An investigation into the protein supplement's use, type and frequency of exercise and potential factors influencing protein supplement use among gymnasium users in Sibu, Sarawak, Malaysia.

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An investigation into the protein supplement's use, type and frequency of exercise and potential factors influencing protein supplement use among gymnasium users in Sibu, Sarawak, Malaysia.

by

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DECLARATION

I, Michael Lo Zhen Haw hereby declare that the thesis is my original work done by me except for quotations and citations which has been duly acknowledged. I also declare that it has not been previously and is not currently submitted by any other degree at Univerisiti Sains Malaysia or at any other institution.

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CI	Confidence Interval
df	Degree of Freedom
M	Mean
N	Number
p	Probability
t	Test

LIST OF ABBREVIATIONS

FDA	Food & Drug Administrations
IBM SPSS	Statistical Package for the Social Sciences
MOH	Ministry of Health
QR	Quick Response
RNI	Recommended Nutrient Intake
USM	Universiti Sains Malaysia
WHO	World Health Organization

LIST OF APPENDICES

KAJIAN TENTANG KELAZIMAN DAN PERSEPSI PENGGUNAAN SUPLEMEN PROTEIN DAN JENIS SERTA KEKERAPAN SENAMAN DALAM KALANGAN PENGGUNA GIM DI SIBU, SARAWAK, MALAYSIA.

ABSTRAK

Objektif: Untuk mengkaji penggunaan suplemen protein yang dilapor sendiri, jenis dan kekerapan senaman, serta faktor-faktor yang berpotensi mempengaruhi penggunaan suplemen protein dalam kalangan pengguna gim di Sibu, Sarawak, Malaysia. **Kaedah:** Borang soalselidik (Project Protein Questionnaire) diberikan secara atas talian kepada pengguna gim di Sibu, Sarawak, Malaysia. Tempoh pengumpulan data adalah dari April – Jun 2021 dan seramai 387 peserta yang layak telah menjawab borang soalselidik tersebut. Data seperti maklumat demografi peserta, jenis dan kekerapan senaman yang dilakukan, dos suplemen protein, serta sebab-sebab pengambilan suplemen protein telah direkod dan dianalisa. **Keputusan:** Terdapat 143 (37%) pengguna suplemen protein dan 244 (63%) bukan pengguna dalam kajian ini. Pengambilan dos suplemen protein yang dilaporkan sendiri menunjukkan perbezaan berbanding cadangan pengambilan nutrient (RNI)**.** Walaupun terdapat perbezaan dalam kekerapan senaman antara pengguna protein dan bukan pengguna, tetapi menjadi seorang pengguna suplemen protein tidak menyebabkan peningkatan dalam kekerapan dalam laithan gim. Melakukan senaman otot perut merupakan salah satu faktor seseorang itu menjadi seorang pengguna suplemen protein. Peserta yang ingin meningkatkan prestasi meningkatkan kemungkinan menjadi seorang pengguna suplemen protein. Tahap kepuasan badan dan umur juga merupakan salah satu faktor menjadi seorang pengguna suplemen protein. **Kesimpulan:** Terdapat lebih ramai bukan pengguna protein daripada pengguna dalam kalangan pengguna gim

rekreasi di mana kebanyakan adalah lelaki (93%). Kekerapan senaman adalah berbeza antara pengguna protein dan bukan pengguna. Faktor-faktor yang berkait dengan seseorang itu menjadi pengguna suplemen protein termasuklah senaman otot perut, kepuasan badan dan umur. Maklumat yang didapati daripada kajian ini dapat membantu pengguna gim dan pengamal kecegasan untuk memahami fator-faktor yang mungkin mempromosikan penggunaan protein, jenis dan kekerapan senaman dan sebagai satu strategi dalam merancang nutrisi dan latihan yang tepat kepada mereka.

AN INVESTIGATION INTO THE PROTEIN SUPPLEMENT'S USE, TYPE AND FREQUENCY OF EXERCISE AND POTENTIAL FACTORS INFLUENCING PROTEIN SUPPLEMENT USE AMONG GYMNASIUM USERS IN SIBU, SARAWAK, MALAYSIA.

ABSTRACT

Objectives: To investigate the gym-goers' self-reported protein supplement use, type and frequency of exercise, and potential factors influencing protein supplement use. **Method:** An online questionnaire was administered to gym-goers attended gym in Sibu, Sarawak, Malaysia. The data collection period was from April – Jun 2021 and 387 eligible participants answered the questionnaire. Data such as participants' demographic, exercise type and frequency, protein supplement dosage, reasons for taking supplement and protein food source intake were recorded and analyzed. **Results:** There were 143 protein supplement users (37%) and 244 non-users (63%) identified in this study. Self-reported protein supplement dosage appeared to differ from recommended nutrient intake (RNI). Although there was a significant difference in exercise frequency between protein users and non-protein users, being a protein supplement user did not caused an increased frequency of exercise. Executing abdominal exercise was a factor for being a protein supplements user. Participants who wanted to improve performance increased the likelihood of being a protein supplements user. Body satisfaction level and age were also a factor for being a protein supplements user. **Conclusions:** There are more non-protein users than users among the recreational gym goers, in which most of them are males (93%). Frequency of exercise between protein users and non-protein users were different. Factors associated with being a supplement user were abdominal exercise, body

satisfaction and age. The information from this study may assist gym-goers and fitness practitioners to understand the likely factors that promote protein use, exercise frequency and exercise types as a strategy in planning the correct nutrition and training for them.

CHAPTER 1

INTRODUCTION

1.1 Study Background

Protein, known as one of the macronutrients, is important for humans. Amino acid is the simplest form of protein structure that exists in the human body for various functions. Amino acids are the simplest structure form of protein, with peptide bonding between the carboxyl and amino group on other amino acids, which eventually form a polypeptide chain (Berg *et al*., 2002). Out of 20 amino acids present in the proteins, nine are essential amino acids or nutritionally indispensable. This is because our body is not able to produce those amino acids and have to obtain them through nutrition intake. The example of the essential amino acid includes leucine, isoleucine, histidine, lysine, valine, methionine, threonine, tryptophan and phenylalanine (Watford & Wu, 2018). Ranging from essential amino acids to non-essential acids, some of them played an important part in human growth functions, for example, arginine, lysine and ornithine. These amino acids help in promoting the production of human growth hormones.

In relation to exercise, these amino acids promote and enhance muscle mass and strength gains (Chromiak & Antonio, 2002). It is known that protein intake in the form of a supplement can help in improving muscle mass, also known as muscle hypertrophy (Stark *et al*., 2012; Pasiakos *et al*., 2014). Hence, there is an increasing prevalence of supplements being used among gym-goers. A study by Morrison *et al*. (2004) in gym-goers who exercised regularly in Long Island, New York, U.S., shows that most participants (84.7%) reported using at least one type of supplement. Among the supplements, there was 42.3% of the participants reported using protein shakes as a

supplement in relation to their exercise in the gym (Morrison *et al*., 2004). The use of supplements may be perpetrated for a few reasons. A study of gym-goers in Seville, Spain by Sanchez-Oliver *et al*. (2011) shows that about 48% of the participants stated the first reason they went to the gym is to be in good shape. The participants indicate that the second reason (19%) was they wanted to exercise, and the third reason (11.1%) was because of health benefits (Sanchez-Oliver et al., 2011).

According to RNI, the recommended daily protein intake for Malaysian adults is around 1.00 g protein/kg body weight/day with reference weights for Malaysian male adults with 60.6kg to 61.4kg and female adults of 52.2kg to 52.9kg (MOH, 2017). As for athletes, a recommended intake of 2.2g/kg of protein supplement helps maximize resistance training-induced gains in lean body mass (Iraki *et al*., 2019). Studies by Egan (2016) showed that team sport athletes among females required 0.8 to 1.7g/kg of protein intake, whereas males required 1.2 to 2.3g/kg in team sports. For strength and power athletes, the protein intake is 2 to 4 times more, with females intake is 2.5g/kg and males intake is 3.2g/kg (Egan, 2016). The adverse effect following protein supplementation has been reported. According to the FDA, there are side effects such as appetite loss, nausea, abdominal pain and others. (U.S. Food & Drug, 2018). In the Malaysian market, there are many different kinds of protein that can be easily obtained from the gym, physical shops and e-commerce stores. A search on the online shopping web-like Lazada, Shopee and Amazon, shows protein supplements with a wide variety of choices being sold. There are different flavours, dosages, and they come in the form of powder, capsule and snack bar, including certified halal status for the Malaysian market (Lazada n.d.).

A study by Morrison *et al.* (2004) showed that the justification of protein intake in 49.1% of the participants was chosen to build up muscle mass, 24.4% wanted to improve performance in a sport, 22.4% wanted to gain strength, and the rest is for body improvement purposes (Sanchez-Oliver *et al.*, 2011). Another study by Carbone *et al.* (2019) showed that male gym-goers with weight around 76.5kg consumed 2.2g to 2.8g/kg/day of protein which is approximately 309% of the daily recommended intake of protein for the general population, 190% for resistance athletes and 141% for strength athletes. An evaluation of varied experimental designs suggested that coupling post-resistance exercise protein ingestion of 0.25 to 0.30g/kg and habitual protein intake of approximately 1.6g/kg/d helped to promote favourable muscle adaptations to exercise training (Carbone *et al.*, 2019). More than half of the participants (55%) consumed supplements without seeking any professional advice and guidance, while 74% of the participants, mostly female (El Khoury & Antoine-Jonville, 2012), reported having a nutritionist. It was reported that participants took supplements by self-prescription, recommended by friends, sellers in the supplement store or influenced by advertisement. Participants (55%) claimed that they had obtained the desired response with the consumption (Morrison *et al.*, 2004; El Khoury & Antoine-Jonville, 2012).

1.2 Problem statement

Protein supplement has been a norm for some regular gym-goers. Although there are current Recommended Nutrient Intake (RNI) guidelines for protein intake from the Ministry of Health Malaysia (MOH) and the World Health Organisation (WHO), there may be discrepancies in the level of protein intake among gym-goers in Malaysia that may lead to an unnecessarily high intake of protein as ergogenic aids. There is currently no data on the factors that influence protein supplement consumption in gym-goers in

Malaysia. Due to the lack of knowledge about protein supplement intake, they tend to surf the internet for more information. Eventually, gym-goers might learn about protein supplements from unverified articles and sources rather than seeking health professionals' advice.

1.3 Objectives

General objective

To investigate the gym-goers' self-reported protein supplement's use, type and frequency of exercise and potential factors influencing protein supplement use.

Specific objectives:

1. To determine the prevalence of protein supplement users among gym-goers
2. To determine the dosage of protein supplements used in relation to recommended nutrient intake (RNI) among gym-goers
3. To determine the frequency and duration of gym use between protein users and non-users.
4. To determine the type of exercises in relation to protein users and non-users among gym-goers
5. To determine the strongest factors influencing protein supplement consumption among gym-goers

1.4 Research Questions and Hypotheses

For specific objective 1

What is the percentage of self-reported protein supplement users among the gym-goers?

H_{O1} : There is no significant difference in the percentage of self-reported protein supplement users than non-users among the gym-goers

H_{A1} : There is a significantly higher percentage of the self-reported protein supplement users than non-users among the gym-goers

For specific objective 2

What is the self-reported dosage of protein supplement use in relation to protein RNI among gym-goers?

H_{O2} : There is no significant difference in the self-reported dosage of protein supplement use in relation to protein RNI among gym-goers

H_{A2} : There is a significantly higher self-reported dosage of protein supplement use in relation to protein RNI among gym-goers

For specific objective 3

Is there any significant difference in the frequency of gym use between protein supplements users and non-users?

H_{O3} : There is no significant difference in the frequency of gym use between protein supplements users and non-users

H_{A3} : There is a significantly higher frequency of gym use in relation to protein supplements users and non-users

For specific objective 4

Is there any significant difference in the type of exercise between protein supplements users and non-users

H_{O4} : There is no significant difference in the type of exercise between protein supplements users and non-users

H_{A4} : There is a significant difference in the type of exercise between protein supplements users and non-users

For specific objective 5

Is there any significantly increased likelihood of being a protein supplement user for age, gender, level of education, frequency and type of exercise among the gym-goers?

H_{O5} : The is no significantly increased likelihood of being a protein supplement user for age, gender, level of education, frequency and type of exercise among the gym-goers

H_{A5} : The is no significantly increased likelihood of being a protein supplement user for age, gender, level of education, frequency and type of exercise among the gym-goers

1.5 Significance of the study

The importance of this study is to identify the number of Malaysian gym-goers' protein supplement users, frequency and type of training, as well as the possible factors that influence their protein supplement use. This study is important because it serves as a preliminary study and basic guidelines to understand the recommended dosage of protein supplements for gym-goers to have proper muscle growth without overconsumption.

CHAPTER 2

LITERATURE REVIEW

2.1 Protein and Recommended Nutrient Intake (RNI)

Proteins are present in all living things. It contains a lot of great nutritional value to our human body functions and growth. It was recognised by a Swedish scientist, Jöns Jacob Berzelius, who came to the word ‘‘protein’’, derived from the Greek word called *prōteios*, which means ‘’holding first place’’ (Koshland *et al*., 2020). Proteins are macronutrients that are required by humans for metabolic functions in daily life. Proteins are linear chains that consist of a combination of their monomer units called amino acids. Proteins can be in many forms of level structure such as primary structure, secondary structure, tertiary structure and quaternary structure. The functions of the proteins are directly dependent on their arranged structure, respectively (Berg *et al*., 2002). There are nine essential amino acids and 11 non-essential amino acids. The examples of the essential amino acids are leucine, isoleucine, lysine, methionine, threonine, tryptophan, phenylalanine and valine, whereas the non-essential amino acids are alanine, arginine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine and tyrosine (Watford & Wu, 2018). It is known that leucine, which is a branched-chain amino acid, has better functions in muscle hypertrophy and muscle recovery after intense exercises. (Kimball & Jefferson, 2006; Rowlands *et al*., 2015).

According to Recommended Nutrient Intake (RNI), protein intake for a normal adult male is 61g to 62g per day, which helps in body maintenance and growth. In contrast, female protein intake is 52g to 53g per day (which is around 1g/kg body weight per day). As for athletes involved in high exercise frequency and would require enhanced muscle recovery, protein intake will be higher than the normal population, 20% to 30% of their

energy intake (1.8 to 2.7g/kg/day) (MOH, 2017). Athletes required different amounts of protein (Kårlund *et al.*, 2019). For example, it is reported that male strength and power athletes required 3.2g/kg and females need 2.5g/kg to have effective performance. As for team sport athletes, males required an intake in the range of 1.2-2.3g/kg and females required 0.8 to 1.7g/kg (Egan, 2016). A paper by Razalee Sedek in 2018 showed that among the participants (249 males and 66 females) in Malaysia, 178 males and 31 female protein intake users relate to gym exercise and activities (Sedek, 2018).

It was reported that over the year 2012 to 2017, protein supplements showed an increasing trend and were increasingly consumed by Malaysian and Singaporean, with the purchase of supplements increased from RM109mil to RM154.7mil (Tartu, 2018). Protein supplement brands like Optimum Nutrition and MuscleTech can be easily obtained in physical malls in Malaysia, such as GNC shops. The protein supplements are whey protein and come in different flavours such as chocolate, strawberry and vanilla (Leong, 2020). Online shopping platforms like Lazada also sell protein supplements in various forms. For example, protein bars, powdered form and certified halal-status (Lazada, n.d.).

2.2 Protein Functions and Effects on Muscle Mass

Proteins that are present in our body have a lot of functions. For example, all enzymes in the human body are proteins that help in catalysing biochemical reactions. Enzymes are substances that speed up the pace of certain reactions in the body. These enzymes are important for chemical processes present in our body, such as cellular metabolism and digestion. Amylase, lipase, pepsin and trypsin are the example of digestive enzymes that helps in the function of digestion of food that we consumed in the body into monomer units for metabolism. Immunoglobulins are defence mechanisms in the body for the

prevention of foreign pathogens entering the body. As for muscle contractions, contractile proteins, for example, actin and myosin, are responsible for muscle contraction in the body for muscle movement and body motion. (Libretexts, 2020) (Carter, n.d.).

Generally, protein source for example leucine has an impact on protein synthesis on muscle mass. Males and females have different body compositions, for example, different levels of testosterone present in the body (Clark *et al*., 2018; Tipton, 2001). Testosterone played an essential role in the male in enhancing muscle protein synthesis. Due to the differences in the level of testosterone, the male appeared to be more masculine (van Anders *et al.*, 2015). Testosterone affects the protein synthesis between males and females because testosterone helps build bone density (Tyagi *et al*., 2017) and muscle mass (Griggs *et al*., 1989). It is also known that testosterone helps in net muscle protein balance. Thus, males will have significantly clear muscle hypertrophy results than females (Tipton, 2001).

Males generally have more lean mass than females, which means a male's absolute protein needs are greater than in women. However, evidence by Evans and colleagues showed that males would require intake of 1.3g/kg/day of protein for lean mass maintenance whereas slightly lower protein intake in the female with a recorded intake of 1.2g/kg/day of protein (Evans *et al*., 2012). It is known that post-exercise ingestion of protein increases post-exercise muscle protein synthesis rate and facilitates adaptive response to prolonged exercise (van Loon *et al*., 2014). However, muscle protein synthesis showed an equally increment between young males and females (Markofski *et al*., 2011).

2.3 Effect of Protein Supplement in relation to the Frequency and Type of Exercise

Recent meta-analysis research regarding protein supplementation to muscle mass gains showed that there is a relationship between resistance training and post-workout protein intake (Morton *et al*., 2018; Coburn *et al*., 2006; Bird *et al*., 2006). Other findings demonstrated that intake of whey protein could promote muscle recovery after carbohydrate drink, which found that the group consumed protein supplement has a significant result of showing a faster recovery rate (West *et al*., 2017). Specifically, leucine, an essential amino acid and branched-chain amino acid, has been shown to stimulate muscle protein synthesis upon high dosages (Cintineo *et al*., 2018). Leucine in high dosage also inhibits protein degradation in skeletal muscle and liver. The mechanism of leucine that promotes muscle protein synthesis is that leucine enhancing sensitivity to insulin (Garlick, 2005).

Protein such as leucine or (leucine enriched essential amino acids) helps in building muscle mass (Stark *et al*., 2012; Volek *et al*., 2013) and also muscle recovery after exercise (Matsui *et al.*, 2019). In contrast, there was data showing that protein intake with the carbohydrate-restricted state prior to endurance-type exercise did not show any enhancement in muscle growth and recovery because of the body priority shift of energy preservation (Larsen *et al*., 2020). Another study on judoist's aerobic and anaerobic power with the use of protein supplements shown that there were changes among the judoist during the early training phase (Laskwoski & Antoiewicz, 2003). Study on exercise frequency in relation to protein supplements by Pasiokos in 2014 showed that the results are significant in changes of lean mass and muscle strength among untrained individuals. Another study by Rossi and Tirapegui (2016) related to protein supplement and exercise frequency also concluded that there was a statistically significant association

between exercise frequency of more than five days a week and consumption of nutritional supplements such as protein supplements.

A study of protein intake ingestion with relation to strength exercise concluded that people with protein supplement ingestion before and after exercise showed a positive effect on muscle lean mass and strength (Candow *et al*., 2006). However, there is no clear significant result with protein supplement intake on the increment in lean muscle mass and muscle strength with exercise duration of less than 8 weeks (Herda *et al*., 2013). A recent study on people in Beirut regarding protein supplement intake showed that there were 72% males taking protein supplements. It was reported that these participants exercised for at least more than a year (El Khoury & Antoine-Jonville, 2012). Another study regarding protein intake between males and females in the United Kingdom (UK) and Europe countries clearly showed that more males have protein intake than females with 94.7% and intake frequency of 4.5 ± 1.2 per week (Ewan *et al*., 2019). This study also can be supported by Ruano and Teixeira (2020) showing more males being protein supplements users with 62.7% than females ($p<0.005$) (Ruano & Teixeira, 2020). However, a study showed that males have the highest number intake of protein supplements than females, but it was not statistically significant ($p = 0.22$) (Whitehouse & Lawlist, 2017). A study by El Khoury and Antoine-Jonville in 2012 shown that whey protein users mostly were male users with a percentage of almost 90%, and protein powder recorded with almost all of the users were males with no reported female users.

2.4 Prevalence of Protein Supplement Use and Protein Dosage among Gym-goers

A report by Sedek in 2018 showed that in Malaysia, there were 66.3% supplement users. Gender-wise, there were 71.5% males and 47% females who took supplements. Among

these supplements users, they were users of protein bars, protein shakes, protein powder, protein from casein, soy and whey and sports bar with percentages range between50.8% to 73.7% (Sedek, 2018). This report can also be supported by research in Saudi Arabia that gender distributions were significantly high between two groups (P = 0.0001) with recorded 89.4% male and 10.6% female with 38.9% were protein-based supplements which recorded having the highest among other supplements (Jawadi *et al*., 2017). The authors also recorded that the prevalence of protein supplements use was 37.8% among gym-goers. The prevalence of supplement use among gym-goer in Switzerland was recorded 82% and 43%of these gym-goers were users of protein powder and drinks (Mettler *et al*., 2020). Morrison *et al.* in 2004 concluded that the use of protein supplements five times per week helps in muscle growth. Therefore, an increased prevalence of the use of protein supplements may be due to reasons that it provided health benefits.

CHAPTER 3

METHODOLOGY

3.1 Study Design and Sampling Method

The present study is a descriptive study that involves data collection through a questionnaire (Figure 3.1). Purposive sampling was used to recruit participants via the dissemination of online questionnaires to several gyms in Sibu, Sarawak.

3.2 Participants' selection criteria

3.2.1 Inclusion criteria

Participants included in this study were healthy young men and women, age between 19-40 years old, who exercise regularly at commercial and community gyms located in Sibu, Sarawak. They were also have attended the gym for at least 3 months prior to the study.

3.2.2 Exclusion criteria

Participants were excluded if they were using medications, having acute/chronic musculoskeletal injuries and inflammatory disease, smoking and pregnant (women).

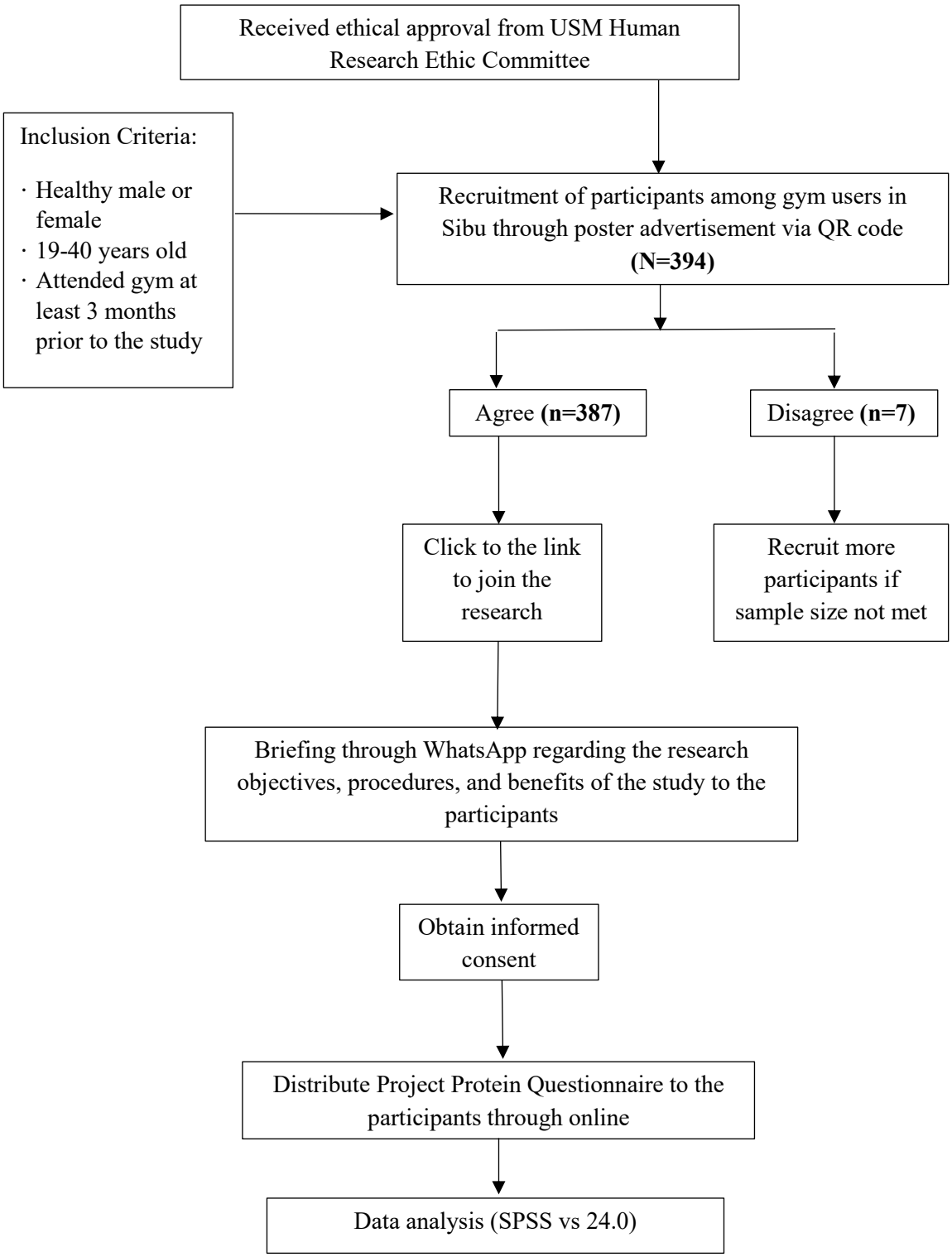

Figure 3.1: Flow chart of the study procedures

3.3 Sample size calculation

The sample size was calculated by using this formula:

$n = \hat{p} \times (1 - \hat{p}) \times z^2 / e^2$

The power of this study was set at 95% of confidence interval (CI) corresponding to z = 1.96. We assumed that the estimated population of Sibu attending the gym is around ($\hat{p}$ = 10%). The study margin of error is 3% (Goston & Toulson Davisson Correia., 2010). By using the formula, $n = \hat{p} \times (1 - \hat{p}) \times z^2 / e^2$, the sample size of 385 participants was calculated.

$$n = \hat{p} \times (1 - \hat{p}) \times z^2 / e^2$$

$$n = 0.1 \times (1-0.1) \times 1.96 / 0.03$$

$$n = 384.16 \sim 385$$

Table 3.1: List of gymnasium centres and memberships of participants in Sibu, Sarawak.

#	Gyms in Sibu	Estimated Memberships (Check-ins)	Date Recorded (Check-ins)
1	Lifestyles Gym	1,648	9 March 2021
2	Solid Gym	5113	9 March 2021
3	Empire Gym	5414	9 March 2021
4	Urban Gym	433	9 March 2021
5	D'Fitness Gym	19	9 March 2021
6	Synergy Gym	1417	9 March 2021
7	Max Gym	743	9 March 2021
8	Mar X Fitness Studio	1895	9 March 2021
9	Winner gym	960	9 March 2021
10	JM Gym	559	9 March 2021
11	Ifit Gym	3674	9 March 2021
Total		**21875**	

3.4 Participant Recruitment and Location of Data Collection

After obtaining human ethical approval (Appendix A), participants' recruitment was started via dissemination of poster advertisement (poster with QR code-Appendix B) to several gyms in Sibu, Sarawak. The present study was carried out online at their current locations and at their convenience.

3.5 Project Protein Questionnaire

The project protein questionnaire (Appendix C) collects data that concerns the type and frequency of supplement use, reasons for using it, exercise reasons and sources of information on supplements. The developer of this questionnaire is Prof. Dr. Antonino Bianco from the Department of Psychology, Education Science and Human Movement, University of Palermo, Italy. The developer has provided written permission with further help on the method to administer the questionnaire through his co-researcher, Dr. Ambra Gentile. All responses were automatically recorded on the Microsoft Forms (Microsoft, Inc.). The questionnaire aims to collect data from participants related to physical activity and protein supplement use. The questionnaire did not contain information that will identify the name of the individuals and was collected anonymously.

3.6 Data Collection Procedures

Participants were briefed on the study procedures online. They were screened for the inclusion and exclusion criteria to determine their eligibility to join the study. Those who are eligible and agree to join the study were asked to sign the consent form (Appendix E). Next, participants were administered the project protein questionnaire online. The questionnaire consists of questions regarding physical activity level, protein consumption, food habits and body satisfaction. Each segment of the questionnaire was categorised. The percentage of protein supplement users among gym-goers, dosage of protein supplement used among gym-goers, frequency of gym use with relation to protein dosage, type of exercise with relation to protein dosage and factors influencing the usage of protein supplements use were assessed.

3.7 Statistical Analysis

Data were analysed using IBM Statistical Package for Social Science (SPSS) Version 24.0. All the data were expressed in means and standard deviation (SD). The normal distribution of all data was determined using the Kolmogorov-Smirnov test. Categorical variables such as gender, employment, frequency of exercise and so on and so forth were expressed in frequencies (percentages). Continuous variables such as age and self-reported protein supplement dosage were expressed in means and standard deviation. One sample t-test was used to measure the dosage of protein supplement use in relation to Recommended Nutrient Intake (RNI). An independent sample t-test was used to compare protein users and non-users with their frequency of exercise per week and per day. A linear regression test was performed to determine the significance between exercise, reasons & influence and demographic factors associated with the likelihood of protein usage with $p<0.05$. Statistical significance was accepted at $p < 0.05$.

CHAPTER 4

RESULTS

In the present study, a total of 387 gym-goers from 11 gyms in Sibu had completed the study. Out of 387, 143 of them are protein supplements users (37%), and 244 are non-users (63%) (Table 4.1). The age of the participants ranged from 19-40 years, with a mean of 25.52 and standard deviation of 4.53 years old for protein users, whereas mean of 24.93 and a standard deviation of 4.16 years old for non-protein users. Among the protein users, there are 133 (93%) men and 10 (7%) women, whereas 148 (61%) men and 96 (39%) women are non-protein users. Regarding the respondents' employment, among the protein users, there are 60 (42%) students, 79 (55%) are workers and 4 (2.8%) are unemployed. Among the non-protein users, there are 122 (50%) students, 119 (48.8%) are in working status and 3 (1.2%) are unemployed.

Table 4.1: Demographics of protein and non-protein users in gym-goers

Participants		**Protein users n=143 (37%)**		**Non-Protein users n=244 (63%)**	
		Mean	**SD**	**Mean**	**SD**
Age (year)		25.52	4.53	24.93	4.16
		N	**%**	**N**	**%**
Gender	Male	133	93	148	61
	Female	10	7	96	39
Employment	Student	60	42	122	50
	Working	79	55	119	48.8
	Unemployed	4	2.8	3	1.2

As shown in the Table 4.2, the mean of protein supplements dosage (g/kg BW) was significantly different with the recommendation of RNI. The mean of protein supplements dosage (0.75±0.33 g/kg BW) was lower than recommendation of RNI of 1.0-1.5 g/kg BW for normal adult and 1.8 g/kg BW for athletes.

Table 4.2: Dosage of protein supplement use in relation to Recommended Nutrient Intake (RNI) (protein users only, N=143)

Protein dosage	Mean (g/kg body weight)	SD	RNI recommendation (g/kg body weight)	p-value
Users	0.75	0.33	1.0-1.5 (adult) 1.8 (athletes)	<0.001* <0.001*

***Denotes significant results*

Table 4.3.a shows the frequency of exercise per week was significantly different between protein users and non-users. Cramer's V suggested a strong difference where, there are more non-users exercising less than 5 days per week (***p*<0.001**).

Table 4.3.a: Comparison of protein users and non-users with their frequency of exercise per week (n=387).

Frequency of exercise	**Protein users N=143**		**Non-protein users N= 244**		**Pearson's Chi-Square value**	**Cramer's V value**	**Asymptotic significance, *p***
	N	**%**	**N**	**%**	31.032[a]	0.283	**<0.001***

< 3 days per week	20	14	99	40.6			
3-5 days per week	116	81.1	132	54.1			
>5 days per week	7	4.9	13	5.3			

***Denotes significant difference between users and non-users*

As shown in Table 4.3.b, Pearson Chi-Square test shows that the duration of exercise per day was significantly different between protein users and non-users. Cramer's V also suggested that the duration of exercise per day has a strong difference between protein users and non-users. There are more non-users exercising for less than 2 hours (p<0.001).

Table 4.3.b: Comparison of Protein supplements users and non-users with the duration of exercise per day (n=387).

Duration taken to exercise (per day)	**Protein users N=143**		**Non-protein users N= 244**		**Pearson's Chi Square Value**	**Cramer's V Value**	**Asymptotic significance, *p***
	N	%	N	%			
<1 hr	14	9.8	83	34	28.175[a]	0.270	**<0.001***
1-2 hr	110	76.9	137	56.1			
>More than 2 hr	19	13.3	24	9.8			

***Denotes significant difference between users and non-users*

Table 4.4 shows the frequency of type of exercise and statistical differences between protein users and non-protein users. An independent-samples t-test was conducted to compare between type of exercise for protein users and non-protein users. There was no significant difference in cardio exercises among users (M=0.22, SD=0.418) and non-users (M= 0.20, SD=0.398; t (385) = 0.633, *p*= 0.527). There was significant difference in legs exercise among users (M=0.24, SD=0.431) and non-users (M=0.56, SD=0.498; t (331.90) =-6.50, *p*<0.001**).** There was significant difference in biceps and triceps exercises among users (M=0.13, SD=0.333) and non-users (M=0.46, SD=0.50; t (378.72) =-7.95, *p*<0.001). There was significant difference in chest and back exercises among users (M=0.14, SD=0.348) and non-users (M=0.41, SD=0.492; t (371.57) =-6.20, ***p*<0.001).** There was significant difference in shoulder exercises among users (M=0.17, SD=0.381) and non-users (M=0.55, SD=0.499; t (358.77) =-8.30, ***p*<0.001).** There was significant difference in abdominal exercises among users (M=0.29, SD=0.454) and non-users (M=0.29, SD=0.49; t (315.86) =-2.17, ***p*= 0.034).**

Table 4.4: Comparison between protein supplements user and non-users with their type of exercise (N=387)

Type of exercise	Protein users N=143				Non-protein users N= 244				t	*df*	*p*	95% CI	
	N	%	M	SD	N	%	M	SD				Lower	Upper
Cardio	111	77.6	0.22	0.418	196	80.3	0.20	0.398	0.633	385	0.527	-0.057	0.111
Legs	108	75.5	0.24	0.431	108	44.3	0.56	0.498	-6.50	331.90	**<0.001***	-0.407	-0.218
Biceps & triceps	125	87.4	0.13	0.333	131	53.7	0.46	0.500	-7.95	378.72	**<0.001***	-0.421	-0.254
Chest & back	123	86.0	0.14	0.348	145	59.4	0.41	0.492	-6.20	371.57	**<0.001***	-0.350	-0.182
Shoulder	118	82.5	0.17	0.381	110	45.1	0.55	0.499	-8.30	358.77	**<0.001***	-0.463	-0.286

Abs	102	71.3	0.29	0.454	148	60.7	0.29	0.49	-2.17	315.86	**<0.034***	-0.204	-0.010

***Denotes significant difference between protein users and non-protein users.*

Table 4.5.a shows the results of the regression analysis in which it was found that there was statistically significant increased likelihood of being a protein supplement user for the type of exercises. The abdominal exercise was shown to be a significant predictor of using protein supplements among the protein users in the present study (***p*=0.027**).

Table 4.5.a: Linear regression analysis of exercise factors associated with the likelihood of protein usage.

Exercise	**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficients Beta**	**t**	***p***
Frequency of exercise per week	3.90	4.02	0.085	0.969	0.334
Duration of exercise per day	-1.661	3.751	-.0.039	-0.443	0.659
Types of exercises					
Cardio	-4.962	5.285	-0.081	-0.939	0.349
Legs	-0.901	4.481	-0.018	-0.201	0.841
Biceps & Triceps	3.90	6.024	0.074	0.647	0.519
Chest & Back	-6.98	6.17	-0.129	-1.131	0.26
Shoulder	-5.82	5.95	-0.115	-0.978	0.330
Abdominal	-10.16	4.55	-0.195	-2.23	**0.027***
(Constant)	51.85	28.89		1.79	0.075

**Denotes significant results*