



(REVIEW ARTICLE)



Review of resveratrol for the management of hyperlipidemia and survey

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Abstract

The goal of this paper is to conduct a literature search to determine the beneficial use of resveratrol in the management of hyperlipidemia. Based on the literature results obtained, a survey questionnaire was developed with the secondary goal of conducting a knowledge and opinion survey among pharmacy students. Data was then analyzed via SPSS software. A total of 45 students participated in the study. There were more females than males (N=27, 64.3%) and the majority were between the ages of 24-26 years old (N=17; 40.5%). More than half lived outside of the Washington, DC, Maryland, and Virginia area (N=27, 57.1%), and have a BA/BS degree (N=34, 81%). The knowledge-based questions were scored, and the average number of correct responses was 58.74%. This reveals that only about half of the respondents were familiar with the beneficial use of resveratrol in lowering serum lipids. However, results also show that although survey participants may be a little familiar with resveratrol, 61.91% of them are least likely to recommend it to family and friends. Some significant values presented during the survey were discussed. Based on this study, it may be advisable to incorporate dietary supplement modules earlier in the didactic portion of the pharmacy curriculum. A larger study that also includes participants from other healthcare professions is necessary.

Keywords: Resveratrol; Hyperlipidemia; Pharmacy; Student; Survey; Dietary supplement

1. Introduction

Hyperlipidemia is a condition in which an excessive amount of lipids accumulate in the bloodstream and cause blockage in the blood vessels. This can become a problematic situation if left untreated and eventually lead to the number one cause of death in Americans, cardiovascular disease. Good High-density lipoprotein (HDL) is at least 60 mg/d L, low-density lipoprotein (LDL) is best at less than 100 mg/dL, total cholesterol is best at less than 200 mg/dL, and triglycerides is best at less than 150 mg/ dL. Resveratrol is a group of compounds, known as polyphenols, acting like antioxidants that protect the body in opposition to things that can put subjects at high risk of heart disease¹. Although it has not been well studied in people, early research suggests in animals it can reduce LDL levels, making it harder to form blood clots that can lead to heart disease. Resveratrol is derived from the skin of red grapes and has been reported for its anti-aging and disease-fighting powers in animals². A study published in 2018 was conducted to explore the effect of resveratrol supplementation on lipid profiles in 71 individuals with dyslipidemia. The authors concluded that resveratrol supplements significantly reduce total cholesterol and triacylglycerol concentrations in individuals with dyslipidemia³. Although this study is useful only seventy-one individuals were included over a time period of two months, thus further research should be conducted.

A similar randomized, double-blinded, crossover study was conducted where eight overweight or obese patients with mild hypertriglyceridemia were either given resveratrol 1000 mg daily for 7 days and then 2000 mg daily for the next 7 days or the placebo. At the end of the study, it was seen that resveratrol reduced the rate of production of apoB-48 by 22% with a P=0.007 and no significant effect on the fractional catabolic rate. Resveratrol was also able to reduce the production of apoB-100 production rate by 27% (P=0.02) and reduced the rate for fractional catabolic rate by 26%

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($P=0.04$). The results of this study reported that in two weeks resveratrol at high doses can decrease lipoprotein production⁴.

Another study of resveratrol benefiting hyperlipidemia was included in a meta-analysis, which showed the use of resveratrol at 250 mg per day for a 3-month period. The study revealed a notable decrease in LDL, total cholesterol, oxidized LDL, and ApoB levels in patients with type 2 diabetes, coronary artery disease, or other cardiovascular risk factors⁵.

As a pharmacist, it is important to study herbal supplements to ensure patients get the best treatment of therapy. It is also very critical to be mindful that all herbal supplements are not safe, so counseling, monitoring, and following up with each patient is extremely important, even though it is an herbal supplement. However, there are not many published studies available to determine the level of knowledge or opinion of pharmacy students in this area. The objective of this study was to determine how knowledgeable pharmacy students were with resveratrol and hyperlipidemia in correlation to the findings from the literature search.

2. Methods

This study included 45 first-year professional pharmacy students at Howard University College of Pharmacy with a 93% response rate. Students participated in a study that was provided in the drug informatics course. The questionnaire consisted of 8 demographic questions including age, gender, education, state of residence before coming to Howard University, work experience, annual income, and 5 knowledge and 5 opinion questions using a Likert scale (strongly agree to strongly disagree) throughout the survey. The results of this survey were analyzed using SPSS software and descriptive statistics percentage and numbers.

3. Results

The majority of the participants for this study are in the age range of 24-26 ($N=17$; 40.5%) of females gender ($N=27$, 64.3%), live outside of the Washington, DC, Maryland, and Virginia area ($N=18$, 42.9%), and have a BA/BS degree ($N=34$, 81%).

Table 1 Demographics of participants

Demographics	Group	N (%)	Mean Std. Deviation
Age	18-20	0	(3.07)1.022
	21-23	14 (33.3)	
	24-26	17(40.5)	
	27-29	5(11.9)	
	>29	6(14.3)	
Gender	Female	27(64.3)	(1.64)0.485
	Male	15(35.7)	
Residence	Washington DC	4(9.5)	(2.93)1.068
	Maryland	13(31.0)	
	Virginia	7(16.7)	
	Other states	18(42.9)	
Education	Some college	1(2.4)	(3.12)0.633
	Associate Degree	1(2.4)	
	BA/BS	34(81.0)	
	MSC/MA	4(9.5)	
	PHD/PROFESSIONAL	2(4.8)	

Table 2 shows the results of the various income and work experience-related questions. The majority of participants in the study worked RX-related (N=16; 38.1%), their income range was <\$10,000 (N=13; 31.0%), has worked full time (N=21; 50%) for at least 1-2 years (N=19; 45.2%) and most are not currently working but have a plan to work soon (N=18, 42.9%).

Table 2 Statistics on Job, Income, and Work EXP

Demographics	Group	N (%)	Mean Std. Deviation
Job Type	RX-related	16(38.1)	(1.98)0.897
	Other Healthcare	12(28.6)	
	Non-Healthcare	13(31.0)	
	Not Applicable	1(2.4)	
Income	<\$10,000	13(31.0)	(2.86)1.617
	\$10,001-\$20,000	7(16.7)	
	\$20,001-\$30,000	6(14.3)	
	\$30,000-\$40,000	5(11.9)	
	>\$40,000	11(26.2)	
Work EXP	Never worked	2(4.8)	(3.33)0.816
	Short-term	3(7.1)	
	Part-time	16(38.1)	
	Full-time	21(50.0)	
YRS Worked	Never worked	1(2.4)	(2.76)0.878
	1-2 YRS	19(45.2)	
	3-4 YRS	11(26.2)	
	>4	11(26.2)	
Working Now	YES	9(21.4)	(2.14)0.751
	NO, But plan soon	18(42.9)	
	NO, NO PLAN WORKING	15(35.7)	

Survey participants were asked to answer 5 knowledge-based questions and their responses were scored against information obtained from the literature search. Our study shows that students have limited knowledge regarding the use of resveratrol. The overall average score was less than the expected pass score of 70% (n=24.6; 58.74%). The question that was answered correctly with the highest number was the one that asked about the source of the herbal supplement. We know from a literature search that resveratrol (trans-3,5,4'-trihydroxystilbene) is found in widely varying amounts among grape varieties, relatively higher in muscadine grapes (*V. rotundifolia*). Muscadine grapes are nearly immune to insects and diseases and are known to possess one of the highest antioxidant levels among fruits. Resveratrol is primarily found in grape skin, at a concentration of 50–100 µg/g.⁶

Resveratrol is well-known for its antioxidant effect and has been shown to afford health promotion in several chronic conditions such as aging, heart diseases, and cancers.⁷ However, 45.23% of participants answered incorrectly regarding the knowledge of resveratrol acting like an antioxidant. Overall, the results show that the participants have limited knowledge about resveratrol supplements.

Table 3 Knowledge base questions

Knowledge-based Questions	T. Response	T. Responses	Mean Std. Deviation
	Correct	Incorrect	
Studies show that Resveratrol is most used for lowering high cholesterol	25(59.53)	17(40.48)	2.36(0.96)
Resveratrol is a natural compound found in red grape skin	27(64.28)	15(35.71)	2.12(0.94)
Research suggests that Resveratrol acts like an antioxidant	26(61.91)	16(38.09)	2.31(0.87)
According to studies Resveratrol can be used up to 3000 mg daily	22(52.38)	20(47.62)	2.40(0.89)
Resveratrol is part of a group of compounds called polyphenols	23(54.77)	28(45.23)	2.40(0.91)
Average	24.6 (58.74)	19.2 (41.43)	

Abbreviations: S. Agree= strongly agree, S. Disagree= strongly disagree, T. Response= total responses.

Table 4 shows the results of the opinion questions. The majority of the participants responded they believed that resveratrol may be ineffective for lowering cholesterol compared to other drugs such as statins at 57.14%, they prefer a relatively safe supplement if it will be used to lower cholesterol. However, the herb is known to reduce LDL cholesterol. In a recent study, Zunino and colleagues assessed the effects of dietary grapes on blood lipid profiles, plasma inflammatory marker concentrations, and immune cell function in a randomized, double-blind crossover study in 24 obese human subjects. This study suggested that dietary grapes may induce beneficial alterations in potentially atherogenic lipid sub-fractions associated with an increased risk of obesity-related diseases, such as cardiovascular diseases.⁸ In this study, dietary grape powder supplementation (46 g grape powder in 240 mL of water, two times per day for 3 weeks, representing four servings of grapes/day) was found to (1) reduce plasma concentrations of large LDL cholesterol and large LDL particles, and (2) increase production of IL-1 β and IL-6 in supernatants from lipopolysaccharide-activated peripheral blood mononuclear cells (PBMCs).

Table 4 Opinion-based questions

Survey Statement	T. Responses	T. Responses	Mean Std. Deviation
	S. Agree/ Agree	Disagree/ S. Disagree	
I believe Resveratrol may be ineffective for lowering cholesterol compared to prescription drugs such as statins.	24(57.14)	18(42.85)	2.24(0.93)
I believe Resveratrol is a relatively safe supplement if used in lower doses to reduce cholesterol.	22(52.38)	20(62.9)	2.40(0.89)
I prefer taking Resveratrol for mildly elevated high cholesterol than taking prescription medication	23(54.76)	19(45.24)	2.21(0.87)
Eating red grapes will help get all nutrients rather than taking Resveratrol	22(52.38)	20(47.62)	2.50(0.89)
I would recommend Resveratrol to family and friends for hyperlipidemia	16(38.09)	26(61.91)	2.71(0.94)

Abbreviations: S. Agree= strongly agree, S. Disagree= strongly disagree, T. Response= total responses.

In another question, a little more than half (54.76%) of the participants would rather take resveratrol for mildly elevated cholesterol than take a prescription medication, they also believe that eating red grapes will help them get all the nutrients needed rather than taking resveratrol. However, 62.9% of the participants disagreed with resveratrol being a relatively safe supplement if used at lower doses to reduce cholesterol, and then there were 61.91% that would not

recommend resveratrol at all to family or friends. Grapes, one of the main sources of resveratrol, are one of the 20 most frequently consumed raw fruits. Generally, there are no or extremely limited safety issues regarding the consumption of raw fruit. However, a proprietary formulation of resveratrol, called SRT501 (synthesized by Sirtris), has been studied in several healthy and diseased populations and exhibited renal toxicity in multiple myeloma patients when used at a daily dose of 5 g in combination with bortezomib, SRT501.⁹

Overall, the average total response of participants agreeing to take resveratrol is 50.95% while disagreeing is 52.10%. This shows that participants almost have equal opinions on whether or not they believe that resveratrol is going to be the right supplement for them.

Table 5 Significant variables

Demographics variables	P-value	Interpretation
Education vs taking dietary supp.	P<0.026	Participants with higher education are more willing to take dietary supplements
Type of Work experience vs on dietary supplements.	P<0.026	Participants with work experience are able to afford the dietary supplements
Income vs dietary knowledge	P<0.05	Patients with more income are able to afford to get properly educated on the supplement
Years worked- took a dietary supplement	P<0.01	The longer the patient worked the longer they were able to keep taking the supplement

Participants are more willing to take dietary supplements when they have more educational experience. The type of work and years of experience determine whether or not one can afford to keep taking the supplements. Those participants with more income are properly educated regarding the knowledge of the supplement.

Table 6 Significant variable in association with opinion-based questions

Demographic Factors	P-value
Education vs taking Resveratrol for mildly elevated high cholesterol than taking prescription medication	P<0.031
Job type vs Resveratrol may be ineffective for lowering cholesterol compared to prescription drugs such as statins	P<0.046
Working now vs Is Resveratrol a relatively safe supplement if in lower doses to reduce cholesterol	P<0.017

Level of education, the type of job participants held, and having a job currently were found to be contributing factors that significantly affect the outcome of the survey. Participants with a higher level of education seem to prefer taking resveratrol for mildly elevated cholesterol than having prescription medicines. The type of job experiences the participants had also is one of the factors to believe that resveratrol is to be ineffective for lowering cholesterol when compared to prescription drugs like statins.

Overall, participants believe that resveratrol is a relatively safe supplement if used in lower doses to reduce cholesterol and are more willing to purchase it since they are currently working.

4. Discussion

In this study, a literature review of the medical benefit of resveratrol in the management of hyperlipidemia was conducted. Additionally, a survey was administered to get the knowledge and opinion of pharmacy students on the topic. To have a clear understanding of how knowledgeable participants were with resveratrol, they were given five knowledge-based questions. Results revealed that respondents have limited knowledge about this supplement according to (Table 3). The study also shows that the age of the participants was one of the factors that contributed to

their knowledge score. Those in the 24-26 years old age range answered question #2 correctly with 64.28%, which shows that they know resveratrol is a natural compound found in red grape skin. However, overall there was limited knowledge of resveratrol supplementation at an average of 58.74% among all the participants.

The purpose of the opinion questions was to see whether the education behind the resveratrol supplement had an impact on whether or not they would be willing to still take the supplement. After the opinionated questions were distributed, the results revealed that 57.14% believed that resveratrol would be ineffective, when compared to drugs like statins in the case of lowering cholesterol levels.

An average of 50.95% agree that resveratrol is a supplement that they would be willing to take, however, 52.10% of participants do not agree with taking the supplement. Results also revealed that education, job type, and if they were working now had a significant difference in whether or not participants took the supplement with the listed p-values $p < 0.031$, $p < 0.046$, and $p < 0.017$ respectively.

There were a number of similar published studies that also found a limited knowledge base of dietary supplements among pharmacy students, especially in the early stage of their training. A previous study done in our college concluded with the suggestion that students' knowledge of herbal and dietary supplements was limited. However, the authors reported that the participants were willing to take herbal supplements for themselves to manage minor illnesses¹⁰. Several other studies deal with the knowledge and opinion of students on various dietary supplements including Lycopene for hypertension; Glutathione use in multiple sclerosis; grape seed extracts; flaxseed; and glutathione for multiple sclerosis¹¹⁻¹⁷.

The mean and standard deviation throughout the study showed us how dispersed the data is in relation to the mean. For the knowledge-based questions, the highest standard deviation was with question #1 at 0.96 (mean=2.36) and the lowest standard deviation was with question #3 at 0.87 (mean 2.31). In the opinion-based questions the highest standard deviation was with question #10 at 0.94 (mean= 2.71) and the lowest standard deviation was with question #8 at 0.87(mean=2.21).

4.1. Limitations of the study

The sample size of this study was small and only included first-year pharmacy students. It is recommended to have a larger participant group to authenticate the results. Another limitation that may have been a disadvantage to our study was the limited questions that were asked to the participants. If the study called for more questions to be asked that may have given the participants a chance to show that they are more knowledgeable about the relationship between resveratrol and hyperlipidemia.

5. Conclusion

The outcome of this study shows that a little more than half of the participants were familiar with Resveratrol. Although they may not be familiar, they are least likely (61.91%) to recommend it to family and friends. However, they also believe that prescription drugs such as statins would be a better treatment for hyperlipidemia (57.14%).

Compliance with ethical standards

Disclosure of conflict of interest

The study was approved by the Howard University IRB and done as a part of a course. Therefore, there was no need to obtain informed consent from all individual participants included in the study.

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