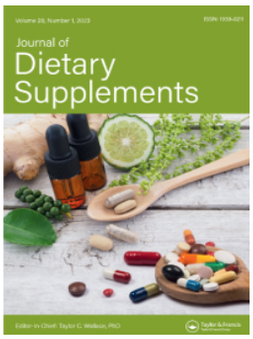

Journal of Dietary Supplements

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ijds20

Assessment of Dietary Supplements Use among American University of Beirut Students: Prevalence, Knowledge, and Reasons for Supplementation

Leen Lawand, Rewa Youness, Loubna Sinno, Nabih Lawand & Samaa Al Tabbah

To cite this article: Leen Lawand, Rewa Youness, Loubna Sinno, Nabih Lawand & Samaa Al Tabbah (2023) Assessment of Dietary Supplements Use among American University of Beirut Students: Prevalence, Knowledge, and Reasons for Supplementation, Journal of Dietary Supplements, 20:1, 106-117, DOI: 10.1080/19390211.2021.1981512

To link to this article: https://doi.org/10.1080/19390211.2021.1981512

JOURNAL OF DIETARY SUPPLEMENTS
2023, VOL. 20, NO. 1, 106–117
https://doi.org/10.1080/19390211.2021.1981512

Taylor & Francis
Taylor & Francis Group

ARTICLE

Assessment of Dietary Supplements Use among American University of Beirut Students: Prevalence, Knowledge, and Reasons for Supplementation

Leen Lawand[a], Rewa Youness[a], Loubna Sinno[b], Nabih Lawand[c] and Samaa Al Tabbah[d]

[a]Nutrition and Food Sciences Department, Faculty of Agriculture and Food Sciences, American University of Beirut, Beirut, Lebanon; [b]Research Unit, Makassed General Hospital, Beirut, Lebanon; [c]Psychology Department, Faculty of Arts and Sciences, American University of Beirut, Beirut, Lebanon; [d]School of Pharmacy, Lebanese American University, Beirut, Lebanon

ABSTRACT

The purpose of this study was to evaluate the prevalence and type of supplements used among university students, level of knowledge in this respect, reasons to supplement their diet, and the sources for information about dietary supplements. A sample of 100 students at the American University of Beirut were surveyed through a questionnaire composed of 22 questions and divided into four sections: socio-demographic, anthropometric, dietary supplement (DS) knowledge, DS intake and reasons. Descriptive statistics were conducted to determine the frequency of respondents for each variable and appropriate statistical tests were used for associations according to variable type and data. A total of 100 participants were included in the study of which 49 (49.0%) were males and 51 (51.0%) were females. Sixty-eight participants were dietary supplement users, of which 27 (39.7%) were males and 41 (60.3%) were females. Supplementation reasons differed: 53 consumed supplements to improve energy and vitality, 22 to enhance cognitive performance, 22 to promote hair, skin and health, and 13 to prevent or treat cold. A significant association was observed between dietary supplements use and female gender (OR = 5.66, 95% CI: 1.60-20.10). No significance was found between consuming dietary supplements and smoking status, BMI, living conditions, medical condition, age, exercise, major, dietary knowledge, and side effects. More than half of the participants are dietary supplements users with females being more likely to use them. The main reason for both genders to resort to dietary supplement use is to improve their energy and vitality.

KEYWORDS

dietary supplements; knowledge; prevalence; reasons; students

CONTACT Samaa Al Tabbah samaa.tab@hotmail.com School of Pharmacy, Lebanese American University, Beirut, Lebanon

Supplemental data for this article can be accessed online at https://doi.org/10.1080/19390211.2021.1981512.

All the authors contributed equally to this paper.

Introduction

A dietary supplement (DS) is defined as a product taken by mouth that contains a "dietary ingredient" intended to supplement the diet (1). Vitamins, minerals, amino acids, and herbs or botanicals, as well as any other ingredient used to supplement the diet are considered dietary supplements (2). These supplements are usually not required unless needed for a specific therapeutic purpose, prevention of diseases, and high endurance sports. They are added to diets to increase the intake of essential nutrients, minerals, herbs, or vitamins (3).

Dietary supplements are used in situations where people should support and complement their diets (4). They are mostly effective in maintaining good health in people with psychological disruption (5), cancer patients (6) and individuals following a certain diet that does not support all of the five main food groups (7). However, people are substituting nutrient-rich foods with dietary supplements. In fact, a recent study confirms that users of dietary supplements consume lower portions of fruits and vegetables and higher portions of commercial and ready foods (8).

Furthermore, several other reasons were identified as motivators to the use of dietary supplements, these include; appealing reasons like improving skin and hair, improvement of health and immunity, enhancing performance such as building muscles and losing weight, and meeting the body's energy requirements (5, 7–9). In addition to that, numerous studies have shown that the intake of supplements differs across gender, education levels, and degree of health-related knowledge (7, 10–12).

Recently, there has been a worldwide surge in the manufacture of dietary supplements due to its high demand in the market (13). This could be linked to the improper supervision imposed by authorities and the ease of accessibility to these products by individuals. Dietary supplements can be easily purchased from pharmacies or general nutrition sports centers without any medical prescription (5). On the other hand, the Food and Drug Administration (FDA) regulates dietary supplements under a different set of regulations than those covering "conventional" foods and drug products (1). One of the marketing strategies used to promote these products is paid endorsements to athletes or celebrities, who claim that dietary supplements improve sports performances (14).

According to the World Health Organization (WHO), almost 80% of the world population use dietary supplements (15). In fact, a study conducted by Lieberman *et al.* in 5 different United States universities, showed that 73% of the students surveyed, used dietary supplements to promote health and wellbeing (16). Also, a study carried out in Singapore by Tian *et al.*, showed that a total of 76.8% of athletes used some kind of herbal and/or dietary supplements (17). However, 86.4% of university athletes who use supplements lacked knowledge about its potential adverse effects, high risks of toxicities (10), side effects such as nausea, vomiting, diarrhea, sleep disturbances, abdominal pain, and constipation (3, 5), in addition to drug nutrient interactions (18–20) and hepatotoxicity (21).

Despite the high prevalence of supplement use worldwide, studies on supplement use in the Middle East, particularly Lebanon are scarce. University students are the population that mostly use dietary supplements (22). Following this, the purpose of this study was to evaluate the prevalence and type of dietary supplements used among

university students, their level of awareness and knowledge in this respect, the sources they rely on for information about dietary supplements, and the reasons that drive them to supplement their diet.

Methods

Study design, setting, and participants

We carried out a cross-sectional study at the American University of Beirut (AUB), a private, nonsectarian, and independent university chartered in New York with a campus in Beirut, Lebanon. It involved 100 students who were enrolled at the AUB, form both genders, aged 18 years and above, and from different majors. The sample size chosen was a convenient sample size due to limited resources.

Data collection

A multicomponent questionnaire was used to collect data with the purpose of the assessment of dietary supplements use among university students; more specifically, prevalence, knowledge, and reasons for supplementation (Supplementary material). The questionnaire comprised 22 questions distributed between four sections: socio-demographic (gender, age, smoking status, living conditions, major, study year, medical condition, and exercise), anthropometric (weight and height), DS knowledge (knowledge of DS and their side effects, DS intake and reasons (routine of taking DS if daily or weekly). One hundred questionnaires were distributed by hand randomly to the students. Some of the students declined from participating in the survey. The questionnaires of those who declined from participating were distributed to other students. Those who declined were 20 students. Others accepted to participate and thus the 100 surveys were filled. Questions were allowed upon filling the questionnaire, which took no more than 10 min to be completed. Regarding the weight and height measurements, each participants recorded his own weight and height.

Data analysis

For data analysis, the Statistical Package for Social Sciences (SPSS version 24.0 by IBM) was used. To describe the categorical variable (percentage and number), descriptive statistics were used. In addition, linear variables were converted to categories such as BMI and age. Cross-tabulation method was used to identify the differences between two categorical variables. A comparison between characteristics of macronutrients and micronutrient supplement users versus non-users was conducted using chi-square analysis. Univariate and multivariate regression analysis was conducted.

Ethical considerations

Before data collection initiation, oral consent was obtained from students who agreed to participate and fill the questionnaires. The oral consent described the main objective

of the study and assured that the questionnaire was completely anonymous, its completion was voluntary, and data would only be used for the purpose of the study. Furthermore, it assured that participants could withdraw at any time during questionnaire completion without any implicated consequences. Throughout the study, confidentiality and anonymity was maintained at all times. This study was approved by the Institutional Review Board (IRB) at the American University of Beirut and it was conducted in accordance with its guidelines.

Results

Table 1 summarizes the socio-demographic characteristics and dietary supplements knowledge of users and nonusers. A total of 100 participants were included, of which 49 (49%) were males and 51 (51%) were females. The majority of the participants was between 19 and 21 years old and more than half of the target segment was composed of undergraduates (91%) and postgraduate students (9.0%). Moreover, 68 participants stated that they used dietary supplements. A significant association was observed between dietary supplements use and gender, where 41 (60.3%) of those who consumed DS were females, compared to 27 (39.7%) males (OR = 3.34, 95% CI: 1.37-8.15). Another significant association was found between DS use and knowledge where 83.8% of users had knowledge about the supplements compared to 16.2% who were not knowledgeable (OR= 0.37, 95% CI: 0.14-0.98). Furthermore, no significant difference was found between pursuing dietary supplements and smoking status, BMI, living conditions, medical condition, age, exercise, major, and side effects (Table 1).

Multivariate logistic regression showed that gender and exercise were significant factors that influenced DS use. Females were more likely to consume DS (OR= 5.66, 95% CI: 1.60-20.10), while those who did not exercise were less likely to use DS (OR= 0.27, 95% CI (0.09-0.85). There was no significant relationship between smoking, age, BMI, living condition, study major, medical condition, and dietary supplement knowledge and its side effects (Table 2).

Furthermore, Table 3 summarizes the characteristics of dietary supplements use among participants. Out of the total users ($N=68$), only (61.2%) researched information on dietary supplements before deciding to use them. As for those who did not research information before consuming (38.8%), the majority did not since they trusted the person who recommended it. Around (29%) of users consumed DS weekly and occasionally. Most of DS users (88.2%) took it in the form of a pill. Regarding the type of supplements, vitamins had the highest intake (77.9%) followed by minerals (42.6%). Fish oils and proteins were consumed by (22.1%) and (19.1%) of the participants, respectively. Other types of supplements included, meal replacement formula (2.9%), weight gain supplements (2.9%), slimming products (5.9%) and botanicals (7.4%). In addition, (44.1%) of the DS users followed the recommendations of DS intake most of the time. Additionally, (77%) of DS users found it effective with (92.5%) reporting no adverse effects upon consumption. As for the source used by DS users to get information about dietary supplements, healthcare professionals had the highest percent (61.8%), followed by the Internet (44.1%), friends or family (30.9%), fitness coach (22.1%), media (13.2%), textbooks (10.3%), and sales representative (4.4%).

Table 1. Socio-demographic characteristics and DS knowledge.

	Total $N=100$ (%)	Users $N=68$ (%)	Non-users $N=32$ (%)	OR (95% CI)
Gender				
Males	49 (49.0%)	27 (39.7%)	22 (68.8%)	Reference
Females	51 (51.0%)	41 (60.3%)	10 (31.3%)	3.34 (1.37-8.15)
Smoking				
Yes	28 (28.0%)	19 (27.9%)	9 (28.1%)	Reference
No	72 (72.0%)	49 (72.1%)	23 (71.9%)	1.00 (0.39-2.57)
Age				
<19 years	19 (19.0%)	12 (17.6%)	7 (21.9%)	Reference
19-21 years	65 (65.0%)	45 (66.2%)	20 (62.5%)	0.76 (0.26-2.22)
>21 years	16 (16.0%)	11 (16.2%)	5 (15.6%)	0.78 (0.19-3.19)
BMI (kg/m^2)				
<18.5: Underweight	5 (5.0%)	4 (5.9%)	1 (3.1%)	Reference
18.5-24.9: Normal	60 (60.0%)	42 (61.8%)	18 (56.3%)	1.71 (0.18- 16.43)
25-29.9: Overweight	25 (25.0%)	16 (23.5%)	9 (28.1%)	2.25 (0.22-23.32)
>30: Obese	10 (10.0%)	6 (8.8%)	4 (12.5%)	2.67 (0.21-33.49)
Living condition				
Family	70 (70.0%)	48 (70.6%)	22 (68.8%)	Reference
Room-mates	20 (20.0%)	14 (20.6%)	6 (18.8%)	0.94 (0.32-2.76)
Alone	9 (9.0%)	6 (8.8%)	3 (9.4%)	1.09 (0.25-4.77)
Others	1 (1.0%)	0 (0.0%)	1 (3.1%)	–
Study Major				
Non-health-related	85 (85.0%)	57 (83.8%)	28 (87.5%)	Reference
Health-related	15 (15.0%)	11 (16.2%)	4 (12.5%)	1.35 (0.39-4.62)
Study year				
Freshman	9 (9.0%)	6 (8.8%)	3 (9.4%)	Reference
Sophomore	18 (18.0)	14 (20.6%)	4 (12.5%)	0.57 (0.09-3.38)
Junior	30 (30.0)	20 (29.4%)	10 (31.3%)	1.00 (0.21-4.86)
Senior	34 (34.0%)	21 (30.9%)	13 (40.6%)	1.24 (0.26-5.83)
Graduate	9 (9.0%)	7 (10.3%)	2 (6.3%)	0.57 (0.07-4.64)
Medical condition				
Yes	17 (17.0%)	15 (22.1%)	2 (6.3%)	Reference
No	83 (83.0%)	53 (77.9%)	30 (93.8%)	0.24 (0.05-1.1)
Exercise				
Yes	48 (48.0%)	37 (54.4%)	11 (34.4%)	Reference
No	52 (52.0%)	31 (45.6%)	21 (65.6%)	0.44 (0.18-1.05)
DS knowledge				
Yes	78 (78.0%)	57 (83.8%)	21 (65.6%)	Reference
No	22 (22.0%)	11 (16.2%)	11 (34.4%)	0.37 (0.14-0.98)
DS side-effect				
Yes	80 (80.0%)	57 (85.1%)	23 (74.2%)	Reference
No	18 (18.0%)	10 (14.9%)	8 (25.8%)	0.50 (0.18-1.44)

Figure 1 shows the different reasons for using dietary supplements. The highest number of users, 53 users (77.9%) out of the 68 used dietary supplements to improve energy and vitality. Additionally, 22 users (32.4%) consumed DS to enhance athletic performance and to promote hair and skin health.

Discussion

Dietary supplements are one of the most easily available products, and their use has been gradually increasing worldwide. This study was conducted among AUB students to assess the prevalence of DS use. Males (49%) and females (51%) were represented. Out of the 100 participants at AUB, (68%) reported using dietary supplements. Similar findings were reported in studies conducted in medical colleges in Nigeria and South

Table 2. Multivariate logistic regression showing factors that influenced DS use.

	OR (95% CI)
Gender	
Male	Reference
Female	5.66 (1.60-20.10)
Smoking	
Yes	Reference
No	0.96 (0.28-3.35)
Age	
<19 years	Reference
19-21 years	1.09 (0.26-4.65)
>21 years	0.71 (0.13-3.77)
BMI (kg/m^2)	
<18.5:Underweight	Reference
18.5-24.9:Normal	1.49 (0.09-25.37)
25-29.9:Overweight	1.33 (0.07-26.71)
>30: Obese	1.16 (0.05-28.77)
Living condition	
Family	Reference
Room-mates	1.22 (0.33-4.49)
Alone	0.87 (0.13-5.91)
Others	–
Study Major	
Non-health-related	Reference
Health-related	0.40 (0.09-1.92)
Medical Condition	
Yes	Reference
No	0.33 (0.06-1.73)
DS knowledge	
Yes	Reference
No	0.78 (0.22-2.74)
Exercise	
Yes	Reference
No	0.27 (0.09-0.85)
DS side effects	
Yes	Reference
No	0.42 (0.11-1.63)

Africa where DS use was reported by (50%) and (42%) of the students, respectively (10, 23). Our study also documented the prevalence of DS use by gender (more females used DS compared to males). An occurrence of (39.7%) was reported in male students and (60.3%) in females with the majority of the participants having a healthy BMI, being nonsmokers, and exercising regularly. This is similar to some studies conducted in the United States and Serbia, where it was found that females used dietary supplements more frequently compared to their male counterparts (24). After observing the results, we found that in our study there was no significant correlation between taking DS and having a medical condition since only (17%) of participants had medical conditions. However, in another study (16), a statistical correlation was seen between these two. This incompatibility is possible because university students tend to be among the healthiest groups in the population. The data collected showed a statistical significance between DS users and knowledge about DS (83.8%). This finding is similar to Shahwan *et al.* result that related good knowledge about DS with the use of DS (7).

Furthermore, the dietary supplement questionnaire utilized helps in identifying the difference in prevalence of DS use among students who belonged to health sciences as well as non-health domains. Among the students identified as users, we found

Table 3. Characteristics of DS use among the participants.

	N = 68 (%)
Do you research the DS before taking it?	
Yes	41 (61.2%)
No	26 (38.8%)
What are the reasons for not researching the DS?	
Laziness	6 (8.8%)
Trust the person who recommended it	21 (30.9%)
Trust that the product is safe because it is available in the market	3 (4.4%)
Frequency of DS consumption	
Daily	17 (25.0%)
Weekly	20 (29.4%)
Occasionally	20 (29.4%)
Once in a while	11 (16.2%)
DS forms	
Pills	60 (88.2%)
Powder	14 (20.6%)
Powder bar	3 (4.4%)
Liquid	8 (11.8%)
DS type	
Vitamins	53 (77.9%)
Minerals	29 (42.6%)
Botanicals	5 (7.4%)
Proteins	13 (19.1%)
Slimming products	4 (5.9%)
Fish oil	15 (22.1%)
Weight gain formula	2 (2.9%)
Meal replacement	2 (2.9%)
Do you follow the recommendation for your DS intake?	
Yes, very strictly	26 (38.2%)
Yes, most of the times	30 (44.1%)
No, I take more	1 (1.5%)
No, I take less than recommended	11 (16.2%)
Do you consider your dietary supplements effective?	
Yes	51 (77.3%)
No	15 (22.7%)
Have you ever had adverse effects from consuming your DS?	
Yes	5 (7.5%)
No	62 (92.5%)
Source of DS information	
Fitness coach	15 (22.1%)
Healthcare professional	42 (61.8%)
Sales representative	3 (4.4%)
Friends or family	21 (30.9%)
Textbooks	7 (10.3%)
Internet	30 (44.1%)
Media	9 (13.2%)

that (83.8%) were from a non-health related major. On the other hand, (16.2%) were from health-related majors. Therefore, no significance was pointed out between majors and dietary supplements consumption. This contradicts the study carried out by Naqvi *et al.*, which concluded that the use of dietary supplements was associated with health majors who are more likely to use them (12).

The most common DS used was vitamins (77.9%). In other studies, it was found that multivitamins were by far the most commonly used DS among students in other parts of the world (16, 24, 25).

A small segment (7.5%) of our study population indicated that they experienced adverse effects from supplements. Our findings were in agreement with the results

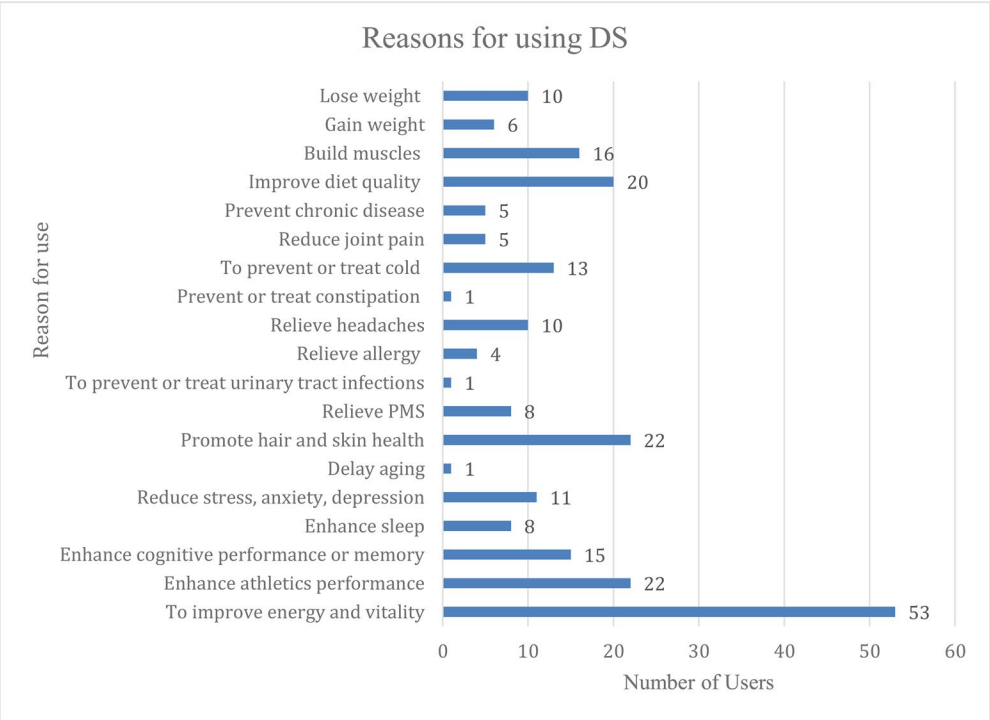

Figure 1. Reasons for using DS.

reported by other studies which showed a low incidence of adverse events related to dietary supplements use (26, 27).

The results of this study clearly indicate that healthcare professionals and the Internet were the most frequently used types of sources to obtain information about supplement use. Our findings are similar to those of Neuhouser *et al.* for a general population sample in the USA and to the one conducted in Lebanon, where most of the respondents believed that dietary supplements were safe to use. They used dietary supplements on recommendation of friends, peers, and relatives (28, 29). As mentioned previously, dietary supplements are legal and accessible, so students and people have easy access to them. The main source of purchasing supplements for users is the pharmacy, electronic or social media sites (8) According to a cross-sectional study conducted at a University in south India carried out by Sharma *et al.*, there was a big gap in knowledge about dietary supplements by science students (9). Thus, improving students' knowledge concerning dietary supplements is highly recommended, especially those in a medical related field, since they will be dealing with patients later on. Many students rely on their personal experience in order to recommend a dietary supplement for other people (6). On the other hand, students use evidence-based approaches or search in biomedical literature such as randomized controlled trials reports, systematic reviews, or some databases like PubMed to find information about DS (6). Moreover, medical students were more likely to get their source of information about dietary supplement from the supplement leaflet, while non-medical students sought the help of their friends and/or relatives (30).

This study had several limitations. A main limitation in our study was the sample size where it may not adequately represent the realities of the population studied, and thus it may not yield valid results. This study is considered a pilot study and further research must be carried out with a bigger sample size from the AUB population, which will be a more representative sample. Another limitation was that DS users were more predisposed to accept the invitation and complete the forms, and thus this predisposition may affect the results. Moreover, a third limitation was that the students themselves reported their weight and height and we did not measure it due to limited resources. Finally, the DS knowledge was recorded as a yes or no reply and we did not use a knowledge score.

Conclusion

By examining the prevalence, knowledge, and reasons for dietary supplementation, this study assessed the use of dietary supplements among university students. The majority of male and female students from different majors were dietary supplement users; however, the reasons behind their usage differed. The main reason for use of dietary supplements by both genders was to improve their energy and vitality. There was a significant association between DS use and gender. However, additional research is further needed to identify the prevalence, knowledge and reasons for supplementation among university students in Lebanon and the Middle East.

Acknowledgements

The authors acknowledge the contribution of all the students who participated in the study.

Disclosure statement

The authors declare no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Ethical standards disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Institutional Review Board (IRB) at the American University of Beirut.Verbal consent was witnessed and formally recorded.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

ORCID

Samaa Al Tabbah http://orcid.org/0000-0002-6876-9794

About the authors

Leen lawand received her Bachelor of Science in Nutrition and Dietitics from the American University of Beirut in Lebanon. She finished her clinical training as a Dietetic Intern at the Saint Georges Hospital in Beirut. Through her training, she has been involved in clinical rotation, food service rotation, community nutrition.Her research interest is generally in clinical research especially in the nutrition and dietitics.

Rewa Youness received her Bachelor of Science in Nutrition and Dietitics from the American University of Beirut in Lebanon. She finished her clinical training as a Dietetic Intern at the Clemenceau Medical Center in Beirut. Her research interest is generally in clinical research especially in the nutrition and dietitics.

Loubna Sinno received her Bachelor of Science in Biology followed by a Masters in Public Health (MPH) from the American University of Beirut, Lebanon. She was appointed as a Research Coordinator at Makassed General Hospital, Beirut, Lebanon. Through her work, she has been involved in supervising research projects as well as helping in analyses and manuscript writing. Her research interest is generally in clinical research especially in the obstetrics & gynecology and internal medicine fields.

Nabih Lawand is a psychology student at the American University of Beirut. He is a pre- med student who is currently preparing to join Medical School at the American University of Beirut. His research interest is generally in clinical research especially in clinical psychology, Public health, and General Medicine fields.

Samaa Al Tabbah received her Bachelor of Science in Medical Laboratory Technology from the American University of Beirut in Lebanon followed by a Pharm. D. in Clinical Pharmacy from the Lebanese American University in Lebanon. She is currently the founder and CEO of MARS (Medical Agency for Research and Statistics) which is a clinical research company based in Beirut, Lebanon. Through her work, she has been involved in research projects as well as manuscript writing and clinical research training workshops. Her research interest is generally in clinical research especially in Oncology.

References

[1] ″Questions and Answers on Dietary Supplements″. Food and Drug Administration (FDA). 2019. Available from: https://www.fda.gov/food/information-consumers-using-dietary-supplements/questions-and-answers-dietary-supplements.

[2] ″FDA 101: Dietary Supplements ″. U.S. Food & Drug Administration (FDA). 2020. Available from: https://www.fda.gov/consumers/consumer-updates/fda-101-dietary-supplements.

[3] Naqvi AA, Ahmad R, Zehra F, Yousuf R, Kachela B, Nehal Nadir M. Dietary supplement use among students of pharmacy colleges in the City of Karachi, Pakistan: Prevalence, opinions, and attitudes. J Diet Suppl. 2019;16(2):166–78. doi:10.1080/19390211.2018.1443191.

[4] Dwyer JT, Coates PM, Smith MJ. Dietary supplements: Regulatory challenges and research resources. Nutrients. 2018;10(1):41–65. doi:10.1186/s12906-017-2031-6.

[5] Stanojevic-Ristic Z, Stević S, Rašić J, Valjarević D, Dejanović M, Valjarević A. Influence of pharmacological education on perceptions, attitudes and use of dietary supplements by medical students. BMC Complement Altern Med. 2017;17(1):527.

[6] Bukic J, Rusic D, Bozic J, Zekan L, Leskur D, Seselja Perisin A, Modun D. Differences among health care students' attitudes, knowledge and use of dietary supplements: a cross-sectional study. Complement Ther Med. 2018;41:35–40. doi:10.1016/j.ctim.2018.09.005.

[7] Shahwan MAA, Sham MZ. Knowledge and practice of dietary supplement and micronutrients among medical students at Ajman University. J Pharmaceut Sci Res. 2018;10(1):85–90.

[8] AlTamimi JZ. Awareness of the consumption of dietary supplements among students in a university in Saudi Arabia. J Nutr Metab. 2019;2019:1–10. doi:10.1155/2019/4641768.

[9] Sharma A, Oommen S, Topno I, Saya RP. Perceptions and practices of self-medication in healthcare and nonhealthcare university students in South India. J Basic Clin Physiol Pharmacol. 2015;26(6):633–40. doi:10.1515/jbcpp-2015-0025. PMID: 26131646
[10] Steele M, Senekal M. Dietary supplement use and associated factors among university students. South Afr J Clin Nutr. 2005;18(1):17–30. doi:10.1080/16070658.2005.11734034.
[11] Wiltgren AR, Booth AO, Kaur G, Cicerale S, Lacy KE, Thorpe MG, Keast RSJ, Riddell LJ. Micronutrient supplement use and diet quality in university students. Nutrients. 2015;7(2):1094–107. doi:10.3390/nu7021094.
[12] Naqvi AA, Ahmad R, Elewi AAW, AlAwa AH, Alasiri MJ. Dietary supplement use among undergraduate male students in health and non-health cluster colleges of a public-sector university in Dammam, Saudi Arabia. BMC Complement Altern Med. 2018;18(1):269. doi:10.1186/s12906-018-2332-4.
[13] Monterrosa EC, Beesabathuni K, van Zutphen KG, Steiger G, Kupka R, Fleet A, Kraemer K. Situation analysis of procurement and production of multiple micronutrient supplements in 12 lower and upper middle-income countries. Matern Child Nutr. 2018;14(Suppl 5):e12500. doi:10.1111/mcn.12500.
[14] Valentine AA, Schumacher JR, Murphy J, Ma YJ. Dietary supplement use, perceptions, and associated lifestyle behaviors in undergraduate college students, student-athletes, and ROTC cadets. J Am Coll Health. 2018;66(2):87–97. doi:10.1080/07448481.2017.1377205.
[15] "Global nutrition policy review 2016-2017: country progress in creating enabling policy environments for promoting healthy diets and nutrition". World Health Organization (WHO). 2016–2017. https://www.who.int/publications-detail-redirect/9789241514873
[16] Lieberman HR, Marriott BP, Williams C, Judelson DA, Glickman EL, Geiselman PJ, Dotson L, Mahoney CR. Patterns of dietary supplement use among college students. Clin Nutr. 2015;34(5):976–85. doi:10.1016/j.clnu.2014.10.010.
[17] Tian HH, Ong WS, Tan CL. Nutritional supplement use among university athletes in Singapore. Singapore Med J. 2009;50(2):165–72.
[18] Sicińska E, Bojarska K. Intakes of folic acid from dietary supplements and fortified products in students. Rocz Panstw Zakl Hig. 2013;64(1):55–9.
[19] Al-Naggar RA, Chen R. Prevalence of vitamin-mineral supplements use and associated factors among young Malaysians. Asian Pac J Cancer Prev. 2011;12(4):1023–9.
[20] Datta M, Vitolins MZ. Food fortification and supplement use-are there health implications? Crit Rev Food Sci Nutr. 2016;56(13):2149–59. doi:10.1080/10408398.2013.818527.
[21] Navarro VJ, Lucena MI. Hepatotoxicity induced by herbal and dietary supplements. Semin Liver Dis. 2014;34(2):172–93. doi:10.1055/s-0034-1375958.
[22] Daniells S. "College students more likely than general population to use dietary supplements, says survey". 2015. Available from: https://www.nutraingredients-usa.com/Article/2015/09/23/College-students-more-likely-than-general-population-to-use-dietary-supplements-says-survey.
[23] Aina BA, Ojedokun OA. Knowledge and use of dietary supplements by students of College of Medicine, University of Lagos, Idi-Araba, Lagos, Nigeria. J Basic Clin Pharm. 2014;5(2):34–9. doi:10.4103/0976-0105.134952.
[24] Moore KL, Saddam AM. Dietary supplement use among undergraduate college students. J Am Dietetic Assoc. 1999;99(9):A96. doi:10.1016/S0002-8223(99)00733-6.
[25] Ranelli PL, Dickerson RN, White KG. Use of vitamin and mineral supplements by pharmacy students. Am J Hosp Pharm. 1993;50(4):674–8. doi:10.1093/ajhp/50.4.674.
[26] Biesalski HK, Tinz J. Multivitamin/mineral supplements: Rationale and safety. Nutrition. 2017;36:60–6. doi:10.1016/j.nut.2016.06.003.
[27] Gardiner P, Sarma DN, Low Dog T, Barrett ML, Chavez ML, Ko R, Mahady GB, Marles RJ, Pellicore LS, Giancaspro GI. The state of dietary supplement adverse event reporting in the United States. Pharmacoepidemiol Drug Saf. 2008;17(10):962–70. doi:10.1002/pds.1627.
[28] El Khoury G, Ramadan W, Zeeni N. Herbal products and dietary supplements: A cross-sectional survey of use, attitudes, and knowledge among the Lebanese population. J Community Health. 2016;41(3):566–73. doi:10.1007/s10900-015-0131-0.

[29] Neuhouser ML, Patterson RE, Levy L. Motivations for using vitamin and mineral supplements. J Am Diet Assoc. 1999;99(7):851–4. doi:10.1016/S0002-8223(99)00202-3.
[30] Alhomoud FK, Basil M, Bondarev A. Knowledge, Attitudes and Practices (KAP) relating to dietary supplements among health sciences and non-health sciences students in one of the universities of United Arab Emirates (UAE). J Clin Diagn Res. 2016;10(9):JC05–JC09.