ISSN 2379-6375

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# Dietary Supplements: A Survey of the Opinion of First-Year Professional Pharmacy Students

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***Article information***
**Received:** March 8th, 2022; **Accepted:** March 23rd, 2022; **Published:** March 24th, 2022

***Cite this article***
Hailemeskel B, Fullas F. Dietary supplements: A survey of the opinion of first-year professional pharmacy students. *Diabetes Res Open J*. 2022; 8(1): 18-22. doi: 10.17140/DROJ-8-155

## ABSTRACT

**Introduction**
Pharmacists need to be at the forefront in advising consumers of dietary supplements (DS) about quality, claims, labeling, safety, efficacy, DS-drug interactions, and other aspects. Yet, the knowledge base of pharmacists and pharmacists-in-training about DS appears to be below expectation.

**Objective**
The goal of the study is to evaluate pharmacy student opinions about DS.

**Methodology**
A survey questionnaire was developed, tested, and distributed among students who were enrolled in the Drug Information class, which is a 2-credit hour mandatory course for all first professional pharmacy students at Howard University, College of Pharmacy. The data was analyzed using SPSS statistical analysis software.

**Results**
A total of 42 students (15 male, 27 female) participated in the survey. Of these, 25 respondents (59.5%) felt comfortable about their knowledge of DS, while only 14 (33.4%) reported participation in counselling ($p$=0.0281). Most respondents (29; 69%) had used DS in the past, while 21 (50%) claimed they used DS at the time of the survey. To a specific query in the questionnaire regarding lycopene-containing food items, 28 (66.7%) agreed they would use such foods in the future for health benefits. Analysis of the survey data revealed no statistical differences between the responses of male and female students ($p$>0.05 for all the five questionnaire items).

**Conclusion**
In a survey of 42 pharmacy students at Howard University College Pharmacy, over half (59.5%) felt comfortable about their knowledge of DS. About one-third students (33%) reported they were involved in patient counseling and interaction. Over two-third respondents (69%) took DS in the past, while half were taking DS at the time of the survey.

**Keywords**
Dietary supplements; Knowledge; Counseling; Use; Lycopene.

## INTRODUCTION

The Dietary Supplement Health and Education Act (DSHEA) was enacted by US Congress with the purpose of regulating dietary supplements (DS) in the United States. Formulations of botanicals, vitamins, minerals, and amino acids constitute DS. They do not require pre-market approval by the Food and Drug Administration (FDA).[1] Manufacturers of DS are allowed to make structure-function claims, with a disclaimer that the latter have not been evaluated by FDA. They are also required to include a statement that a DS is not intended to diagnose, treat, cure, or prevent any disease.[2] The semantics adds to the confusion of interpreting claims. As of 2014, there were more than 85,000 diverse DS products in the market.[1] The quality and safety of DS continue to be of much concern.

A positive role cab be played by pharmacists in selecting appropriate DS not only for their own use, but also for public consumers who seek their advice. Pharmacists need to be at the forefront in advising consumers of DS about quality, claims, label-

*Diabetes Res Open J.* 2022; 8(1): 18-22. doi: 10.17140/DROJ-8-155

ing, safety, efficacy, DS-drug interactions, and other aspects.[1] Yet, the knowledge base of pharmacists and pharmacists-in-training about DS appears to be below expectation. According to a study by Shah et al,[3] pharmacy students felt their knowledge about herbal supplements was inadequate, with 95% of the survey participants reporting a need to learn more about herbal supplements. In a systematic review of the literature by Kwan and colleagues, it was shown in 1990 that about 50% of surveyed pharmacists perceived they have some knowledge about DS.[4] The review reported similar results in five more studies. However, the actual knowledge level of pharmacists was even lower than 50%.[4] Data gathered from 41 academic pharmacists in US pharmacy schools indicated a use rate of 54% in the past, with 16 (39%) reporting taking DS at the time of the study.[5] In a survey of 179 pharmacy students by Axon et al,[6] it was reported 52% used at least one dietary supplement in their lifetime.[6] In a similar manner, another study which surveyed 70 pharmacists showed a majority (52.9%) reported taking dietary supplements.[7] In a 2017 survey, Hailemeskel et al[8] reported about 53% use rate among HU first year pharmacy students.[8] For this survey, several herbs were presented to the participants as a part of the survey. The herbs are listed alphabetically (Table 1) and by the diseases states they are intended to be used (Table 2) as shown below.

**Table 1:** *Dietary Supplements Included in the Study*

| Dietary Supplements | Indications/Use |
|---|---|
| Alpha lipoic acid | Multiple sclerosis |
| | Liver disease |
| Berberine | Diabetes mellitus |
| Bitter melon | High blood pressure |
| Citicoline | Parkinson's disease |
| Coenzyme Q10 | Hypertension |
| Curcumin | Hyperlipidemia |
| Fenugreek | Diabetes |
| Flaxseed | Hyperlipidemia |
| Garlic | High blood pressure |
| Ginkgo biloba | Parkinson's disease |
| Glutathione | Multiple sclerosis |
| Grape seed extract | High blood pressure |
| Hawthorn | High blood pressure |
| L-arginine | Hypertension |
| | Diabetes mellitus |
| L-Carnitine | Parkinson's disease |
| Low dose naltrexone | Opioid addictions |
| Lycopene | High blood pressure |
| Magnesium | Fibromyalgia |
| Melatonin | High blood pressure |
| Mucuna Purines (Velvet Beans) | Parkinson's disease |
| NADH | Parkinson's disease |
| OMEGA-3 (DHA/EPA) | Parkinson's disease |
| Phosphatidylserine | Parkinson's disease |
| Resveratrol | Hyperlipidemia |
| Sea weeds | Hypertension |
| Taurine | High blood pressure |
| Tocotrienol | Hyperlipidemia |

**Table 2:** *Dietary Supplements by the Respective Disease States Claimed to be Useful*

| Disease States | Dietary Supplements |
|---|---|
| Diabetes mellitus | Fenugreek |
| | L-carnitine |
| | Berberine |
| Fibromyalgia | Magnesium |
| High Blood Pressure | Bitter melon |
| | Garlic |
| | Grape seed extract |
| | Hawthorn |
| | Lycopene |
| | Taurine |
| | Coenzyme Q10 |
| | L-arginine |
| | Sea weeds |
| Hyperlipidemia | Curcumin |
| | Flaxseed |
| | Resveratrol |
| | Tocotrienol |
| Liver disease | Alpha-lipoic acid |
| Multiple sclerosis | Alpha lipoic acid |
| | Glutathione |
| Opioid addictions | Low dose naltrexone |
| Parkinson's disease | Citicoline |
| | Ginkgo biloba |
| | Mucuna purines (velvet beans) |
| | NADH |
| | OMEGA-3 (DHA/EPA) |
| | Phosphatidylserine |
| | L-Carnitine |

The current survey was carried out to evaluate the opinion of first year pharmacy students at Howard University (HU), College of Pharmacy regarding their knowledge, counseling roles, their own past and current use of DS. It is hoped the survey results would help HU College of Pharmacy address any deficits.

## METHODS

After receiving approval from Howard University Institutional Review Board (IRB), the study voluntarily enrolled 45 incoming first professional year pharmacy students at HU College of Pharmacy for the year 2021. The survey was conducted as part of a Drug Information course, which is a 2-credit hour course in the college. Of these, 42 (93.3% response rate) completed the survey. Demographic data were collected on age, gender, education, residence, work-related items, and annual income. Five opinion questions were also included in the survey questionnaire. A 4-point Likert scale (1=strongly agree; 2=agree; 3=disagree; 4=strongly disagree) was used to collect responses. In cases where a "yes" or "no" answer was inferred, the strongly agree and agree responses were considered as a "yes" while the disagree and strongly disagree responses were considered "no". Mean Likert score were used to

*Diabetes Res Open J.* 2022; 8(1): 18-22. doi: 10.17140/DROJ-8-155

place the levels of aggregate agree and disagree responses. Statistical methods were used to calculate confidence intervals and significance. A two-tailed Fisher's exact test was utilized to determine *p* values by comparing responses based on gender.

## RESULTS

As shown in Table 3, most survey respondents (27; 64.3%) were female students. Thirty-four (81%) had a bachelor's degree prior to starting the pharmacy program. Respondents scored 2.14, 2.17, 2.38 and 2.43 on the mean Likert scale in three of the opinion

**Table 3:** *Demographic Characteristics of Respondents*

| Characteristics | Respondents (n, %) | 95% CI (% range) |
|---|---|---|
| **Age (years)** | | |
| 21-23 | 14 (33.3) | 19.1-47.6 |
| 24-26 | 17 (40.5) | 25.6-55.3 |
| 27-29 | 5 (11.9) | 2.1-21.7 |
| >29 | 6 (14.3) | 3.7-24.9 |
| **Gender** | | |
| Male | 15 (35.7) | 21.2-50.2 |
| Female | 27 (64.3) | 49.8-78.8 |
| **Education** | | |
| Some college | 1 (2.4) | 0.0-7.0 |
| Associate Degree | 1 (2.4) | 0.0-7.0 |
| BA/BSc | 34 (81) | 69.1-92.8 |
| MSc | 4 (9.5) | 2.7-22.6 |
| PhD/Professional | 2 (4.8) | 0.0-11.2 |
| **Residence** | | |
| Washington, D.C. | 4 (9.5) | 0.7-18.4 |
| Maryland | 13 (31) | 16.9-44.9 |
| Virginia | 7 (16.7) | 5.4-27.9 |
| Other States | 18 (42.9) | 27.9-57.2 |
| **Working Now** | | |
| Yes | 9 (21.4) | 9.0-33.8 |
| No | 33 (78.6) | 66.2-90.9 |
| **Work Experience** | | |
| Never worked | 2 (4.8) | 0.0-11.2 |
| Short-term | 3 (7.1) | 0.0-14.9 |
| Part-time | 16 (38.1) | 23.4-52.8 |
| Full-time | 21 (50) | 34.9-65.1 |
| **Type of Job** | | |
| Pharmacy related | 16 (38.1) | 23.4-52.8 |
| Other healthcare | 12 (28.6) | 14.9-42.2 |
| Non-health related | 13 (31) | 16.9-44.9 |
| Not applicable | 1 (2.4) | 0.0-7.0 |
| **Annual Income** | | |
| < USD 10,000 | 13 (31) | 16.9-44.9 |
| 10,001-20,000 | 7 (16.7) | 5.4-27.9 |
| 20,001-30,000 | 6 (14.3) | 3.7-24.9 |
| 30,001-40,000 | 5 (11.9) | 2.1-21.7 |
| >40,000 | 11 (26.2) | 12-9-39.5 |
| **Years Worked** | | |
| None | 1 (2.4) | 0.0-7.0 |
| 1-2 | 19 (45.2) | 30.2-60.3 |
| 3-4 | 11 (26.2) | 12.9-39.5 |
| >4 | 11 (26.2) | 12.9-39.6 |

CI=Confidence interval; Normal approximations of binomial exact values.

*Diabetes Res Open J.* 2022; 8(1): 18-22. doi: 10.17140/DROJ-8-155

questions, which is close to the designated agree score of 2.

One questionnaire item scored a mean of 2.76, which is close to the disagree level on the scale (Table 4). A total of 25 respondents (59.5%) felt comfortable in their knowledge DS (mean Likert score=2.38±0.70). Fourteen (33.3%) were involved in counseling consumers of DS (mean Likert score=2.76±0.88). Most of the respondents (29; 69%) had taken DS in the past, while 21 (50%) used DS at the time of this survey (Table 4).

Gender-based sub-analysis of the data did not show statistical differences in the responses to the five opinion questions ($p$>0.05). The most difference was noted in the response to the question on past use of DS, which favored females (21 of 27 [77.8%]) *vs* males (8 of 15 [55.3%]), $p$=0.1635 (Table 5).

## DISCUSSION

In a survey of 179 students by Axon et al,[6] 52% had used at least one DS in their lifetime. Our survey showed a higher user rate (69%) when such use in the past was inquired. In another survey of 70 pharmacists, a majority (52.9%) reported taking dietary supplements,[7] which agrees with our finding. Furthermore, in a survey of 41 pharmacy faculty and professional staff, Murphy et al[5] found a prior user rate of 54%, lower than our finding. In our survey, current user rate was 50% compared to 39% reported by Murphy et al.[5] Analysis of the response pattern to the five questions in our questionnaire based on gender did not show statistical difference. Most respondents in our study (59.5%) felt comfortable about their knowledge of DS, yet only 33% were involved in counseling, which indicated a statistically significant discrepancy ($p$=0.0281).

## CONCLUSION

In a survey of 42 pharmacy students at Howard University College Pharmacy, 25 (59.5%) felt comfortable about their knowledge of DS. Fourteen students (33%) reported they were involved in patient counseling and interaction. A total of 29 respondents (69%) took DS in the past, while 21 (50%) were taking DS at the time of the survey. Twenty-eight respondents (66.7%) agreed they would consume lycopene-containing foods in the future to derive some health benefits.

## CONSENT

Yes.

## INSTITUTIONAL REVIEW BOARD PERMISSION

Yes.

**Table 4:** *Questionnaire Items and Answers of Respondents on a 4-point Likert Scale*

| Questionnaire Items | Strongly Agree (n, %) | Agree (n, %) | Disagree (n, %) | Strongly Disagree (n, %) | Mean Likert Score (SD) |
|---|---|---|---|---|---|
| Are you comfortable in your knowledge of dietary supplements (DS) (n=42) | 3 (7.1) | 22 (52.4) | 2 (35.7) | 5 (4.8) | 2.38±0.70 |
| I have been involved in counseling and interaction with patients on DS (n=42) | 4 (9.5) | 10 (23.8) | 20 (47.6) | 8 (19.1) | 2.76±0.88 |
| I have taken DS in the past for several reasons (n=42) | 10 (23.8) | 19 (45.2) | 10 (23.8) | 3 (7.1) | 2.14±0.87 |
| I am currently on some type of DS including vitamins (n=42) | 9 (21.4) | 12 (28.6) | 15 (35.7) | 6 (14.3) | 2.43±0.99 |
| I will start eating foods containing lycopene for my own personal health (n=42) | 9 (21.4) | 19 (45.2) | 14 (28.6) | 2 (4.8) | 2.17±0.82 |

Mean Likert score was calculated by multiplying each score by the number of responses, adding up the total and then dividing by the number of respondents; SD=Standard Deviation

**Table 5:** *Breakdown of Responses Based on Gender*

| Survey Items | Gender | SA | A | DA | SDA | Ag A's | Ag DA's | *p* value |
|---|---|---|---|---|---|---|---|---|
| Are you comfortable in your knowledge of dietary supplements (DS)? | M (n) | 2 | 7 | 6 | 0 | 9 | 6 | 0.7464 |
| | F (n) | 1 | 15 | 9 | 2 | 16 | 11 | |
| I have been involved in counseling and interaction with patients on DS | M (n) | 1 | 5 | 7 | 2 | 6 | 9 | 0.5159 |
| | F (n) | 3 | 5 | 13 | 6 | 8 | 19 | |
| I have taken DS in the past for several reasons | M (n) | 3 | 5 | 7 | 0 | 8 | 7 | 0.1635 |
| | F (n) | 7 | 14 | 3 | 3 | 21 | 6 | |
| I am currently on some type of DS including vitamins | M (n) | 4 | 4 | 4 | 3 | 8 | 7 | 1.0000 |
| | F (n) | 5 | 8 | 11 | 3 | 13 | 14 | |
| I will start eating foods containing lycopene for my own personal health | M (n) | 3 | 8 | 4 | 0 | 11 | 4 | 0.7337 |
| | F (n) | 6 | 11 | 8 | 2 | 17 | 10 | |

Abbreviations: SA=Strongly agree; A=Agree; DA=Disagree; SDA=Strongly disagree; Ag A's=aggregate agrees; Ag DA's=aggregate disagrees; M=Male; F=Female
*p* values were determined by using a two-tailed Fisher's exact test; values>0.05 are considered not significant.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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