

April 2022

## KNOWLEDGE OF THE EFFECT OF SYNTHETIC PROTEINS ON THE OVERALL HEALTH IN LEBANESE ADULTS: A CROSS-SECTIONAL STUDY

Zeina Al shoufi

*Student, Nursing Department, Faculty of Health Sciences, Beirut Arab University, Beirut, Lebanon,*  
zeinashoufi@gmail.com

Alaa Al Bardan

*Student, Nursing Department, Faculty of Health Sciences, Beirut Arab University, Beirut, Lebanon,*  
alaa.bardan19@hotmail.com

Ahmad Shishnieh

*Student, Nursing Department, Faculty of Health Sciences, Beirut Arab University, Beirut, Lebanon,*  
ahmadsh306@outlook.com

Rami Asaad

*Student, Nursing Department, Faculty of Health Sciences, Beirut Arab University, Beirut, Lebanon,*  
raa179@student.bau.edu.lb

Hiba Deek

Follow this and additional works at: <https://digitalcommons.bau.edu.lb/hwbjournal>  
*Assistant Professor, Nursing Department, Faculty of Health Sciences, Beirut Arab University, Beirut,*  
 [hdeek@bau.edu.lb](mailto:hdeek@bau.edu.lb), and the [Public Health and Community Nursing Commons](#)

### Recommended Citation

Al shoufi, Zeina; Al Bardan, Alaa; Shishnieh, Ahmad; Asaad, Rami; and Deek, Hiba (2022) "KNOWLEDGE OF THE EFFECT OF SYNTHETIC PROTEINS ON THE OVERALL HEALTH IN LEBANESE ADULTS: A CROSS-SECTIONAL STUDY," *BAU Journal - Health and Wellbeing*: Vol. 4: Iss. 2, Article 5.

DOI: <https://www.doi.org/10.54729/BTH04637>

Available at: <https://digitalcommons.bau.edu.lb/hwbjournal/vol4/iss2/5>

This Article is brought to you for free and open access by Digital Commons @ BAU. It has been accepted for inclusion in BAU Journal - Health and Wellbeing by an authorized editor of Digital Commons @ BAU. For more information, please contact [ibtihal@bau.edu.lb](mailto:ibtihal@bau.edu.lb).

---

# KNOWLEDGE OF THE EFFECT OF SYNTHETIC PROTEINS ON THE OVERALL HEALTH IN LEBANESE ADULTS: A CROSS-SECTIONAL STUDY

## Abstract

The aim of the study was to assess the knowledge of gym attendees on the effects of protein shakes on their health. A descriptive cross-sectional study involving a self-administered questionnaire was undertaken. Data were collected through a self-administered questionnaire in two ways. First method was googled form links which was sent out to acquaintances on social media (WhatsApp, Facebook, Instagram and Twitter) in both English and Arabic language. In addition, questionnaire was printed and distributed to four different gyms in Beirut. The coaches of the gyms took charge of distributing and completing the questionnaire. Reminders were issued every 2 days throughout the data collection period. The mean age of the study participants was 25.58 (SD=6.82) years. The majority were male participants (66.9%). The findings show that participants were not aware about the side effects of protein shakes consumption. Only 61.4% knew about kidney problems, 33.7% knew about its effect on blood pressure, 38% knew about its effect on breast enlargement and only 10% knew about its effect on fertility. As a conclusion, this study provided information about the knowledge base of gym attendees on the use of protein shakes. This information will help in raising and spreading awareness among people about the effect of protein shake on their health. Future studies should address other age groups.

## Keywords

synthetic proteins, protein shakes, gym attendees

## 1. INTRODUCTION

Physical activity and sports are important in our daily living for having favourable impacts on the overall physical wellbeing (Wicker, Coates, & Breuer, 2015). Such effects include decreasing the risks of obesity, diabetes, psychological disorders in addition to other non-communicable diseases (Wicker et al., 2015). Physical activity is classified into aerobic, muscle-strengthening activity (weight lifting), bone-strengthening activity (weight bearing), balance activities and multicomponent physical activity (Piercy et al., 2018). Muscle strengthening activity is sometimes accompanied by supplements to boost energy levels and improve gym performance (Kårlund et al., 2019). These dietary supplements help gym attendees to adapt to the training requirements (Salami, Ghaddar, Aboumrad, & Joumaa, 2017). Supplements usually taken by female are for their general positive health impact. While men take supplements to enhance their power and strength (Salami et al., 2017). Some of these products are amino acids, sports drinks, anabolic steroids (hormones) and protein powder also known as protein shakes (Alshammari, AlShowair, & AlRuhaim, 2017). Vitamin, mineral, carbohydrate, fat, caffeine, nitrates, probiotics, and antioxidants are also considered supplements (Vitale & Getzin, 2019).

Protein shakes are widely used by gym attendees (Salami et al., 2017). There are four main types of protein shakes: whey concentrate, whey isolate, whey hydrolysate and mass gainer (Hoffman & Falvo, 2004). Whey concentrate is known to take off water, lactose, ash and some minerals, which is more preferable for athletes considering its components. Whey protein isolate has concentrated protein by 90% or more while whey isolate loses fats and lactose during the manufacturing process making it safe for people who have lactose intolerance (Hoffman & Falvo, 2004). Furthermore, whey hydrolysate is the hydrolysis of whey protein and it can be absorbed by the body quickly. Finally, mass gainer is known for low protein amount and high fat and carbohydrates (Rana & Agarwal, 2019). The rate of consumption of protein shakes ranges from 37% in developing countries such as Brazil to 85% in the developed countries such as the United States (U.S) (Salami et al., 2017).

Protein shakes are associated with many side effects. These include elevated blood pressure, excessive facial hair, mood changes and changes in urine output. Additionally, some of these products contain ephedrine and pseudoephedrine which can negatively affect the cardiovascular system. Another harmful component found in these substances is erythropoietin which affects blood coagulation. In addition to anabolic steroids have many health risks and may not be known to gym attendees. Gym attendee's knowledge depends on the athletic coaches and seldom on dietitians. Gym attendees were in some instances aware of the side effects associated with these protein products, such reported side effects include kidney problems, elevated blood pressure, increased urine output and breast enlargement (Abdelbaky, Althubaiti, Aloufi, Almalki, & Aljohani, 2020). However, some coaches and competitors have lacking information of sport nourishment and suggest the use of dietary supplements in excess (Salami et al., 2017).

## 2. LITERATURE REVIEW

Supplements consumed by gym attendees can include vitamin supplements, such as potassium and sodium chloride, caffeine supplements or protein supplements (Martínez-Rodríguez et al., 2020). In a study conducted on a sample of 113 participants showed that supplements mostly used in gym were protein shakes. Those who consumed protein shakes reported practicing for longer durations and more strenuous exercises than those who did not. Additionally, protein shakes consumers reported attending gym for purposes like body building while non-consumers of protein shakes reported attending gyms for fitness and weight control (Farhat & El-Hachem, 2015). On the other hand, other supplements such as vitamins, were found to be more consumed by females than males. This is because of their wish to maintain health and replace inadequate diet while males were more interested in physical performance (McDowall, 2007).

The use of dietary supplements was found to be highly prevalent among university students in Singapore to reach 76.8%. These supplements included sport drinks, multivitamins or single vitamins such as vitamin C, herbal preparations in addition to protein supplements (Tian, Ong, & Tan, 2009). This finding was supported by another study conducted in Australia among the adolescent population. The target population was composed of 87 participants with ages ranging between 13 and 18 years and found more than 60% to be consumers of protein supplements alone.

Despite these findings, more than 55% of those consuming protein shakes know about possible risks of these products without being able to name any of these risks (Whitehouse & Lawlis, 2017).

### **2.1 The Effects of Protein Supplements on the Body Physiology**

Protein supplements have many positive and adverse effects on the body organs. This was shown in a study conducted on 42 middle aged men aged between 48 and 72 years. The study participants were divided into four groups; placebo versus, creatine, whey protein or a combination of both in addition to resistance training three times weekly. The results showed that protein supplements can increase the intracellular and extracellular water, decrease the regional arm fat but no effect on the body composition (Eliot et al., 2008). However, another study reporting the results of a systematic review and meta-analysis of combined randomized controlled trials contradicted this finding (Lam, Khan, Faidah, Haseeb, & Khan, 2019). The results of this study showed that whey protein significantly increased the amino-acids, creatinine kinase and myoglobin levels in blood when compared to the control group who consumed no protein supplements. The levels were determined by blood biochemistry levels on a sample of 230 participants (Lam et al., 2019). Another study conducted in Lebanon on 360 participants aged between 20 and 50 showed that the protein shakes can have mild to moderate effects on the body physiology. The reported effects included polyuria, excessive facial hair, mood swings and elevated blood pressure (Salami et al., 2017). This data was collected through a cross-sectional approach. Other reported side effects included digestive problems and urticaria (Sung & Choi, 2018). However, these proteins were not found to have any effect on the semen volume or morphology, sperm concentration, morphology or motility. The findings were presented from a study conducted on a sample of 778 men enrolled in the Danish National Birth Cohort 1996-2002 (Tøttenborg et al., 2020).

On the other hand, supplementation with whey protein showed positive effects on the body composition in the older adult population. This was shown in a study conducted in China on a sample of 115 community members who were frail and suffered from fatigue, reduced activity and weight loss. The target population was divided into those who were given the whey supplement (intervention group of 66 participants) and those who were not (control group of 48 participants). The results showed improvement in terms of muscle function and enhanced physical activity among those who were given the supplements (Kang et al., 2019).

### **2.2 Knowledge about the Side Effects of Protein Shakes among Gym Attendees**

The main reason for consuming protein supplements was reported to be muscle building among a sample of 223 young male participants aged in their 20s. The data was retrieved through a cross-sectional design in South Korea in 2016. These participants also reported that they felt more comfortable using products that were advertised by known athletes and sold online in affordable prices (Sung & Choi, 2018).

Gym attendee's knowledge regarding the effects and side effects of synthetic proteins varied. The majority of protein supplement consumers were unaware of the side effects of these products (Salami et al., 2017). The source of knowledge mostly came from the internet (Whitehouse & Lawlis, 2017), while other reported sources included, the media, other athletes and coaches (Tian et al., 2009). In fact, coaches were shown to have a great influence on their trainees to consume these products (Jovanov et al., 2019). In a study conducted in Lebanon on 220 male participants, aged between 15 and 53 years, it was found that knowledge was low. More than half (57.8%) did not believe that these supplements had any side effects (Farhat & El-Hachem, 2015). On the contrary, another study conducted on a sample of 348 international competing athletes showed that 72.1% were aware of the health risks associated with protein supplements. This study was done on a sample of participants from four countries which are Serbia, Germany, Japan and Croatia. The difference between these two studies may also be that those living in developed countries may have better access to accurate information than those living in developing countries (Jovanov et al., 2019).

Another study conducted in Saudi Arabia, a country with similar culture to Lebanon, recruited 316 male gym attendees to evaluate their level of knowledge of protein shakes consumption. The results showed that 68.4% of those that used nutritional supplements used protein shakes. The use of protein shakes was less reported in those who believed they had health risks while those who knew less about their health consequences used it more (Al Nozha & Elshatarat, 2017). Another study also in Saudi Arabia showed that male participants

attending the gym, 30% consumed nutritional supplements including protein shakes. Of those consuming these products, 11.2% reported knowing about their effect on blood pressure, 35.5% about weight gain, 40.2% about kidney effects, 25.4% reported knowing about testicular hypertrophy and 37.9% knew about breast enlargement (Abdelbaky, Althubaiti, Aloufi, Almalki, & Aljohani, 2020).

### 3. METHODOLOGY

#### 3.1 Research Design:

A descriptive cross-sectional study involving a self-administered questionnaire.

#### 3.2 Target Population

Gym attendees to one of the four gyms that were included in this study. Inclusion criteria were those aged 18 years and above who attended the gym as personal trainers or trainees. People who do not attend the gym and those aged less than 18 years were excluded.

Setting: Four gyms were included in this study that are located in the capital city of Lebanon, Beirut. These gyms were labelled as Gym 1, Gym 2, Gym 3 and Gym 4. The involved gyms' presentations are in Table 1.

Table 1: Presentation of the gym characteristics

Gym name	Capacity	Population	characteristics	Sells protein products
Gym 1	100	Male and female	Opening hours: 9 am-10pm. Types of workouts: cardio and stretching	Yes
Gym 2	150	Male and female	Opening hours: 10am-10pm. Types of workouts: Yoga and cross fit.	Yes
Gym 3	90	Male and female	Opening hours 11am- 11pm. Types of workouts: Zumba and weightlifting	No
Gym 4	200	Male and female	Opening hours: 24 hours. Types of workouts: weight bearing	Yes

#### 3.3 Sample Size Calculation

The main outcome under study was the knowledge about protein shakes use and their effect on the overall health. This has been addressed preciously by studies, which sought a sample size to range between 105 and 139 participants (Scofield & Unruh, 2006; Ziegler, Nelson & Jonnalagadda, 2003). While taking into account a 10% rate of incomplete data we sought to increase the sample size to 150 participants.

#### 3.4 Data Collection

The coach of every gym was approached to assist in the distribution of the questionnaire through papers. The coach was reminded about these questionnaires every 2 days. The data collection duration through papers was over two weeks from each of the included gyms. Another self-administered questionnaire using snowball technique was distributed through a link generated by Google form. The link was sent to the researchers' acquaintances and their groups through social media; Facebook, Twitter and WhatsApp application. The questionnaire was developed for the current study with variables found to be significant from the literature. The variables studied are as below.

Data were collected using a questionnaire developed for this study in both English (Appendix A) and Arabic (Appendix B). The questionnaire included questions on the following sections:

A. Sociodemographic characteristics: This section included questions on age, gender, occupation, income, marital status, education level, weight and height.

- B. Medical profile: This section included questions on past medical history (heart, respiratory and kidney diseases) and surgical history.
- C. Lifestyle practices: This section included questions on smoking status, water pipe smoke, alcohol consumption, types of exercises and duration, in addition to their perceptions about protein shakes.
- D. Practices related to gym attendance: This section included questions on the purpose of protein intake, types of protein shake, knowledge on side effects, and how protein affect different body organs.

### 3.5 Statistical Analysis

Data analysis was divided into two variables: continuous and categorical. The continuous variables were presented as means and standard deviations. Categorical variables were presented as frequencies and percentages. For bivariate analysis, chi square test was used in case of two categorical variables. If one categorical and one continuous variable then non-parametric analysis was used when the continuous variable was not normally distributed. If the continuous variable that was normally distributed, parametric testing was used for analysis. The p-value of less than 0.05 was considered as statistically significant. Data analysis was done using SPSS version 22.

#### Ethical Considerations

Ethical approval from the Institutional Review Board (Appendix C) was taken and the study was approved by the Faculty of Health Sciences administration (Appendix D). Additionally, administration approval was secured from all the involved gyms. All the data collected was anonymized and the information remained confidential. Data was stored under double lock and key in the supervisor's office with limited access. All data will be stored for five years following the completion of the study and then will be shredded.

## 4. RESULTS

### 4.1 Demographic Characteristics

Table 2: Presentation of the sociodemographic characteristics and medical profile of the study participants (N=166).

Variables	Total (N=166, 100%)	Protein Shake consumers (n=73, 44%)	Non-consumers (n=93, 56%)	p value
Age*	25.58 (6.82)	25.66 (7.500)	25.52 (6.28)	0.895
Gender:				0.001**
• Male	111 (66.9)	59 (35.5)	52 (31.3)	
• Female	55 (33.1)	14 (8.4)	41 (24.7)	
Occupation				0.479
• Student	72 (43.4)	35 (21.1)	37 (22.3)	
• Self-employed	26 (15.7)	13 (7.8)	13 (7.8)	
• Fulltime worker	62 (37.3)	23 (13.9)	39 (23.5)	
• Unemployed	6 (3.6)	2 (1.2)	4 (2.4)	
Income* (L.L.)				0.539
• <500,000	38 (22.9)	18 (10.8)	20 (12.0)	
• 500,000-1,000,000	26 (15.6)	10 (6.0)	16 (8.16)	
• 1,000,000-3,000,000	70 (42.2)	35 (21.1)	35 (21.1)	
• >3,000,000	32 (19.2)	10 (6.0)	22 (13.2)	
Marital status				0.620
• Single	134 (80.7)	57 (34.3)	77 (46.4)	
• Married	29 (17.5)	14 (8.4)	15 (9.0)	
• Divorced/widowed	3 (1.8)	2 (1.2)	1 (0.6)	
Educational level				0.355
• Illiterate	1 (0.6)	1 (0.6)	0 (0.0)	
• Secondary school	2 (1.2)	1 (0.6)	1 (0.6)	
• High school	29 (17.5)	16 (9.60)	13 (7.8)	
• Bachelor's degree or beyond	134 (80.7)	55 (33.1)	79 (47.6)	
Weight*	79.81 (23.10)	82.82 (21.249)	77.45 (24.322)	0.138
Height*	172.20 (15.50)	174.21 (15.872)	170.63 (15.106)	0.141
Medical profile				

Heart disease	4 (2.4)	3 (1.8)	1 (0.6)	0.206
Respiratory disease	14 (8.4)	6 (3.6)	8 (4.8)	0.930
Kidney problems	3 (1.8)	2 (1.2)	1 (0.6)	0.424
Hypertension	3 (1.8)	2 (1.2)	1 (0.6)	0.424
Medication				0.344
• Cardiovascular medication	2 (1.2)	2 (1.2)	0 (0)	
• Diuretic	3 (1.8)	2 (1.2)	1 (0.6)	
• Vitamin supplements	38 (22.9)	17 (10.2)	21 (12.7)	
Surgical procedure	125 (75.3)	13 (7.8)	27 (16.3)	0.154

LEGEND: \*: presented in means and standard deviations; \*\*significant at less than 0.05.

The total sample was 166 participants with a mean age of 25.58 (SD=6.82) years. The majority were male participants (n=111, 66.9%) and students (n=72, 43.4%). Most were bachelor's degree holders or beyond (n=134, 80.7%). The majority had a monthly income ranging between 1,000,000 and 3,000,000 L.L. (n=70, 42.2%). Most of the participants were single (n=134, 80.7%) with a mean weight of 79.81 (SD= 23.10) kg. When looking at the medical profile, n=4 participants (2.4%) had heart disease, n=14 had respiratory disease (8.4%), n=3 had kidney problems (1.8%) and n=3 had hypertension (1.8%). A total of n=27 participants reported taking medications (16.3%) and 125 participants (75.3%) had undergone surgical procedures. The detailed sociodemographic and medical profile description of the study participants are presented in Table 2.

#### 4.2 Lifestyle Practices

In terms of lifestyle, the majority were non-smoker (n=92, 55.4%), non-alcoholic (n=95, 57.2%) and never used waterpipe smoke (n=120, 72.3%). The level of exercise for the majority were intense (n=60, 36.1%) and weightlifting was the highest type of exercise performed (n=51, 30.7%). Slightly over half of the participants (n=86, 51.8%) performed four sessions of exercise per week. In terms of protein intake, most of the participants were with taking protein supplements (n=84, 50.6%). The lifestyle details are presented in Table 3.

Table 3: Presentation of Lifestyle practices of the study participants (N=166)

Variables	Total (N=166,100%)	Protein Shake consumers (n=73, 44%)	Non-consumers (n=93, 56%)	P value
Smoker				0.168
• Never	92 (55.4)	37 (22.3)	55 (33.1)	
• Quit	7 (4.2)	6 (3.6)	1 (0.6)	
• Occasionally	33 (19.9)	13 (7.8)	20 (12.0)	
• One pack/day	27 (16.3)	13 (7.8)	14 (8.4)	
• More than one pack/day	7 (4.2)	4 (2.4)	3 (1.8)	
Alcohol consumption				0.861
• Never	95 (57.2)	42 (25.3)	53 (31.9)	
• Quit	11 (6.6)	6 (3.6)	5 (3.0)	
• Occasionally	3 (19.3)	14 (8.4)	18 (10.8)	
• Daily	2 (16.9)	11 (6.6)	17 (10.2)	
Water pipe smoke				0.155
• Never	120 (72.3)	55 (33.1)	65 (39.2)	
• Quit	12 (7.2)	7 (4.2)	5 (3.0)	
• Occasionally	27 (16.3)	7 (4.2)	20 (12.0)	
• Daily	7 (4.2)	4 (2.4)	3 (1.8)	
Level of exercise				0.135
• Mild	46 (27.2)	17 (10.2)	29 (17.5)	
• Moderate	32 (19.3)	10 (6.0)	22 (13.3)	
• Intense	60 (36.1)	32 (19.3)	28 (16.9)	
Type of exercise				0.001*
• Cardio	45 (27.1)	20 (12.0)	25 (15.1)	
• Stretching	18 (10.8)	2 (1.2)	16 (9.6)	
• Weight bearing	47 (28.3)	20 (12.0)	27 (16.3)	

• Weight lifting	51 (30.7)	31 (18.7)	20 (12.0)	
Number of sessions/ week				0.000*
• Once	33 (19.9)	3 (1.8)	30 (18.1)	
• Twice	17 (10.2)	6 (3.6)	11 (6.6)	
• Three sessions	26 (15.7)	11(6.6)	15 (9.0)	
• Four times	86 (51.8)	53 (31.9)	33 (19.9)	
Protein intake				0.000*
• With	84 (50.6)	50 (30.1)	34 (20.5)	
• Against	82 (49.4)	23 (13.9)	93 (56.0)	

LEGEND: \*significant at less than 0.05

### 4.3 Practices Related to Gym Attendance

More than half of the study participants were non-consumers of protein powder (n=93, 56.0%). Among those who consumed proteins, one third of the participants used protein shake for the purpose of muscle enlargement (n=56, 33.7%), n= 127 participants (76.5%) reported no side effects while consuming protein and n=39 participants (23.5%) started seeing results after one month (n=39, 23.5%) of its consumption. The main source of protein preferred by the participants was food rich in protein (n=146, 88.0%) while protein shake consumers preferred whey isolate (n=54, 32.5%) over other types. Regarding the participant's knowledge about protein shake effect, n=102 (61.4%) considered that it affects the kidney, affects kidney hormone (n=86, 51.8%), causes toxicity (n=42, 25.3%), causes proteinuria (n=73, 44.0%), affects blood pressure (n=56, 33.7%), affects mood (n=61, 36.7%), leads to breast enlargement (n=63, 38%), causes adrenal dysfunction (n=46, 27.7%), reduces craving (n=137, 82.5%), reduces appetite (n=57, 34.4%), gains muscle mass (n=158, 95.2%) and only 10% believe that it may affect fertility (n=5). The details of the practices related to gym attendance and protein shakes are presented in Table 4.

Table 4: Presentation of practices related to gym attendance of the study participants (N=166)

Variables	Total (N=166,100%)
Protein powder	
• Consumers	73 (44.0)
• Non-consumers	93 (56.0)
Scoops	
• One scoop	31 (18.7)
• Two scoops	33 (19.9)
• Three scoops	8 (4.8)
• Four and more	3 (1.8)
Purpose	
• Muscle enlargement	56 (33.7)
• Increase muscle tonicity	18 (10.8)
• Weight loss	9 (5.4)
• Weight gain	15 (9.0)
• Improve shape	31 (18.7)
• Gain strength	10 (6.0)
Side effects	
• Yes	39 (23.5)
• No	127 (76.5)
Results	
• One month	39 (23.5)
• Two months	29 (17.5)
• Three months	26 (15.7)
Protein source	
• Protein supplement	20 (12.0)
• Food rich in protein	146 (88.0)
Kind of protein	
• Whey isolate	54 (32.5)
• Whey hydrolysate	9 (5.4)
• Whey concentrate	20 (12.0)
• Mass gainer	34 (20.5)

#### 4.4 Main Results

Significant difference was noted between the two genders where male participants consumed more synthetic proteins than females (n=59, 35.5% vs. n=14, 8.4%; p=0.001 respectively). Also, significance was seen between types and frequencies of performed exercises where participants practicing weightlifting and those who visited the gym more than four times per week consumed synthetic proteins more than their counterparts.

Regarding the knowledge of the effect of protein shakes on health, it was noted that those who consumed the protein shakes were less knowledgeable about its effect on the kidney hormones (n=29, 17.5% vs. n=57, 34.3%; p=0.000 respectively), toxicity (n=11, 6.6% vs. n=31, 18.7%; p=0.01 respectively), proteinuria (n=16, 9.6% vs. n=57, 34.3%; p=0.000 respectively), blood pressure (n=10, 6% vs. n=46, 27.7%; p=0.000 respectively), mood (n=13, 7.8% vs. n=48, 28.9%; p=0.000 respectively), breast enlargement (n=15, 9% vs. n=48, 28.9%; p=0.001 respectively) and adrenal dysfunction (n=12, 7.2% vs. n=34, 20.5%; p=0.008 respectively). The knowledge of study participant about the effect of synthetic proteins represented in table 5.

Table 5: Knowledge of study participants about the effects of synthetic proteins

Variables	Total (N=166,100%)	Consumers (n=73 %=44)	Non-consumers (n=,93 %=56)	p value
Affect Kidney	102 (61.4)	40 (24.1)	62 (37.3)	0.475
Affect kidney hormone	86 (51.8)	29 (17.5)	57 (34.3)	0.000*
Toxicity	42 (25.3)	11 (6.6)	31 (18.7)	0.010*
Proteinuria	73 (44.0)	16 (9.6)	57 (34.3)	0.000*
Affect blood pressure	56 (33.7)	10 (6.0)	46 (27.7)	0.000*
Mood	61 (36.7)	13 (7.8)	48 (28.9)	0.000*
Breast enlargement	63 (38)	15 (9.0)	48 (28.9)	0.001*
Adrenal dysfunction	46 (27.7)	12 (7.2)	34 (20.5)	0.008*
Reduce craving	137 (82.5)	62 (37.3)	75 (45.2)	0.470
Reduce appetite	57 (34.3)	20 (12.0)	37 (22.3)	0.107
Muscle gain	158 (95.2)	71 (42.8)	87 (52.4)	0.268

Legend: \* significant at less than 0.05

## 5. DISCUSSION

The aim of this study was to assess the knowledge of gym attendees on the effects of protein shakes on their health. This was evaluated through a cross-sectional approach on 166 gym attendees in Beirut region. The main findings of the study showed that less than half of the gym attendees were protein shake consumers and those who consumed these products were less aware of their side effects. These consumption rates are slightly higher than those reported three years before this current study in a sample of high school students who attended gym (Salami et al 2017). However, the rates were lower than another reporting that 60% of the gym attendees consumed protein also three years ago. The difference could be due to the younger age group in the Australian study where the study participants aged between 13 and 18 years (Whitehouse 2017). Another difference is the timing of the current study amid the COVID-19 pandemic which limited the participant's access to gyms and the protein shake products. In terms of knowledge, most of the gym attendees in the current and previous studies (Salami et al., 2017; Whitehouse et al., 2017) were less knowledgeable about the side effects of protein shakes than those who did not consume them. While those who knew about the possible side effects were not able to name any of these risks (Whitehouse et al., 2017). This contradicted the findings of another study done in Serbia, Germany, Japan, and Croatia conducted on a sample of 348 international athletes. The results showed that 72.1% of these participants were aware of the health risks associated with protein supplements. The difference between the two studies may be that those living in developed countries may have better access to accurate information than those living in developing countries, additionally, coaches were shown to have a great influence on their trainees to consume protein shakes (Jovanov et al., 2019).

In detailed analysis of the knowledge, it was found that the current study sample was less knowledgeable about the possible side effects and risks of protein consumption than participants of other studies. This comparison came from a study conducted in Saudi which showed that more participants knew about the effects of protein shakes on blood pressure elevation than the current study (11% vs. 6%). However, more in the current study knew about the effects on these substances on the kidney in comparison to those reported in the Saudi sample (61.4% vs. 40.2%). Additionally, only 9% of the current study sample reported knowledge about breast enlargement while almost 40% of the Saudi sample reported knowledge about this issue (AbdelBaky 2020). Surprisingly, less than 10% of the current study sample reported knowledge about the effect of protein shakes on fertility while these rates are much less than those reported in another study (AbdelBaky 2020).

The difference in genders on the consumption of protein shakes was shown in this study similar to previous studies where male participants were higher consumers than female participants. On the other hand, female participants were more consumers of vitamins (McDowall, 2017).

The limitations of the study lie first in its design where a cross-sectional study does not determine the cause/effect relationship or follow up of the participants for accurate data. In addition, the sample size was relatively low and limited to Beirut region which limits the generalizability of the study. Another limitation is the risk of social desirability and reporting bias where participants could report knowledge about risk side effects while really not being aware of these risks.

## 6. CONCLUSION

This study aimed to shed lights on the negative side effects of protein shakes and outline the level of knowledge gym attendees have on those risks. The results showed that participants knew about the effects of these products on the kidney but were less knowledgeable about its effects on blood pressure, mood, breast size and fertility. Additionally, those who consumed protein shakes were less knowledgeable about their toxic effects than non-consumers. These findings raise the need for educational campaigns to the community about the effects of the protein shakes on the general health. Future studies should address other age groups, in different areas of the country for allowing generalizability of the findings.

## 7. ACKNOWLEDGEMENTS

We would like to express our special thanks of gratitude to our supervisor Dr. Hiba Deek for her continuous support, guidance, cooperation and encouragement to accomplish this project. We really appreciate her experience and professionalism throughout the project.

The completion of this project could not have been accomplished without the support of our doctors, classmates and friends that helped us countless times throughout our journey

To our family, we won't be this stronger without your inspiration. You are the reason we keep pushing.

## REFERENCES

- Abdelbaky, A., Althubaiti, A. A., Aloufi, B. A., Almalki, N. A., & Aljohani, R. S. (2020). Evaluation of knowledge, attitude and use of dietary supplement and hormones among male gym attendees in Taif city, Saudi Arabia. *Middle East Journal of Family Medicine*, 7(10), 176.
- Al Nozha, O. M., & Elshatarat, R. A. (2017). Influence of knowledge and beliefs on consumption of performance enhancing agents in north-western Saudi Arabia. *Annals of Saudi medicine*, 37(4), 317-325.
- Alshammari, S. A., AlShowair, M. A., & AlRuhaim, A. (2017). Use of hormones and nutritional supplements among gyms' attendees in Riyadh. *Journal of family & community medicine*, 24(1), 6.
- Butterworth, M., Lees, M., Harlow, P., Hind, K., Duckworth, L., & Ispoglou, T. (2019). Acute effects of essential amino acid gel-based and whey protein supplements on appetite and energy intake in older women. *Applied Physiology, Nutrition, and Metabolism*, 44(11), 1141-1149.

- Eliot, K., Knehans, A., Bembien, D., Witten, M., Carter, J., & Bembien, M. (2008). The effects of creatine and whey protein supplementation on body composition in men aged 48 to 72 years during resistance training. *The Journal of Nutrition Health and Aging*, 12(3), 208-212.
- Farhat, A., & El-Hachem, C. (2015). Exercising behavior differences in users and non-users of dietary supplements by sportsmen in Lebanon. *metabolism*, 50(66), 72.
- Hoffman, J. R., & Falvo, M. J. (2004). Protein—which is best? *Journal of sports science & medicine*, 3(3), 118.
- Jovanov, P., Đorđić, V., Obradović, B., Barak, O., Pezo, L., Marić, A., & Sakač, M. (2019). Prevalence, knowledge and attitudes towards using sports supplements among young athletes. *Journal of the International Society of Sports Nutrition*, 16(1), 1-9.
- Kang, L., Gao, Y., Liu, X., Liang, Y., Chen, Y., Liang, Y., . . . Peng, L.-N. (2019). Effects of whey protein nutritional supplement on muscle function among community-dwelling frail older people: A multicenter study in China. *Archives of gerontology and geriatrics*, 83, 7-12.
- Kårlund, A., Gómez-Gallego, C., Turpeinen, A. M., Palo-Oja, O.-M., El-Nezami, H., & Kolehmainen, M. (2019). Protein supplements and their relation with nutrition, microbiota composition and health: is more protein always better for sportspeople? *Nutrients*, 11(4), 829.
- Lam, F.-C., Khan, T. M., Faidah, H., Haseeb, A., & Khan, A. H. (2019). Effectiveness of whey protein supplements on the serum levels of amino acid, creatinine kinase and myoglobin of athletes: a systematic review and meta-analysis. *Systematic reviews*, 8(1), 1-12.
- Martínez-Rodríguez, A., Cuestas-Calero, B. J., Hernández-García, M., Martínez-Olcina, M., Vicente-Martínez, M., & Rubio-Arias, J. Á. (2020). Effect of Supplements on Endurance Exercise in the Older Population: Systematic Review. *International Journal of Environmental Research and Public Health*, 17(14), 5224.
- McDowall, J. A. (2007). Supplement use by young athletes. *Journal of sports science & medicine*, 6(3), 337.
- Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., . . . Olson, R. D. (2018). The physical activity guidelines for Americans. *Jama*, 320(19), 2020-2028.
- Rana, S. S., & Agarwal, R. (2019). Legal status and use of dietary supplements a study among gym goers in Lucknow, Uttar Pradesh.
- Salami, A., Ghaddar, A., Aboumrada, E., & Joumaa, W. H. (2017). Dietary Supplement Use in Sport Gyms in Lebanon: Are They Necessary and are There Side-Effects? *International Journal of High Risk Behaviors and Addiction*, 6(1).
- Scofield, D. E., & Unruh, S. (2006). Dietary supplement use among adolescent athletes in central Nebraska and their sources of information. *The Journal of Strength & Conditioning Research*, 20(2), 452-455.
- Sung, Y., & Choi, J. (2018). Protein supplement usage among Male University students: comparisons between current and previous users. *Journal of the American College of Nutrition*, 37(2), 127-132.
- Tian, H., Ong, W., & Tan, C. (2009). Nutritional supplement use among university athletes in Singapore. *Singapore Medical Journal*, 50(2), 165.
- Tøttenborg, S. S., Glazer, C. H., Hærvig, K. K., Høyer, B. B., Toft, G., Hougaard, K. S., . Ramlau-Hansen, C. H. (2020). Semen quality among young healthy men taking protein supplements. *Fertility and sterility*, 114(1), 89-96.
- Vitale, K., & Getzin, A. (2019). Nutrition and supplement update for the endurance athlete: review and recommendations. *Nutrients*, 11(6), 1289.
- Whitehouse, G., & Lawlis, T. (2017). Protein supplements and adolescent athletes: A pilot study investigating the risk knowledge, motivations and prevalence of use. *Nutrition & dietetics*, 74(5), 509-515.
- Wicker, P., Coates, D., & Breuer, C. (2015). Physical activity and subjective well-being: the role of time. *The European Journal of Public Health*, 25(5), 864-868.
- Ziegler, P. J., Nelson, J. A., & Jonnalagadda, S. S. (2003). Use of dietary supplements by elite figure skaters. *International journal of sport nutrition and exercise metabolism*, 13(3), 266-276.