

Dietary Supplement Use, Knowledge and Perceptions among College Students Enrolled in Coordinated Programs in Dietetics

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Abstract

Dietary Supplement (DS) use in the United States (US) has increased over the years with over half of adults regularly consuming at least one. DS use is also increasing on college campuses in the US; however, little is known about the DS use among dietetic students. The purpose of this study was to assess DS use, knowledge and perceptions of students enrolled in coordinated programs in dietetics. A quantitative, descriptive, cross-sectional, convenient sampling strategy was used and data were collected from a validated online survey distributed to students by their program directors. Participants (n=136; mean age=24.79; SD=5.608) were predominately female, Caucasian and single. Students were mostly graduate students, ranked their health as good with overall good eating habits, were trying to maintain their weight and did not follow a specific diet. Most students reported they knew the ingredients in their DSs and reported no adverse effects. 85% of students reported taking supplements and multiple vitamin/mineral supplements were the most frequently used. Of the vitamins, minerals and/or supplements listed, most were used daily to promote general health; whereas most other supplements listed were used a few times per week to promote general health. The main source reported for retrieving DS information from was health professionals followed by the internet. Finally, 10.4% were extremely confident that DSs are safe to consume and 52.6% of students rated their education on DSs as average.

Keywords: Dietary supplements; Dietetics; Students; Coordinated programs; Education

Introduction

Dietary Supplement (DS) use is widespread with over half of the adult population in the United States consuming one or more DSs daily, but confusion about the health benefits, efficacy and safety remain [1,2]. The Dietary Supplement Health and Education Act (DHSEA) of 1994 defines a DS as a product that supplements the diet and contains one or more of the following: (a) vitamin; (b) mineral; (c) herb or botanical; (d) amino acid; (e)

substance for use to supplement the diet and increase total dietary intake; or (f) concentrate, metabolite, constituent, extract or grouping of any ingredients listed [3]. A Dietary Supplement (DS) can be taken in the form of a pill, capsule, tablet, or liquid and is labeled and marketed as a DS [4].

Approximately half of adults report regular use of DSs, according to the National Health and Nutrition Examination Survey (NHANES) data [5]. Adult consumers' DS usage mainly consists of a multivitamin while others take a variety of different products and the primary reason for taking DSs is for health and wellness and to meet nutrient gaps [5]. DSs do not replace nutrition from a healthful diet, but they can supplement important elements the body needs to function [6]. Many adults use DSs because they believe they will enhance their performance, supplement something deficient in their diet, build muscle and help them to lose or gain weight [7].

Data collected from the NHANES 2011-2014 concluded 52% of adults take one or more DSs, with multivitamin-mineral products being the most frequently consumed supplement among all age groups [1]. Participant's incomes were associated with DS use, type and number of supplements taken. Based on NHANES survey data from 1999-2000 and 2011-2012, the use of DSs has remained stable at 52%, but patterns of DS varied and MVI and multi-mineral product use decreased [8]. The majorities of consumers consider MVIs and other supplements as helpful in relation to filling nutrient gaps in their diets but are not considered as a healthy diet replacement [9].

DS use is increasing in also increasing on college campuses in the United States [10]. As students' age increases, the odds of using a DS also increases and age was a positive correlation with the number of DSs used among college students [11]. Lieberman, et al. reported college students appear more likely to consume DSs than the general population and consume multiple classes of DS every week [12]. The high prevalence of DS use among college students is a concern due to young adults' health habits usually persisting throughout their lifetime [12].

College students enrolled in health care profession programs, particularly students enrolled in Coordinated Programs (CPs) in dietetics within the United States are a particular population of

interest. DS use has been researched among the adult population and college students; however, the DS use, knowledge and perceptions among CPs do not exist. Some studies examine college students' use of DSs while other studies examine college students' education, knowledge, perceptions and lifestyle or socio-demographic factors of DSs [10-16].

Prevalence, safety and education of DS use among college students

College students use DSs for a variety of reasons. Dietary or herbal supplements are mostly used by college students to prevent disease, improve physical performance and immune function and because of recommendations from family or friends [16]. College athletes reported using DSs, energy drinks and prescription medications to enhance athletic performance and energy drinks had the highest prevalence (80.1%) followed by 64.1% DS and 53.3% prescription medications [17]. Other reasons students might use DSs are to treat disease, improve sports performance, improve mental ability or memory, improve sexual performance, because a health care provider recommended them or because medical treatment was either effective or too expensive [16].

College students do not consider DSs essential for health but often use at least one DS compared to the general public [16]. Almost 80% of undergraduate and graduate students reported using DSs within the past 12 months [15]. Lieberman, et al. studied college students from five different United States universities with approximately 66% using DSs and a total of 53.6% student-athletes from Midwestern University also reported use of DSs [10-12].

DS safety is significant and the many risks of taking supplements include combining supplements, using supplements with prescription or over-the-counter medications, substituting supplements for prescriptions and taking too many of specific supplements [6]. More information about DSs is needed to keep the public safe and healthy and ensure they are able to purchase DSs that are safe, worthwhile, high quality and at appropriate costs [18]. Health care professionals can help reduce any and all risks related to DS use [19].

Overall, education on DSs is lacking and Americans need accurate information to ensure healthy people [18]. Health care professionals should be educated on manufactures of DSs to make recommendation based on product quality [20]. Health care professionals can aid in consumers DS decision making, but health care professionals who lack understanding or knowledge of DSs are not equipped to help consumers make informed decisions [6]. College students require knowledge to provide education to and counsel patients or consumers regarding DS benefits, adverse effects and herb-drug or drug-nutrient interactions [20]. DS education is important for health care professionals to help consumers acquire accurate knowledge and prevent unnecessary adverse events from occurring.

Rationale and significance

DS use is prominent among college students, but information does not exist regarding CPs. Understanding DS use, knowledge

and perceptions of CPs can better determine the need for further education and may help to improve programs' curriculums or increase education in other health care professionals' programs. DSs are marketed for health, cognitive or physical performance improvements, energy, weight loss, pain reduction and other favorable effects therefore, supplement safety has become a growing concern, especially with the increasing number of adverse events [13,14]. Educated students promote a positive attitude or healthier pattern toward DS use; therefore, providing education to young adults builds responsible and theoretically healthier future consumers and healthcare professionals [15]. DS education on regulation, marketing, prevalence and safety while enrolled in health care professionals' programs can aid future health care professionals in providing accurate information to consumers and assisting others in making informed decision making on DS consumption.

Materials and Methods

Research design

A quantitative, descriptive, cross-sectional study was used. According to Portney and Watkins, a descriptive research study examines "...factors that describe characteristics, behaviors and conditions of individuals and groups" (p.301) and requires "... specific aims or guiding questions..." (p.133). A cross-sectional research study is efficient because data is gathered from participants at one particular event in time [21]. The purpose of this quantitative descriptive, cross-sectional study was to compare DS use among students enrolled in CPs in dietetics and assess their use, knowledge and perceptions of DSs.

Study participants

The study participants were students enrolled in CPs in dietetics within the United States. The CPs was accredited by the Accreditation Council for Education in Nutrition and Dietetics (ACEND). At the time of this study, there were approximately sixty-one CPs in dietetics on the ACEND website with an estimate of 10-30 students in each program. An email invitation was sent to the program director from each ACEND accredited CP in dietetics to introduce the study. The program directors' email was obtained from the ACEND website. Program directors were encouraged to share the study with their students.

Inclusion criteria: The inclusion criteria of this study were college students enrolled in a CP in dietetics, aged 18 years and older and informed consent.

Exclusion criteria: The exclusion criteria of this study included not answering any of the questions and lack of informed consent to participate in the study.

Sampling methodology: A purposeful, convenience sampling methodology was used to complete this descriptive research study. Convenience sampling is a non-probability sample where participants are picked based on their availability [21].

Institutional review board approval: Approval from the A.T. Still University Institutional Review Board was obtained prior to beginning this study.

Survey development

A validated dietary supplement survey, developed by Lieberman, et al. was used for this study [12]. The survey has been used in a minimum of five research studies and is non-copyrighted, free and adaptable [22]. The survey was adapted to better answer the proposed research question: What is the use, knowledge and perceptions of dietary supplements among students enrolled in CPs in dietetics?

Demographics: The following demographic information was collected from the survey: gender, age, ethnicity and background, health profession, highest level of education completed and marital status.

Dietary supplement survey: Permission to use the dietary supplement survey was received from Harris Lieberman, one of the survey instruments authors, on Monday, November 2, 2020. The dietary supplement survey was adapted to better answer the proposed research question. The survey consisted of 32 questions. The first seven questions included information about gender, age, ethnicity and background, education classification, highest level of education completed and marital status. The next four questions asked students about their health, which included general health and overall eating habits, what students are trying to do about their weight and how students describe their diet. The final 21 questions asked students about their DS use, knowledge and perceptions. Some of the questions included information about the students' knowledge regarding the United States (U.S.) Food and Drug Administration related to DSs, confidence in DS claims, adverse effects of DSs, resources, location to purchase DSs, why avoid DSs and education received regarding DSs.

Data collection

Students enrolled in the CPs in dietetics received an email from their program director. Each student had 4 weeks to complete the survey. A reminder was sent at weeks 2 and 3. Social media was not used to collect data and there were no direct benefits to completing the survey. Data collection was anonymous and voluntary. All data was downloaded from Survey Monkey and stored in an SPSS database on the researcher's computer.

Results

Sample characteristics

Students enrolled in CPs in dietetics accredited by ACEND were sampled in 2021. One hundred forty-five students

completed the dietary supplement survey. Nine surveys were excluded for various reasons, including lack of completion or illegibility. The final sample included surveys from 136 students.

Statistics

IBM SPSS statistics version 27 was used for data analysis. Demographic variables were analyzed by calculating frequencies and percentages for the first seven DS survey questions, which included information about gender, age, ethnicity and background, education classification, highest level of education completed and marital status. Other descriptive variables were also analyzed by calculating frequencies and percentages for categorical values. The Kolmogorov-Smirnov test was used to test variables for normality ($p=0.05$). Summary scores, including frequency or percentage, were used to evaluate ten of the survey questions regarding DS use. *Chi-square* tests were used to assess significant differences for categorical characteristics. Multiple logistic regression was used to examine the independent relationship between DS use and demographic and lifestyle characteristics of the dietetic students.

Demographic results

A total of 145 students enrolled in CPs attempted to complete the dietary supplement survey. Nine surveys were excluded; therefore, the sample consisted of 136 respondents ($n=136$). **Table 1** represents the 136 participants or students, which consisted of 131 females (96.3%) and 5 males (3.7%). The mean age of students was 24.79 ($SD=5.608$) and the students' ages ranged from 20 to 50 years old (see supplementary). The highest percentages of students (19.9%) were 21 years old (**Table 1**).

Table 1 also represents the ethnicity and background of students. A total of 9 (6.6%) students identified as Hispanic or Latino and 127 (93.4%) students as non-Hispanic or non-Latino. Students (118; 86.8%) identified primarily as Caucasian.

Table 1 continues to represent the students' education classification ($n=136$; $SD=0.81$; $mean=4.16$) and degrees completed ($n=135$; $SD=0.81$; $mean=0.99$). Many students had earned a bachelor's degree (60; 44.4%) and were classified as a graduate student (56; 41.2%). Other students completed some college courses (47; 34.8%), an associate degree (20; 14.8%) or a graduate degree (8; 5.9%). Most students (103; 75.7%) were single and never married (**Table 1**). The mean marital status of students was 1.43 ($SD=0.89$).

Table 1: Demographics, education and marital status of dietetic students enrolled in coordinated programs in the United States.

Variables	Categories	Frequency	Percent	Chi-Square	p-value
Demographics n=136					
Mean age (5.608)	24.79			15.04 (0.66)	<0.001

Gender	Female	131	96.30%		<0.001
	Male	5	3.70%		
Ethnicity	Hispanic or Latino	9	6.60%	1.07 (0.30)	<0.001
	Non-Hispanic	127	93.40%		
Background	Caucasian	118	86.80%		<0.001
	Asians	10	7.40%		
	African American	2	1.50%		
	Native American/ Alaskan native	2	1.50%		
	Other	4	2.90%		
Education classification n=136 (0.81) mean 4.16	Freshman	0	0%	0.64 (0.89)	<0.001
	Sophomore	1	0.70%		
	Junior	32	23.50%		
	Senior	47	34.60%		
	Graduate student	56	41.20%		
Highest level of education completed n=135 (0.99) mean=2.21	Some college courses	47	34.80%	0.94 (0.82)	<0.001
	Associate degree	20	14.80%		
	Bachelor's degree	60	44.40%		
	Graduate degree	8	5.90%		
Marital status n=136 (0.89) mean=1.43	Single, never married	103	75.70%	7.91 (0.02)	<0.001
	Married	20	14.70%		
	Not married (widowed/divorced)	1	0.70%		
	Living with partner	12	8.80%		

Note: Standard deviations are presented in parentheses. p=Kolmogorov-Smirnov tests of normality. Multiple responses were allowed on diet descriptions.

Table 2 represent the students' health, eating habits and weight goals (n=136). Most students ranked their general health (67.6%; SD=0.53) and overall eating habits (69.9%; SD=0.59) as good. A total of 34.6% of students were trying to lose weight, while most (62.5%) were trying to maintain their weight (SD=0.95). Most students (71) do not follow a specific diet (**Table 2**). Twenty-four students specified the following diets: DASH,

diabetic friendly, food sensitivity elimination/autoimmune protocol, gluten free, high or low fiber, intuitive eating, high in fruits and vegetables, moderate calorie deficit, more plant based, mostly vegetarian with little meat, no red meat, moderation and portion control, plant based with lean animal protein once a week, unprocessed and low fat and whole foods.

Table 2: Health, eating habits and weight goals and diet description of dietetic students enrolled in coordinated programs in the United States.

Variables	Categories	Frequency	Percent	Chi-Square	p-value
General health n=136 (0.53) mean=1.78	Excellent	37	27.20%	0.03 (0.99)	<0.001
	Good	92	67.60%		
	Fair	7	5.10%		
Overall eating habits n=136 (0.59) mean=2.02	Excellent	20	14.70%	2.61 (0.45)	<0.001
	Good	95	69.90%		
	Fair	19	14%		
	Poor	2	1.50%		
Weight goals n=136 (0.95) mean=2.28	Trying to lose	47	34.60%	2.27 (0.32)	<0.001
	Trying to gain	4	2.90%		
	Maintaining	85	62.50%		
Diet description n=136	Weight loss	20	27.20%		
	Vegetarian	31	67.60%		
	Low salt/sodium	12	5.10%		
	Weight gain	1	14.70%		
	Cholesterol lowering	5	69.90%		
	High protein	16	14%		
	Low fat	7	1.50%		
	High carbohydrate	10	34.60%		
	Low carbohydrate	3	2.90%		
	Not specific	71			
	Other	24	62.50%		

Note: Standard deviations are presented in parentheses. p=Kolmogorov-Smirnov tests of normality. Multiple responses were allowed on diet descriptions.

Students generally knew the ingredients (43.4%; SD=1.24) contained in their DSs and reported their supplements did not (80.7%; SD=0.44) contain caffeine (**Table 3**). Approximately 14.7% of students reported not taking supplements. A total of 92.6% (SD=0.27) of students reported the U.S. government does not require that all DSs sold will work as promised and 67.6% (SD=0.53) reported the U.S. government does not require that all

DSs sold are safe for consumption (**Table 3**). Most students (78.5%; SD=1.79) reported the Food and Drug Administration (FDA) does not require DSs to be approved as safe and effective before marketing and 68.9% (SD=1.69) reported the FDA does not monitor the safety of DSs once they are released on the market (**Table 3**).

Table 3: Dietetic student knowledge of dietary supplements in the United States.

Dietary supplements	Categories	Frequency	Percent
Know ingredients n=136 (1.24) mean=2.52	All	24	17.60%
	Most	59	43.40%
	Some	31	22.80%
	None	2	1.50%
	I do not take supplements	20	14.70%
Caffeine content n=135 (0.44) mean=1.99	Yes	14	10.40%
	No	109	80.70%
	Not sure	12	8.90%
Does the U.S. government require that all DSs sold will work as promised? n=136 (0.27) mean=2.01	Yes	4	2.90%
	No	126	92.60%
	I don't know	6	4.40%
Does the U.S. government require that all DSs sold are safe for consumption? n=136 (0.53) mean=1.78	Yes	37	27.20%
	No	92	67.60%
	I don't know	7	5.10%
The FDA requires that DSs be approved as safe and effective before they are marketed? n=135 (0.41) mean=1.79	TRUE	29	21.50%
	FALSE	106	78.50%
The FDA must monitor the safety of DSs once they are released on the market? n=135 (0.46) mean=1.69	TRUE	42	31.10%
	FALSE	93	68.90%

Note: Standard deviations are presented in parentheses.

Table 4 represents the vitamins, minerals and/or supplements consumed over the past 6 months and the estimation and reason of use. Multiple vitamin and mineral supplement use (72) outranked all other responses. Of the vitamins, minerals and/or supplements, most were used daily (40.5%) to promote general health (101). Other vitamins, minerals and/or supplements included activated charcoal, B7, biotin, Echinacea, CBD, collagen, D-mannose, D3, probiotics, fish oil, Ashwagandha, general prenatal vitamins, Gluten cutter, HTP-5, vegan collagen, L-lysine, Lion's mane mushroom, Myo and D-chiro-inositol, curcumin, algae oil vegan DHA EPA, Omega-3, HCl+ pepsin, turmeric, vegan DHA and protein powder. Other reasons for use included B12 for veganism, magnesium for calming effects, bone strength, immune support or boost, deficiencies or to prevent deficiencies, digestive problems or low stomach acid, doctor or dietitian

recommended, hair/skin health, lactation, malabsorption disorder, limited sun exposure, mental and physical health, ovarian function, to decrease anxiety and depression, to fight osteoporosis, to reduce bloat, to reduce risk of urinary tract infection, sleep/relaxation and workout recovery. **Table 5** represents supplements consumed over the past 6 months and the estimated and reason of use. Most students used protein powder (59), caffeine (33), melatonin (33) and fish oil or Omega-3s (27). These supplements were used a few times per week (46%) to promote general health (51). Other reasons for use included sleep aid, dislike of fish/seafood, deficiency in diet, IBS symptoms, lack of consumption in diet, sleep, good skin, to increase nutrient density, to meet daily protein needs, muscle recovery, doctor recommended to promote muscle growth and wanted to try.

Table 4: Vitamins, minerals and/or supplements consumed in past 6 months, estimation of use and reasons for use of dietetic students of coordinated programs in the United States.

Past 6 months	Categories	Frequency	Percent
Vitamins, minerals and/or supplements	Multiple vitamin/mineral supplements	72	
	Mega/high potency vitamin	1	
	Combination antioxidant supplement	7	
	Vitamin A	1	
	Vitamin C	23	
	Vitamin D	58	
	Vitamin E	4	
	B-complex supplement	17	
	B ₂ (riboflavin) alone	1	
	B ₅ (pantothenic acid) alone	0	
	B ₆ (pyridoxine) alone	0	
	B ₁₂ (cyanocobalamin) alone	26	
	Calcium	14	
	Chromium	0	
	Magnesium	16	
	Phosphate (phosphorus)	0	
	Iron	25	
	Folate (folic acid, folacin)	7	
	Potassium	1	
	Selenium	1	
Zinc	8		
Other	38		
Estimation of use n=131 (1.00) mean=3.06	Once/month	17	13%
	Once/week	11	8.40%
	Few times/week	50	38.20%
	Daily	53	40.50%
Reason for use	Performance enhancer	5	
	Promote general health	101	
	Give more energy	17	

	Weight loss	1	
	Increased endurance	1	
	Greater muscle strength	3	
	Not sure	3	
	Other	42	

Note: Standard deviations are presented in parentheses. Multiple responses were allowed.

Table 5: Supplements consumed in past 6 months, estimation of use and reasons for use of dietetic students of coordinated programs in the United States.

Past 6 months	Categories	Frequency	Percent
Supplements	Protein powder	59	
	Amino acid mixtures	11	
	Arginine/nitric oxide-alone	0	
	Creatine-alone	5	
	Glutamine-alone	2	
	BCAA (Branch Chain Amino Acids)	11	
	Caffeine	33	
	Fish oil or omega-3s	27	
	Meal replacement drinks	11	
	Melatonin	33	
	Psyllium	7	
	DHEA	2	
	Garlic	9	
Estimation of use n=113	Once/month	21	18.60%
	Once/week	19	16.80%
	Few times/week	52	46%
	Daily	21	18.60%
Reason for use	Performance enhancer	18	
	Promote general health	51	
	Give more energy	36	

	Weight loss	4	
	Increased endurance	5	
	Greater muscle strength	26	
	Not sure	6	
	Other	35	

Note: Multiple responses were used.

Table 6 represents some of the adverse effects experienced by students after taking DSs and why students avoided DSs. Of the 50 other responses, 46 students reported no side effects. Most students avoided supplements because they are too expensive. Students' source of DS information was mostly retrieved from health professionals (84) and the internet (61) (**Table 7**). Other sources reported included classes, coaches, Consumer lab, course materials or curriculum, dietetic professionals, professors and preceptors, doctors, mycologists, themselves, podcasts and individuals in the fitness industry.

Over half (55.2%) of the students reported using government sources to obtain information about DSs. A few students (9) reported not using supplements and most (60) reported purchasing their supplements from the grocery store (60) and health food store (38). Other places of purchasing included Amazon, Costco, Bodybuilding website, CVS, Deva, Legendary and Maxx Nutrition stores, naturopathies, pharmacies, rituals, supplement superstores, target, Marshalls, Thrive market, Vitacost, Wellevate and various other websites.

Table 6: Adverse effects and avoiding dietary supplements of dietetic students of coordinated programs in the United States.

Dietary supplements	Categories	Frequency
Adverse effects	Abnormal rapid heartbeat	5
	Stomach pain	10
	Dizziness or confusion	3
	Tremors or shaking	4
	Numbness or tingling of arms or legs	1
	Loss of consciousness	0
	Other	50
Avoid supplements	Aggravates medical problems	2
	Upsets your stomach	12
	Causes insomnia	2
	Causes or intensifies anxiety	6
	Causes or intensifies feelings or nervousness	3
	Does not boost your energy	4
	Heartburn	4
	Dizziness	1
	Dehydration	0

	Rapid heart rate	6
	Too expensive	42
	Do not like the taste	10
	Other	43
Note: Multiple responses were allowed.		

Table 7: Source of dietary supplement information and purchase location of dietetic students of coordinated programs in the United States.

Dietary supplements	Categories	Frequency	Percent
Source of DS information	Family members	17	
	Friends	14	
	Health professionals	84	
	Magazines	3	
	Books	17	
	Peer review journal	55	
	Internet	61	
	Store salesperson	5	
	Television	1	
	Other	19	
Used government sources n=134	Yes	74	55.20%
	No	60	44.80%
Purchase location	Do not use supplements	9	
	GNC store	11	
	GNC website	2	
	Other supplement store	7	
	Drug store	45	
	Grocery store	60	
	Health food store	38	
	Gym/Fitness center	3	
	Not sure	1	
	Other store, Internet site or source	36	
Note: Multiple responses were allowed.			

Table 8 represents dietetics students' recommendation of DSs and the amount of education offered in their dietetics program regarding DSs. Most students would recommend DSs to friends

and/or family (80.7%) and most students reported their education (SD=0.90) as average (52.6%) followed by below average (18.5%).

Table 8: Dietetic students of coordinated programs in the United States recommendation of dietary supplements and their rate of education.

Dietary supplements	Categories	Frequency	Percent
Recommend for friends and/or family? n=135	Yes	109	80.70%
	No	26	19.30%
Rate of education n=135 (0.90) mean=2.90	Excellent	11	8.10%
	Above Average	24	17.80%
	Average	71	52.60%
	Below Average	25	18.50%
	Poor	4	3%

Note: Standard deviations are presented in parentheses.

Other results included dietetic student confidence regarding DSs doing as they claims versus are they safe to consume. Most students were somewhat confident (55.6%) that DSs perform as they claim. Only 3.7% were extremely confident, 33.3% very confident and 7.4% not confident at all that DSs perform as they claim. Most students were very confident (51.9%) that DSs are safe to consume. Only 10.4% were extremely confident, 36.3% somewhat confident and 1.5% not confident at all that DSs are safe to consume.

Discussion

This study presents three significant findings. First, more dietetics students (85%) than the general population (50%) reported using at least one DS. Second, many students considered their education as average. The third finding relates to the students' confidence regarding supplements doing as they claim and safety to consume them.

Most students took vitamins, minerals and/or supplements daily (40.5%) or a few times per week (38.2%) over the past 6 months to promote general health and knew (43.4%) the ingredients in their DSs. Students used most supplements, protein powder (59), caffeine (33), melatonin (33) and fish oil or Omega-3s (27), a few times per week (46%) to also promote general health (51). Interestingly, students took DSs to promote general health; however, students are among the healthiest of U.S. populations. Of the students surveyed, 67.6% ranked their

general health as good and 69.9% ranked their overall eating habits as good. A few students attributed adverse effects to the DS they had used; however, many students avoid supplements because of their expense.

Data from previous research found an increase in DS use in the U.S. [18]. Axon, et al. found DS use among student pharmacists was higher than the general populations. Begdache, et al. and Chretien found DS use increasing among college students [11,15,16]. Stohs and Preuss concluded, because DS use is continuing to increase, health care professionals must have knowledge to provide education and counsel patients on DS benefits, adverse effects and interactions [20].

The next important finding relates to the education offered in students' dietetics programs regarding DSs. Most students reported their education as average (52.6%) followed by below average (18.5%). The students retrieved most of their DS information from health professionals (84) and the internet (61). Most students (78.5%) also knew that the food and drug administration does not require DSs to be approved as safe and effective before marketed; however, only 31.1% knew that the FDA must monitor the safety of DSs once they are released on the market. Another finding was related to the U.S. government. Students (92.6%) reported the U.S. government does not require that DSs sold will work and 67.6% reported the U.S. government does not require that all DSs sold are safe for consumption.

Axon, et al. compared the general population to the student pharmacists and reported the students' knowledge regarding DS was limited [16]. Begdache, et al. found that college education on DS is beneficial to promote healthier use [15]. The U.S. population needs more information about DSs to guarantee the health of the public [18]. Finally, Kim, et al. acknowledged the need for health education related to DS use and the need to re-evaluate restrictions on advertising and marketing for DSs [23].

The last finding is that most students were not extremely confident in DSs doing as they claim or did not consider DSs safe to consume. Only 3.7% were extremely confident and 33.33% were very confident that DS will do as they claim and 10.4% were extremely confident and 51.9% very confident that DSs are safe to consume. However, 80.7% of students would recommend DSs to friends and/or family. Data from previous studies found that student users of DSs reported feeling more favorable or knowledgeable about DSs for various conditions; however, Axon, et al. found that student pharmacist perceived DSs as not essential for health, the research inadequate and the information on the label as unhelpful [10,16]. Only one out of 179 students reported supplements as not safe to use [16].

Limitations

This study has potential limitations that should be noted. All data were self-reported; therefore, the researcher cannot ensure that all participants were honest. The way the researcher asked participants about their overall DS use may also be a limitation. All participants reviewed the FDA's official definition of a DS in the survey; however, some participants may not fully understand the definition or did not read the definition in its entirety. If the researcher improved the design, she would ask participants to affirm they read the definition of a DS and understood the definition. This change could improve the accuracy of the survey. Another limitation of this study was that only dietetic students from CPs received a survey; therefore, it cannot be stated that the students surveyed were fully representative of all the U.S. dietetic students' population. The data does not include dietetic students from future education model graduate programs or didactic program in dietetics with dietetic internships. Finally, the COVID-19 pandemic could have influenced the students DS use.

Recommendations

Although limitations existed for this research, the findings provide further information regarding DS use, perceptions and knowledge of dietetics students in the U.S. Previous research has focused on DS use in various populations including other health care professions, but this study is the first to focus on students enrolled in CPs in dietetics. The results and previous findings support the need for more education on DSs so that future dietitians can adequately advise and inform their patients about their DS use. Students perceived their DS education to not be excellent; therefore, there is a need for additional DS education in dietetics programs. The researcher recommends that future research includes surveying multiple health care profession programs. Additional research can help understand

students' DS use, knowledge and perceptions in different health care professions and therefore better equip future practitioners with the skills to aid consumers in adequate DS decision making. The researcher also recommends incorporating a question on the survey related to what information has been provided or resources have been used in their health care profession programs to educate them about DSs, if any.

Conclusion

This study was the first to measure use, knowledge and perceptions of DSs among students enrolled in CPs in dietetics. The results suggested that DS use is prevalent among dietetics students; however, their knowledge and perceptions were concerning. More education on DSs is needed for future dietitians to improve consumer awareness, prevent adverse events from occurring and prevent others from becoming another statistic in a database. Increasing education on DS regulation, marketing, prevalence and safety while attending college can aid future dietitians in providing accurate information to consumers and assist themselves and others in making informed decisions about DSs. Ultimately, this formative work can help bring awareness about DSs and improve education regarding DSs for future dietitians.

Author Contributions

Dr. JoAnna Cupp, DHSC, MS, RDN, LD, FAND provided content and wrote the manuscript. Dr. Eric Matthews, PhD reviewed and commented on the manuscript as the Applied Research Project Facilitator.

- A.T. Still University Institutional Review Board.
- IRB-Exempt Human Research Protocol.
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