

Original Research

Assessment of Awareness and Opinion: Grape Seed Extract's Health Benefits

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Article information

Received: September 23rd, 2022; **Revised:** October 11th, 2022; **Accepted:** October 12th, 2022; **Published:** October 14th, 2022

Cite this article

Harris M, N'Dea Johnson, Hailemeskel B. Assessment of awareness and opinion: Grape seed extract's health benefits. *Adv Food Technol Nutr Sci Open J.* 2022; 8(1): 20-28. doi: [10.17140/AFTNSOJ-8-176](https://doi.org/10.17140/AFTNSOJ-8-176)

ABSTRACT

Objective

To determine pharmacy students' opinion and knowledge of the role and overall health benefits of dietary and herbal supplements such as grape seed extract.

Methods

Forty-two pharmacy school students were asked to complete an online survey to assess their opinion and knowledge of the overall health benefits of grape seed extract using Likert-scale type questions.

Results

Respondents were given an optional survey which received a 100% response rate. The students were asked nine-demographic questions, four-general lifestyle opinion questions, and five-opinion questions on grape seed extract and its overall health benefits. When investigating students' responses, there was a significant variation between those that agreed to feeling comfortable enough to recommend grape seed extract to a patient with high blood pressure and agreeing to not looking in research evidence to make themselves aware of the benefit of grape seed extract in lowering blood pressure (p value=0.021). The scores of the five knowledge questions asked to the participants averaged 63.3%, with most of the students scoring below average ($n=22$, 52.4%). The question that received the highest rate of correct answers was question #2 that states that grape seed extract can improve blood flow ($n=29$, 69%). When investigating significance in response to blood-related questions (Q# 1,2,5) vs other organ-related questions (Q# 3,4), the results were significant (p value<0.001).

Conclusion

Our results indicated that pharmacy students have a split general lifestyle opinion ($n=22$, 50%) when believing that grape seed extract had many benefits in lowering blood pressure. This study also indicated that first-year pharmacy students have limited knowledge of the application of grape seed extract in hypertension with an average passing score of 63.3% and over half (52.4%) of the students scoring below average. Results from this study additionally showed that demographic factors such as age, residence prior to attending pharmacy school and number of years worked prior to pharmacy school were significant in predicting the knowledge and opinion of grape seed extract. This supports the need to integrate more herbal product education within our pharmacy school modules. As patients become more interested in natural product therapies, it is the job of pharmacy students and pharmacists to educate themselves so they can aid in optimal care of all patients.

Keywords

Grape seed extract; Herbal supplements; Opinion; Knowledge; Pharmacy students.

INTRODUCTION

Grape seed extract is a dietary supplement derived from seeds of wine grapes and used for various health benefits. Grapes are one of the most common fruits produced in the world with

several health advantages such as providing a sufficient source of potassium, manganese, vitamin B6, vitamin C, thiamine, antioxidants and polyphenols.¹⁻³ The chemical compound that has been studied to be responsible for the pharmacological effects of grape seed extract is proanthocyanidin. Some of the pharmacological

effects studied include anti-obesity, anti-diabetic, anti-cancer, anti-inflammatory, cardio-protective and wound healing properties.² Proanthocyanidins are a class of polyphenols found in grapes and many other fruits. Its mechanism of action has been studied to protect cells against oxidative stress and act as an inflammatory reaction regulator.^{1,4} Proanthocyanidins have also been studied to lower inducible nitric oxide synthase (iNOS) which improves vascular function.⁴ Due to the numerous potential clinical benefits, there has been great interest in using grape seed as an alternative method of treatment for certain health conditions.

With increasing interest in the use of grape seed extract, it is imperative that pharmacy students enhance their knowledge of the role and clinical advantages of herbal supplements. Currently, few studies have been conducted to further investigate pharmacy students' knowledge and opinion of herbal supplements. Recent studies have shown there is a lack of knowledge and positive opinion toward the use of herbal and dietary supplements. One study conducted in 2021 surveyed 44 pharmacy students on their knowledge and opinion on herbal and dietary supplements.⁵ In this study, it was found that 88.7% of the participants thought there was not enough medical research to support the clinical use of herbal supplements. Though there was a high percentage of students that believed there was not enough research evidence to support herbal supplement use, 70.45% of the participants agreed they would take an herbal supplement for a health condition.

Another study conducted in 2020 surveyed 355 pharmacy students' knowledge and attitude toward the use of herbal and dietary supplements.⁶ This study found that 47% of the students were currently using at least one herbal supplement to treat a health problem. When asking the pharmacy students about the source of their knowledge regarding the use of herbal and dietary supplements, the majority responded that their primary source was the internet. Another study conducted in 2022 surveyed 42 pharmacy students on their knowledge of the use of glutathione for multiple sclerosis.⁷ When analyzing the scores of the knowledge questions, it was found that the average score was 56.7%. It was also found that certain demographic factors impacted the knowledge of glutathione for multiple sclerosis. The demographic factors found to have a statistically significant effect of the knowledge of glutathione include age and number of years worked prior to attending pharmacy school.

Current research suggested that while pharmacy students are aware that herbal and dietary supplements are an alternative option for treatment of certain conditions, such as diabetes, obesity, cancer and cardiovascular conditions, a gap still lies between the knowledge and opinion of their use. Though there is still evidence lacking in efficacy and safety, patients are still choosing to improve their health conditions with herbal therapies. Knowing this fact, it is the job of pharmacy students to remain educated on all prospective therapies for our patients to ensure we are providing the safest and most effective care possible. Due to the lack of research regarding the knowledge and opinions of grape seed extract in healthcare, the objective of this study is to determine pharmacy students' opinion and knowledge of the role and overall health benefits of grape seed extract.

MATERIAL AND METHODS

A total of forty-two pharmacy students at Howard University were enrolled in this study. All of the students submitted responses to the survey with a 100% response rate. The survey was optional and was dispersed amongst the participants in their drug information course to complete. Qualtrics survey platform was used to disseminate the questions as well as to analyze the demographics and responses to the questions. The survey questions consisted of nine-demographic questions, four-general lifestyle opinion questions, and five-opinion questions on grape seed extract and its role in hypertension. The opinion questions were answered using a Likert scale from strongly agree to strongly disagree. The demographic information that was gathered from the participants included gender, age, highest education attended, residence, work experience, type of job worked, annual income, years worked, and lastly current working status. The results obtained from this study were inputted into IBM statistical package for the social sciences (SPSS) for statistical analysis using multiple linear regression, cross-tabulations, and correlation analysis yielding a *p* value of less than 0.05 as significant.

RESULTS

A total of 42 first-year pharmacy students from Howard University College of Pharmacy were surveyed and answered four general lifestyle opinion questions and five knowledge questions with a 100% response rate. Tables 1 and 2 illustrate the demographic data collected from each participant of the study. The ages of the participants range from 21 to over 29-years-old, with the majority being between 24 and 26 (n=17, 40.5%). Majority of the participants were female (n=27, 64.3%). Most of the participants in the study completed a Bachelor's degree before attending pharmacy school (n=34, 81.0%). A greater percentage of students surveyed in the study resided in states other than Washington D.C., Maryland, and Virginia. Half of the participants worked full time

Table 1. Demographics of Participants N=42

Demographic	Group	N (%)
Gender	Male	15 (35.7)
	Female	27 (64.3)
Age	18 - 20	0 (0)
	21 - 23	14 (33.3)
	24 - 26	17 (40.5)
	27 - 29	5 (11.9)
	>29	6 (14.3)
Highest education before joining HU pharmacy program	Some college courses	1 (2.4)
	Associate Degree	1 (2.4)
	Bachelor's Degree	34 (81.0)
	Master's Degree	4 (9.5)
	Professional or Doctorate Degree	2 (4.8)
Residence before joining HU pharmacy program	Washington DC	4 (9.5)
	Maryland	13 (31.0)
	Virginia	7 (16.7)
	Other states	18 (42.9)

(n=21, 50%) prior to attending pharmacy school. For those that worked before pharmacy school, majority of the participants had a pharmacy related job (n=16, 38.1%). As for annual income for those that worked prior to pharmacy school, most of the students earned less than \$10,000 (n=13, 31.0%). A greater percentage of students that worked had 1-2-years of experience (n=19, 45.2%). At the time the survey was conducted, majority of the participants admit to not working currently in pharmacy school (n=18, 42.9%), but soon planning to.

Table 2. Demographic Data of Respondents N=42

Demographic	Group	N (%)
Prior work experience before joining HU pharmacy program	Never worked	2 (4.8)
	I was working on and off for short period of time	3 (7.1)
	part-time job	16 (38.1)
	full time job	21 (50)
If you have worked, what type of job have you had	Pharmacy related	16 (38.1)
	Other healthcare related, but not pharmacy	12 (28.6)
	Non-healthcare related or non-pharmacy related	13 (31.0)
	Does not apply to me	1 (2.4)
Annual income	<\$10,000	13 (31.0)
	\$10,001-\$20,000	7 (16.7)
	\$20,001-\$30,000	6 (14.3)
	\$30,001-\$40,000	5 (11.9)
	>\$40,000	11 (26.2)
Duration of work	I have never worked	1 (2.4)
	1-2-years	19 (45.2)
	3-4-years	11 (26.2)
	>4-years	11 (26.2)
Currently working while in the HU pharmacy program	Yes	9 (21.4)
	No, but planning to work soon	18 (42.9)
	No, I do not have any plan to work soon	15 (35.7)

The results from this study showed that students are not certain of the clinical benefits of grape seed extract (Table 3). When asked general lifestyle opinions regarding the use of grape seed extract as an herbal supplement, half of the students (57.1%) agreed to recommending grape seed extract to a patient with high blood pressure, while half did not believe grape seed extract had many health benefits in lowering blood pressure (50%). From the general lifestyle opinion questions, 31% of the students agreed to feeling comfortable enough to recommend grape seed extract to a patient with high blood pressure, but also agreed they did not believe grape seed extract had many health benefits in lowering blood pressure. The results also indicated that majority of the students who answered the general lifestyle opinion questions agreed to not looking in research evidence to make themselves aware of the benefit of grape seed extract in lowering blood pressure (64.3%) (Table 4). Of those that did not look in research evidence to make themselves aware of the benefit of grape seed extract in lowering blood pressure, 31% of the students did not believe grape seed extract have many health benefits in lowering blood pressure (Table 5) and 38.1% of the students felt comfortable enough to recommend grape seed extract to a patient with high blood pressure (Table 6).

When investigating various demographics in association to opinion question number three (*I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure*), there were significant findings. When comparing age groups, 24-26 vs 27-29, it was found that students aged 24-26 were more likely not to have looked into research evidence regarding grape seed extract (*p* value=0.038, Table 7). When comparing number of years worked, 1-2-years vs 3-4-years, it was found that students with 1-2-years of prior work experience were more likely not to have looked into research evidence regarding grape seed extract (*p* value=0.04, Table 7). When investigating students' responses to the general lifestyle opinion questions, there was a significant variation between those that agreed to feeling comfort-

Table 3. Participant General Lifestyle Opinion Questions

Question	% of students that Strongly Agree/Agree (N=42)	% of students that Strongly Disagree/Disagree (N=42)
<i>I feel comfortable to recommend grape seed extract to a patient with high blood pressure</i>	57.1%	42.9%
<i>I don't believe grape seed extract have many health benefits in lowering blood pressure</i>	50.0%	50.0%
<i>I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure</i>	64.3%	35.7%
<i>I believe that grape seed extract is a great source of antioxidants and thus must be good in the management of HTN</i>	59.5%	40.5%

Table 4. Results for Students that Responded to Both Opinion Question 1 and 2

		<i>I don't believe grape seed extract have many health benefits in lowering blood pressure</i>		
		Strongly Agree/Agree N (%)	Strongly Disagree/Disagree N (%)	Total N (%)
<i>I feel comfortable to recommend grape seed extract to a patient with high blood pressure</i>	Strongly Agree/Agree N (%)	13 (31.0)	11 (26.2)	24 (57.1)
	Strongly Disagree/Disagree N (%)	8 (19)	10 (23.8)	18 (42.9)
	Total N (%)	21 (50)	21 (50)	42 (100)

Table 5. Results for Students that Responded to Both Opinion Question 2 and 3

I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure

		Strongly Agree/Agree N (%)	Strongly Disagree/Disagree N (%)	Total N (%)
<i>I don't believe grape seed extract have many health benefits in lowering blood pressure</i>	Strongly Agree/Agree N (%)	13 (31.0)	8 (19.0)	21 (50)
	Strongly Disagree/Disagree N (%)	14 (33.33)	7 (16.7)	21 (50)
	Total N (%)	27 (64.3)	15 (35.7)	42 (100)

Table 6. Results for Students that Responded to both Opinion Question 1 and 3

I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure

		Strongly Agree/Agree N (%)	Strongly Disagree/Disagree N (%)	Total N (%)
<i>I feel comfortable to recommend grape seed extract to a patient with high blood pressure</i>	Strongly Agree/Agree N (%)	16 (38.1)	8 (19.0)	24 (57.1)
	Strongly Disagree/Disagree N (%)	11 (26.2)	7 (16.7)	18 (42.9)
	Total N (%)	27 (64.3)	15 (35.7)	42 (100)

Table 7. Demographic Variables in Association with General Lifestyle Opinion Responses

Variable Association	p values
Age groups 24-26 vs 27-29 agreeing to Q#3 (I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure)	0.038
Years worked groups 1-2years vs 3-4years agreeing to Q#3 (I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure)	0.04
Agreeing to Q#1 (I feel comfortable to recommend grape seed extract to a patient with high blood pressure) and Q#3 (I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure)	0.021

Table 8. General Lifestyle Opinion Questions in Association with Age, Years Worked and Residence

		Age				
Q#3 (I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure)		21-23	24-26	27-29	>29	Total
Strongly Agree/Agree	N (%)	8 (19.0)	13 (31.0)	2 (4.8)	4 (9.5)	27 (64.3)
Strongly Disagree/Disagree	N (%)	6 (14.3)	4 (9.5)	3 (7.1)	2 (4.8)	15 (35.7)
Total	N (%)	14 (33.3)	17 (40.5)	5 (11.9)	6 (14.3)	42 (100)
Total of Strongly Agree/Agree per Age Group	%	57.1%	76.5%	40%	66.7%	64.3%
		Years Worked				
Q#3 (I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure)		Never Worked	1-2-Years	3-4-Years	>4-Years	Total
Strongly Agree/Agree	N (%)	1 (2.4)	14 (33.3)	5 (11.9)	7 (16.7)	27 (64.3)
Strongly Disagree/Disagree	N (%)	0 (0)	5 (11.9)	6 (14.3)	4 (9.5)	15 (35.7)
Total	N (%)	1(2.4)	19(45.2)	11(26.2)	11(26.2)	42 (100)
Total of Strongly Agree/Agree per Time Worked	%	100%	73.7%	45.5%	63.6%	64.3%
		Residence				
Q#3 (I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure)		Washington DC	Maryland	Virginia	Other states	Total
Strongly Agree/Agree	N (%)	4 (9.5)	9 (21.4)	5 (11.9)	9 (21.4)	27 (64.3)
Strongly Disagree/Disagree	N (%)	0 (0)	4 (9.5)	2 (4.8)	9 (21.4)	15 (35.7)
Total	N (%)	4 (9.5)	13 (31.0)	7 (16.7)	18(43.0)	42 (100)
Total of Strongly Agree/Agree per Residence	%	100%	69.2%	71.4%	50%	64.3%

Table 9. Percentage of Correctness Amongst Participants Based on Knowledge Questions

Question	Correct Answers (T/F)	% of students that answered correctly (N=42)	% of students that answered incorrectly (N=42)
Grape seed extract reduces blood pressure	True	64.3%	35.7%
Grape seed extract can improve blood flow	True	69.0%	31.0%
Grape seed extract can protect your liver	True	59.5%	40.5%
Grape seed extract causes headaches	True	59.5%	40.5%
Grape seed extract has blood thinning properties	True	64.3%	35.7%
Number of Participants (%)		Score	
20/42 (47.6%)		Scored 80% or above (above average)	
10/42 (23.8%)		Scored 60% (below average)	
3/42 (7.1%)		Scored 40% (below average)	
9/42 (21.4%)		Scored 20% or below (below average)	
22/42 (52.4%)		Scored Below Average	
Average Score		63.3%	
Question answered correctly the most		Q#2 Grape seed extract can improve blood flow	
Questions answered correctly the least		Q#3 Grape seed extract can protect your liver	
		Q#4 Grape seed extract causes headaches	

able enough to recommend grape seed extract to a patient with high blood pressure and also agreeing to not looking in research evidence to make themselves aware of the benefit of grape seed extract in lowering blood pressure (*p* value=0.021, Table 7).

Table 8 showed responses to general lifestyle opinion Q#3 in association with age, years worked, and residence. The students with ages ranged from 24-26 (n=13, 31.0%) mostly strongly agreed/agreed. The students that worked for 1-2-years prior to starting pharmacy school (n=14, 33.3%) mostly strongly agreed/agreed. The students with a prior residence from Maryland and Other states (n=9, 21.4%) mostly strongly agreed/agreed. However, within each separate residence option, 69.2% of the Maryland residents strongly agreed/agreed *vs* 50% of the students from other states that strongly agreed.

The results from this study showed that students have limited knowledge regarding the clinical benefit or grape seed extract (Table 9). The scores of the five knowledge questions asked to the participants averaged 63.3%, with the majority of the students scoring below average (n=22, 52.4%). The question that received the highest rate of correct answers was Q#2 that states that grape seed extract can improve blood flow (n=29, 69%). The two questions that were answered the least correctly were questions #3 and 4 stated that grape seed extract can protect your liver and that grape seed extract causes headaches, respectively. When investigating significance in response to blood-related questions (Q# 1,2,5) *vs* other organ-related questions (Q# 3,4), the results were significant (*p* value<0.001, Table 10).

Table 10. Correct Response to Questions about Blood in Association with Correct Response to Questions about other Organs

Variable Association	<i>p</i> values
Grape Seed Extract effect on blood (Q# 1,2,5) <i>vs</i> other organs (Q#2,3)	<0.001

Table 11 shows knowledge question #2 in association

with age, years worked and residence. The students with ages ranging from 24-26 (n=14, 33.3%) mostly strongly agreed/agreed. The students that worked for 3-4-years and over 4-years prior to starting pharmacy school (n=9, 21.4%) mostly strongly agreed/agreed. Also, within each separate years worked range, 81.8% of both years worked ranges strongly agreed/agreed. Table 12 shows knowledge Q#2 in association with residence. The students with a prior residence from other states (n=11, 26.2%) mostly strongly agreed/agreed.

When investigating various demographics in association to knowledge question number two (Grape seed extract can improve blood flow), there were significant findings. When comparing age groups, 21-23 *vs* 24-26, it was found that students aged 21-23 were more likely to agree that grape seed extract can improve blood flow (*p* value=0.006, Table 12). When comparing prior residence in Washington D.C. *vs* prior residence in Maryland, it was found that students who resided in Washington D.C. were more likely to agree (*p* value=0.021, Table 12). When comparing prior residence in Washington D.C. *vs* prior residence in other states. It was also found that students who resided in Washington D.C. were more likely to agree to knowledge Q#2 (*p* value=0.021, Table 12).

Table 13 showed s knowledge Q#3 in association with age, years worked and residence. The students with ages ranging from 24-26 (n=12, 28.6%) mostly strongly agreed/agreed. The students that worked for 1-2-years prior to starting pharmacy school (n=10, 23.8%) mostly strongly agreed. The students with a prior residence from Maryland (n=9, 21.4%) mostly strongly agreed/agreed.

When investigating residence on whether students agreed to Q#3 (Grape seed extract can protect your liver), the results were significant (*p* value=0.034, Table 14).

Table 11. Knowledge Questions in Association with Age, Years Worked and Residence

		Age				
Q#2 (Grape seed extract can improve blood flow)		21-23	24-26	27-29	>29	Total
Answered Correctly	N (%)	7 (16.7)	14 (33.3)	4 (9.5)	4 (9.5)	29 (69.0)
Answered Incorrectly	N (%)	7 (16.7)	3 (7.1)	1 (2.4)	2 (4.8)	13 (31.0)
Total	N (%)	14 (33.3)	17 (40.5)	5 (11.9)	6 (14.3)	42 (100)
Total of Strongly Agree / Agree per Education type	%	50%	82.4%	80%	66.7%	69.0%
		Years Worked				
Q#2 (Grape seed extract can improve blood flow)		Never Worked	1-2-Years	3-4-Years	>4-Years	Total
Answered Correctly	N (%)	0 (0)	11 (26.2)	9 (21.4)	9 (21.4)	29 (69.0)
Answered Incorrectly	N (%)	1 (2.4)	8 (19.0)	2 (4.8)	2 (4.8)	13 (31.0)
Total	N (%)	1 (2.4)	19 (45.2)	11 (26.2)	11 (26.2)	42 (100)
Total of Strongly Agree / Agree per Residence	%	0%	57.9%	81.8%	81.8%	69.0%
		Residence				
Q#2 (Grape seed extract can improve blood flow)		Washington DC	Maryland	Virginia	Other states	Total
Strongly Agree / Agree	N (%)	4 (9.5)	8 (19.0)	6 (14.3)	11 (26.2)	29 (69.0)
Strongly Disagree / Disagree	N (%)	0 (0)	5 (11.9)	1 (2.4)	7 (16.7)	13 (31.0)
Total	N (%)	4 (9.5)	13 (31.0)	7 (16.7)	18 (43.0)	42 (100)
Total of Strongly Agree / Agree per Residence	%	100%	61.5%	85.7%	61.1%	69%

Table 12. Demographic Variables in Association with Knowledge Question #2

Variable Association	p values
Age groups 21-23 vs 24-26 agreeing to Q#2 (Grape seed extract can improve blood flow)	0.006
Residence: Washington D.C. vs Maryland agreeing to Q#2 (Grape seed extract can improve blood flow)	0.021
Residence: Washington D.C. vs Other states agreeing to Q#2 (Grape seed extract can improve blood flow)	0.021

Table 13. Knowledge Questions in Association with Age, Years Worked and Residence

		Age				
Q#3 (Grape seed extract can protect your liver)		21-23	24-26	27-29	>29	Total
Answered Correctly	N (%)	6 (14.3)	12 (28.6)	3 (7.1)	4 (9.5)	25 (59.5)
Answered Incorrectly	N (%)	8 (19.0)	5 (11.9)	2 (4.8)	2 (4.8)	17 (40.5)
Total	N (%)	14 (33.3)	17 (40.5)	5 (11.9)	6 (14.3)	42 (100)
Total of Strongly Agree / Agree per Education type	%	42.9%	70.6%	60%	66.7%	59.5%
		Years Worked				
Q#3 (Grape seed extract can protect your liver)		Never Worked	1-2-Years	3-4-Years	>4-Years	Total
Answered Correctly	N (%)	0 (0)	10 (23.8)	6 (14.3)	9 (21.4)	25 (59.5)
Answered Incorrectly	N (%)	1 (2.4)	9 (21.4)	5 (11.9)	2 (4.8)	17 (40.5)
Total	N (%)	1 (2.4)	19 (45.2)	11 (26.2)	11 (26.2)	42 (100)
Total of Strongly Agree / Agree per Residence	%	0%	52.6%	54.5%	81.8%	59.5%
		Residence				
Q#3 (Grape seed extract can protect your liver)		Washington DC	Maryland	Virginia	Other states	Total
Strongly Agree / Agree	N (%)	4 (9.5)	9 (21.4)	4 (9.5)	8 (19.0)	25 (59.5)
Strongly Disagree / Disagree	N (%)	0 (0)	4 (9.5)	3 (7.1)	10 (23.8)	17 (40.5)
Total	N (%)	4 (9.5)	13 (31.0)	7 (16.7)	18 (43.0)	42 (100)
Total of Strongly Agree / Agree per Residence	%	100%	69.2%	57.1%	44.4%	59.5%

Variable Association	p values
Residence vs agreeing to Q#3 (Grape seed extract can protect your liver)	0.034

Table 15 shows knowledge Q#4 in association with age. The students with ages ranging from 24-26 (n=11, 26.2%) mostly strongly agreed/agreed. The students that worked for 1-2-years and prior to starting pharmacy school (n=11, 26.2%) mostly strongly agreed/agreed. The students with a prior residence from other states (n=10, 23.8%) mostly strongly agreed/agreed.

DISCUSSION

Grape seed extract is a dietary supplement that is regulated, but not approved by the FDA.⁸ Due to this, extreme caution should be taken when choosing to consume this supplement for health benefits. Most commonly, grape seed extract is useful for conditions including promotion of wound healing and cardiovascular conditions.^{1,9} The benefit of grape seed extract is attributed to the proanthocyanidins within the grape seed.¹ Proanthocyanidin is a chemical compound from the class of polyphenols that are found in many plants and give plants their red, blue or purple colors.⁴ When considering knowledge of grape seed extract for treatment of various conditions, few studies have been conducted. The goal of this study was to evaluate students' opinion and knowledge of the use of grape seed extract. Participants were asked four general lifestyle opinion questions and five knowledge questions in addition to demographic questions, to determine their knowledge of grape seed extract and its overall health benefit.

In our study, the students' opinion was split regarding general lifestyle application of grape seed extract. When asked if students felt comfortable recommending grape seed extract to a patient with high blood pressure, 57.1% agreed. When asked if

grape seed extract is a great source of antioxidants and thus must be good in hypertension management, 59.5% agreed. However, when asked if a student did not believe grape seed extract had many health benefits in lowering blood pressure, only 50% of the class agreed. Though many students had an opinion on the role in therapy of grape seed extract, almost 2/3 of the class agreed to not looking into research evidence to make themselves aware of the benefit of grape seed extract in lowering blood pressure. This is most likely because the Howard University College of Pharmacy curriculum teaches the cardiovascular module during the second year of the program. The students have not yet been introduced to various herbal supplements that could impact blood pressure and thus have not taken the time to conduct research on the matter.

In association with opinion question number three (*I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure*) students with age ranging from 24-26 (n=13, 31%) were more likely to have agreed to not looking into research evidence (p value=0.038, Table 7). This result shows that age has an effect on whether or not a participant conducted research about grape seed extract in their spare time. The younger age group has most likely not had the opportunity to counsel or educate a patient on the use of herbal supplements for blood pressure and for this reason has not yet looked up research evidence.

In association with opinion question number three (*I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure*) students who worked 1-2-years (n=14, 33.3%) were more likely to agree to not looking into research evidence (p value=0.04, Table 7). This result shows that the amount of time a student worked prior to attending Howard University College of Pharmacy affected their decision to conduct research of this herbal supplement. The students with

		Age				
Q#4 (Grape seed extract causes headaches)		21-23	24-26	27-29	>29	Total
Answered Correctly	N (%)	9 (21.4)	11 (26.2)	2 (4.8)	3 (7.1)	25 (59.5)
Answered Incorrectly	N (%)	5 (11.9)	6 (14.3)	3 (7.1)	3 (7.1)	17 (40.5)
Total	N (%)	14 (33.3)	17 (40.5)	5 (11.9)	6 (14.3)	42 (100)
Total of Strongly Agree / Agree per Education type	%	64.3%	64.7%	40%	50%	59.5%
		Years Worked				
Q#4 (Grape seed extract causes headaches)		Never Worked	1-2-Years	3-4-Years	>4-Years	Total
Answered Correctly	N (%)	1 (2.4)	11 (26.2)	7 (16.7)	6 (14.3)	25 (59.5)
Answered Incorrectly	N (%)	0 (0)	8 (19.0)	4 (9.5)	5 (11.9)	17 (40.5)
Total	N (%)	1 (2.4)	19 (45.2)	11 (26.2)	11 (26.2)	42 (100)
Total of Strongly Agree / Agree per Residence	%	100%	57.9%	63.6%	54.5%	59.5%
		Residence				
Q#4 (Grape seed extract causes headaches)		Washington DC	Maryland	Virginia	Other states	Total
Strongly Agree / Agree	N (%)	3 (7.1)	8 (19.0)	4 (9.5)	10 (23.8)	25 (59.5)
Strongly Disagree / Disagree	N (%)	1 (2.4)	5 (11.9)	3 (7.1)	8 (19.0)	17 (40.5)
Total	N (%)	4 (9.5)	13 (31.0)	7 (16.7)	18 (33.3)	42 (100)
Total of Strongly Agree / Agree per Residence	%	75%	61.5%	57.1%	55%	59.5%

less work experience may not have been exposed to grape seed extract as a supplement for blood pressure. Students that have more work experience may have gained more knowledge of both medication therapies and herbal supplements.

When investigating participant's responses to all general lifestyle opinion questions, results showed there was a significant association between those that agreed to question number one (*I feel comfortable to recommend grape seed extract to a patient with high blood pressure*) and those that agreed to question number three (*I have not looked in research evidence to make myself aware of the benefit of grape seed extract in lowering blood pressure*) (p value=0.021, Table 7). Grapes are known to possess antioxidants which have been observed to reduce blood pressure.³ When hearing grape seed extract for the first time, participants that were not aware of the exact benefits of grape seed extract most likely associated its effects with the potential benefits of grapes.

According to the results, the students had limited knowledge of the use of grape seed extract in hypertension which is demonstrated by an overall average score of 63.3%. When investigating all knowledge question responses there was a significance in answering blood-related questions (Q# 1,2,5) versus other organ-related questions (Q# 3,4) correctly (p value<0.001, Table 10). This finding may be attributed to the fact that when the survey was distributed to the students, the title suggested the herbal supplement's impact on hypertension. If no disease states were mentioned in the title of the survey, the participants may have been less likely to get the blood-related answers correct.

A study was conducted to assess the knowledge of grape seed extract for cardiovascular conditions.^{10,11} This study surveyed 29 community pharmacies across Maine, Indiana, Ohio and Kentucky. The purpose of this study was to raise awareness on the lack of knowledge of herbal supplements. When asked if calcium was a better supplement versus grape seed extract, 83% of the participants agreed one was not better than the other. However, results from this study showed that when given the option between calcium which is a well-known supplement and grape seed extract, only two pharmacists agreed to recommending grape seed extract to a patient.⁹ This study suggests that pharmacists are willing to recommend the most common dietary supplements, but still lack concrete knowledge of the benefit of potential useful herbal supplements.

A systematic review was conducted by Waddington et al¹² to examine the current evidence regarding the level of the nutritional and dietary supplement knowledge of community pharmacists and their understanding of their therapeutic effects using electronic databases including Medline, Scopus, Embase, CINAHL, Scifinder and the Cochrane Controlled Trials Register. The authors considered all languages and study designs. They tested pharmacist knowledge with predetermined questions knowledge scores which later were converted to a percentage score. The median knowledge score across all papers was 64%. The authors concluded that global community pharmacist knowledge of dietary supplements appears to be poor.

In another cross-sectional study by Shilbayeh that conducted between 10/2009-5/2010 among 388 pharmacists found that 78.1% believed the majority (77.8%) of pharmacists believed that a balanced diet is more achievable by eating healthily than by vitamins supplements. Moreover, 78.1% of participants believed that vitamins deficiency would not shorten life spans, while 80.7% agreed that vitamin supplements could be toxic or might contain unlabelled harmful ingredients.¹³

A study by Sweileh et al¹⁴ conducted among 111 community pharmacists about their knowledge of herbal products found community pharmacists have poor knowledge about these medicines although most participants thought they have good knowledge of herbal preparations. However, their actual knowledge in response to factual questionnaire was low. The lowest score was observed for herbal drug interactions domain. The authors emphasis the need of continuing pharmacy education for community pharmacists to qualify them to provide a better pharmaceutical care.

Limitations of this study include the title of the survey that was provided to the students, "*Grape Seed in Hypertension*". This title may have influenced the participants decision to associate grape seed extract to reduction of blood pressure. Another limitation for this study is the amount of survey questions used to assess the students' knowledge. The addition of more questions would have given the students a greater opportunity to score higher than the average score of 63.3%. Other limitations also include the small sample size of only 42 students and only including first-year students. Including pharmacy upperclassmen that were already exposed to the cardiovascular module may have greatly impacted the participants' knowledge of herbal supplements in hypertension.

CONCLUSION

In conclusion, several studies have been conducted and show that grape seed extract can reduce blood pressure in patients, but few studies investigate whether pharmacy students, pharmacists or any other healthcare professionals support the use of grape seed extract. In this study, first-year pharmacy school students had split opinions ($n=22$, 50%) when believing that grape seed extract had many benefits in lowering blood pressure. Also in this study, participant students had a limited knowledge of grape seed extract's potential overall impact on patient care with an average passing score of 63.3% and over half (52.4%) of the students scoring below average. Age range and number of years worked prior to attending pharmacy school were demographic factors that significantly impacted the participants' knowledge and opinion of grape seed extract. This supports the need to integrate more herbal product education within our pharmacy school modules. As patients become more interested in natural product therapies, it is the job of pharmacy students and pharmacists to educate themselves so they can aid in optimal care of all patients.

INSTITUTIONAL REVIEW BOARD APPROVAL

This study has been approved by the Howard University (HU)

Institutional Review Board (IRB).

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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