories per gram than protein	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Caffeine can increase the risk of dehydration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	During exercise, mass ingestion of large amounts of fluid is preferred over frequent ingestion of small amounts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Dehydration can impair physical performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	During activity, thirst is an adequate guide to the need for fluids	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Sports drinks are the best way to replace body fluids lost during exercise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Skipping meals is justifiable if you need to lose weight quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	A person with a higher percentage of body fat may weigh less than a person of the same size with a greater muscle mass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	A high fat meal, which is slowly digested, should be avoided before athletic events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	The pre-event meal should be eaten about 3-4 hours before competition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	A sound nutritional practice for athletes is to eat a wide variety of different food types from day to day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Nutrition is more important during the competitive season than during the off-season for the athlete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	An athlete should drink no water during practice, but rather rinse out his or her mouth or suck on ice cubes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	A lack of iron in the diet can result in fatigue, injury, and illness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	Increasing protein in the diet is necessary in order to increase muscle mass of the body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## SECTION D: PHYSICAL ACTIVITY LEVEL

The following questions ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment.

In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

### Work

1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?

Yes

No

→ Skip to question 4

2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work?

\_\_\_\_\_ days

3. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

\_\_\_\_\_ hours \_\_\_\_\_ minutes

4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?

Yes

No

→ Skip to question 7

5. In a typical week, on how many days do you do moderate-intensity activities as part of your work?

\_\_\_\_\_ days

6. How much time do you spend doing moderate-intensity activities at work on a typical day?

\_\_\_\_\_ hours \_\_\_\_\_ minutes

### Travel to and from places

The next questions exclude the physical activities at work that you have already mentioned.

Now the following questions ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship

7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?

Yes

No

→ Skip to question 10

8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?

\_\_\_\_\_ days

9. How much time do you spend walking or bicycling for travel on a typical day?

\_\_\_\_\_ hours \_\_\_\_\_ minutes

### Recreational activities

The next questions exclude the work and transport activities that you have already mentioned.

Now the following questions ask you about sports, fitness and recreational activities (leisure).

10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously?

Yes

No

→ Skip question 13

11. In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (leisure) activities?

\_\_\_\_\_ days

12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

\_\_\_\_\_ hours \_\_\_\_\_ minutes

13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, volleyball] for at least 10 minutes continuously?

Yes

No

→ Skip to question 16

14. In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (leisure) activities?

\_\_\_\_\_ days

15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?

\_\_\_\_\_ hours \_\_\_\_\_ minutes

### **Sedentary behavior**

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping.

16. How much time do you usually spend sitting or reclining on a typical day?

\_\_\_\_\_ hours \_\_\_\_\_ minutes

## SECTION E: ANTHROPOMETRY MEASUREMENTS

To be filled by researcher.

Measurements	Reading 1	Reading 2	Average
Height (cm)			
Weight (kg)			
BMI (kg/m <sup>2</sup> )			
Body fat (%)			



UPM

**SECTION F: DIETARY INTAKE**

The following questions ask about your dietary intake during the past 24-hours. You should recall back your meal type, meal time, food/drink, quantity eaten, and details of the food/drink in the time stated. Please be as specific as you can on what you consume and its quantity.

Time and location	Food and beverages	Amount Eaten	Detailed Description
-------------------	--------------------	--------------	----------------------

**BREAKFAST**

Time: \_\_\_\_\_

<p><b>MORNING TEA</b></p> <p>Time: _____</p>			
--	--	--	--

**LUNCH**

Time: \_\_\_\_\_

<p><b>AFTERNOON TEA</b></p> <p>Time: _____</p>			
--	--	--	--

**DINNER**

Time: \_\_\_\_\_

<p><b>SUPPER</b></p> <p>Time: _____</p>			
---	--	--	--

**END OF QUESTIONNAIRE**  
**THANK YOU FOR YOUR PARTICIPATION AND COOPERATION**