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A survey on the treatment of GERD with aloe vera juice, slippery elm, ginger tea, and chamomile tea

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Abstract

An online survey was conducted among 35 pharmacy students as part of a Drug Informatics mandatory 2-credit hour course given to first-year professional pharmacy students at Howard University College of Pharmacy. The survey investigated the knowledge and opinions of the students on the use of aloe vera juice, slippery elm, ginger tea, and chamomile tea for treating gastroesophageal reflux disease (GERD). Demographic data indicated that most survey participants (77.5%) were female and 90% were in the age range 18-30 years. The primary residence of about 58% of the students was in the District of Columbia-Maryland-Virginia (DMV) area. Work experience prior to joining the College of Pharmacy varied from none to five or more years. About 66.7% had a Bachelor's degree. Each student of the class of 2027 was asked two sets each of five questions, one set comprising knowledge-based questions, and the other comprising opinion-based questions. An average of about 53.5% of the survey respondents answered the knowledge-based questions correctly. The highest correct response rate was 80%, while the lowest was 20%. For the opinion-based questions, an average of about 77.5% of the respondents demonstrated a positive attitude, with the highest being for aloe vera at 85.7% in treating GERD. Strong disagreement was minimal, ranging from 0.0% to 8.6%.

Keywords: Aloe vera; Slippery elm; Ginger; Chamomile; Pharmacy students; Knowledge; Opinions

1. Introduction

1.1. Disease Mechanism

Gastroesophageal reflux disease (GERD) is characterized by stomach acid reflux back into the esophagus, causing inflammation, and damage. This results in irritation and discomfort. The contraction of the lower esophageal sphincter muscle blocks the content of the stomach from flowing back into the esophagus; however, in people with GERD, the sphincter muscle fails to completely contract during digestion, allowing stomach acid to backflow into the esophagus. There are many contributing factors leading to GERD, with the most common etiologies being obesity, pregnancy, hiatal hernia, diet, tobacco use, and alcoholism [1-4].

1.2. Prevalence and Impact

GERD is prevalent in the Western World (North America, Europe, and Australia), Brazil, and India. Chronic GERD increases the chance of developing esophageal cancer. It can lower the quality of life by limiting the selection of foods enjoyed by individuals due to discomfort. Furthermore, common treatments for GERD are usually antacids, proton pump inhibitors (PPI's), or histamine-2 (H2) blockers that lower the acidity of the stomach, decreasing the absorption of certain vitamins and minerals as well as some medications leading to nutritional deficiencies. Chronic lowering of the acidity of the digestive tract can lead to a risk of *C. difficile* infection [5,6].

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1.3. Review of Herbs

Aloe Vera Juice (*Aloe Barbadense*): Aloe Vera is a succulent plant whose gel-like constituents of the leaves are used for anti-inflammatory, healing, and soothing properties. A review article by Pady et al. (7) investigated the use of PPIs, aloe vera, and the combined regimen for treating peptic ulcer, a disease similar to GERD. The compounds from aloe vera were shown to reduce inflammation and promote healing. Lectins in aloe vera extract can potentially inhibit gastric acid secretion, thus relieving the symptoms [7].

A 2015 study investigated the efficacy and safety of aloe vera syrup for the treatment of GERD. The study was conducted in a randomized positive-controlled trial. The result showed that the efficacy of aloe vera syrup in treating GERD is comparable to PPIs and H2 blockers. It was found that glycoprotein in aloe vera helps to reduce the secretion of gastric acid as well as pepsin. Other compounds also have been shown to increase interleukin 10, the negative mediator of inflammation, and decrease in TNF-alpha, the positive mediator of inflammation. The combination of these effects can help alleviate the symptoms of GERD [8].

1.4. Slippery Elm (*Ulmus rubra*)

The slippery elm is so named for its mucilaginous properties derived from its bark. The Native Americans had used it topically for skin remedies, such as for healing wounds, inflammation, and burns. The mechanism of action for treating GERD is physical, as the mucilaginous substance acts to help protect the mucosa [9]. Evidence is lacking for effective treatment of GERD using slippery elm. Randomized controlled clinical trials are extremely rare, if any, to support the efficacy of slippery elm as a treatment for GERD [10].

1.5. Ginger Tea (*Zingiber officinale*)

Native to Southeast Asia, ginger has been used for millennia to treat various ailments, such as viral infections, nausea, arthritis, gastrointestinal disorders, inflammation, immunity improvements, and digestion. Ginger is well known for treating nausea and indigestion. Compounds in ginger are found to have biological activities, such as 5-HT3 receptor antagonism, responsible for its antiemetic properties, and for 5-HT4 receptor agonism, which is responsible for gut motility, thus decreasing the amount of gastric acid from refluxing back into the esophagus [11].

A 2015 study investigated the effect ginger and artichokes have on dyspepsia. The study was conducted as a randomized, double-blind, and placebo-controlled clinical trial. When taken with artichoke in the form of an extract supplement, ginger was shown to be effective for the treatment of functional dyspepsia for 14 days. The result was significant; 63% of the experimental group displayed a significant reduction in dyspepsia symptoms compared to 25% of the placebo group showing positive outcomes, and 53% of the control group displayed an improvement of the dyspepsia symptoms [12].

1.6. Chamomile tea (*Matricaria chamomilla*)

The chamomile is a plant in the daisy family commonly used for insomnia, anxiety, and gastrointestinal ailments. Chamomile tea is available in supermarkets. The pharmacological properties of chamomile help to reduce inflammation and irritations in the esophageal and gastric mucosa, thus alleviating the discomfort arising from GERD. Several bioactive compounds found in chamomile such as flavonoids, sesquiterpenes, polyphenols, and terpenoids are responsible for the anti-inflammatory properties [13].

No clinical studies were found that specifically focus on the treatment of GERD or dyspepsia using chamomile tea. Various sources have attributed chamomile carminative properties and anti-inflammatory properties, which can decrease pressure on the lower esophageal sphincter as well as reducing discomfort due to inflammation. Apigenin-7-glucoside, one of the compounds, has been found to inhibit TNF-alpha produced from macrophages that mediate inflammation. This can have implications in treating GERD by reducing inflammation [13].

Health Care Professionals' Knowledge and Opinions: Studies regarding the knowledge or opinion of healthcare professionals on the uses of natural remedies against GERD are very limited. No formal guidelines have been implemented for the use of natural remedies for treating various ailments. Most of the population uses these products without consulting with healthcare professionals. Much of the information regarding these products is from media such as advertisements, magazines, TV, online, and from friends and family.

1.7. Literature Gap, Study Objective, and Impact

Although there is an abundance of studies regarding the usage of natural remedies for various ailments, studies that address the knowledge and opinions of healthcare professionals regarding using natural remedies to treat GERD are lacking. The objective of this review is to provide various reviews to demonstrate the effectiveness of various natural remedies in treating GERD. The impact of this study is most likely the acknowledgment of utilizing natural remedies to treat GERD and other ailments as an effective alternative medicine.

2. Methods

An online survey was conducted as part of a Drug Informatics course, a mandatory 2-credit hour course taken by first-year professional pharmacy students at Howard University College of Pharmacy. Demographic data were obtained on 39 students. A total of 35 students participated in the knowledge-based and opinion questions. Of these, in one instance only 34 students responded in each category. For opinion-based data, a 4-point Likert scale was used (1: strongly agree; 2: agree; 3: disagree; 4: strongly disagree). The closer to or lower the responses are than 2, they indicated agreement. Descriptive statistics were used to analyze demographics, educational levels, work experience, and responses to knowledge-based questions and opinion statements. Each student was asked two sets of five questions, one set comprising knowledge-based questions, and the other comprising opinion-based questions.

3. Results and discussion

3.1. Demographics

The data in Table 1 contains demographic information on gender, age distribution, and geographical backgrounds of the participants of the survey. There were 39 responders for the demographic section of the survey. About three-quarters (74.4%) of the respondents were female and a quarter were male (25.6%). Regarding age, the majority fall in the 18-24 (51.3%), and 24-30 (38.5%) years age range. Smaller percentages included 7.8% for ages 30-40, and 2.6% for years above 40.

Regarding the state of residence before the program, many of the survey respondents fall in other states (42.1%), and Maryland (39.5%), with Washington, DC at 15.8%, and the fewest being Virginia, with 2.6%.

Table 1 Demographic data of the participants (*n*=39)

Demographic characteristics		***n* (%)**
Gender	Male	10 (25.6)
	Female	29 (74.4)
Age (Years)	18-24	20 (51.3)
	24-30	15 (38.5)
	30-40	3 (7.7)
	Above 40	1 (2.6)
State of Residence Prior to the Program	Washington, DC	6 (15.8)
	Maryland	15 (39.5)
	Virginia	1 (2.6)
	Other State	16 (42.1)

3.2. Work and educational background of participants

The data, shown in Table 2, provides insights into the respondents' work experience and educational background prior to joining the HUCOP program. Regarding the number of years of paying job before the initiation of the program, many of the participants (about 41%) had 5 or more years of experience, followed by 1-2 years of experience (30.8%), and 23.1% for 3-4 years. 5.13% (*n*=2) of the class never worked. Regarding occupational or job types, only 37 out of 39 respondents were asked, excluding the two who never worked. Out of the 37 respondents, the majority (about 54.1%)

worked at pharmacy related jobs prior to the program. Following that is other healthcare-related jobs, with 24.32%. About 21.6 % held jobs other than pharmacy or healthcare related. A large majority of the respondents (66.7%) had a BSc (bachelor's in science) or a BA degree, followed by 17.9% with a master's degree or equivalent. About 10.3% finished only pre-pharmacy prerequisite courses. 5.13% of the respondents had an Associate degree. None of the respondents had a PhD degree or equivalents.

Table 2 Work and educational background of the participants

Work experience	**Type of work**	***n* (%)**
Number of years of paying job before initiation of the program	*n*= 39	
	Never worked	2 (5.13)
	1-2	12 (30.8)
	3-4	9 (23.1)
	5 or more	16 (41.0)
Occupation/Job types	*n*=37	
	Pharmacy related	20 (54.1)
	Other healthcare-related	9 (24.3)
	Non-health care related	8 (21.6)
Highest level of education before the program	*n*=39	
	Pre-pharmacy/Prerequisites	4 (10.3)
	Associates	2 (5.1)
	BSc or BA	26 (66.7)
	MSc	7 (17.9)
	PhD or equivalent	0 (0)

3.3. Knowledge-based questions

Overall, an average of 53.5% of the respondents answered the questions correctly (Table 3). Expected correct answers to the first two and the last questions were TRUE and for the third and fourth questions, the correct answers were FALSE. With all five questions, most respondents answered "true", with an average rate of 75.3%, and the rest answered 'false." The question with the largest number of correct responses was question 5, with a rate of 80%. The answers that were answered most incorrectly were questions 3 and 4, at a rate of 20% and 25.7%, respectively.

The first question pertains to the mechanism of action of aloe vera in treating GERD, asserting that the promotion of Interleukin 10 and inhibition of TNF-alpha is accurate, which garnered a scoring rate of approximately 80%, securing the second highest score. Aloe vera's potential therapeutic effects for GERD are based on its documented anti-inflammatory properties, thus promoting anti-inflammatory cytokines such as interleukin 10 (IL-10) and inhibiting pro-inflammatory cytokines like TNF-alpha [14].

The second question states that Slippery Elm is an herbal medication that has little or no clinical evidence of its efficacy in treating GERD which is true. Slippery Elm is often suggested for the management of GERD symptoms due to its mucilaginous properties, which may help coat and soothe the esophagus. However, there is no or limited clinical evidence to support its efficacy specifically in treating GERD. A review of scientific literature, such as the Cochrane Database of Systematic Reviews, reveals a scarcity of robust clinical studies supporting its use for GERD.

The third item states that apigenin-7-glucoside assists in the formation of mucilaginous substances to protect the gastric and esophageal mucosa. This statement is false. It received the lowest correct score. There is no widely recognized evidence or literature supporting the role of apigenin-7-glucoside in the formation of mucilaginous substances for the protection of the gastric and esophageal mucosa. The compound's specific role in mucilage formation is not well-established in current scientific literature.

Regarding the fourth item on the one-month efficacy of ginger and artichoke leaf in treating dyspepsia, the statement is false. The duration of their efficacy varies among individuals, with no universally accepted one-month standard. Clinical studies often focus on short-term effects, with efficacy influenced by factors such as symptom severity, individual response, and specific formulations used.

The last item states that compounds in ginger interact with 5HT3, 5HT4, and cholinergic receptors for treating gastrointestinal ailments, which is a true statement. Bioactive compounds like gingerol in ginger have demonstrated interactions with various receptors, including serotonin receptors (5HT3 and 5HT4) and cholinergic receptors, contributing to the modulation of gastrointestinal functions. Bode and Dong reported in detail on the pharmacological actions of ginger on these receptors, providing valuable insights [15].

Overall, only about half of the participants answered all the questions correctly. The average standard deviation (SD) of 0.4249 suggests that the data are spread widely around the mean, with a corresponding cumulative variance of 0.1816.

Table 3 The results of the knowledge-based questions (total *n*=34 for 1; *n*=35 for 2,3,4 &5)

#	**Questions**	**Correct answer**	**Participants with correct answers (%)**	**True (*n*)**	**False (*n*)**	**Mean correct answer rate (± SD)***	**Variance**
1	Promotion of Interleukin 10 and inhibition of TNF-alpha is the mechanism of action of aloe vera in treating GERD	True	27 (79.4)	27	7	0.7941±0.4043	0.1635
2	Slippery Elm is an herbal medication that has little or no evidence (clinical studies) of its efficacy in treating GERD.	True	22 (62.9)	22	13	0.6286±0.4832	0.2334
3	Apigentin-7-glucoside assists in the formation of mucilaginous substances to protect the gastric and oesophageal mucosa.	False	7 (20.0)	28	7	0.2±0.4	0.16
4	The effect of ginger and Artichoke leaf on the treatment of dyspepsia is one month.	False	9 (25.7)	26	9	0.2571±0.4371	0.1910
5	The compounds in ginger have interactions with 5HT3, 5HT4, and Cholinergic receptors for the treatment of gastrointestinal ailments.	True	28 (80.0)	28	7	0.8±0.4	0.16
	Average correct answer		53.54			0.5354±0.4249	0.1816

*SD= standard deviation; in the calculation of mean, SD and variance, correct answers & wrong answers were assigned 1 & 0, respectively.

3.4. Opinion Based Questions

The respondents were prompted to choose between strongly agree, agree, disagree, or strongly disagree responses for each of the questions. The overall agreement rate was about 77.5%. Table 4 shows that the majority of the respondents agreed with the opinion-based questions. Nearly 85% of the respondents expressed some agreement that aloe vera's inflammatory compounds can help alleviate symptoms of GERD, while 79% of respondents agreed that ginger is an effective alternative to prescription medications in treating nausea and vomiting.

Slippery elm and chamomile tea have an agreement rate of nearly 77% and 74%, respectively. While Slippery elm is commonly suggested for managing GERD symptoms due to its mucilaginous properties, clinical evidence supporting its effectiveness specifically for GERD is limited. The Cochrane Database of Systematic Reviews highlights a scarcity of robust studies on Slippery Elm's efficacy for GERD, suggesting that its effectiveness may not be firmly established.

The third statement received the lowest agreement rate (71%) from the respondents. Both aloe vera and ginger have been studied for their anti-inflammatory properties. Some preclinical studies suggest potential benefits in colorectal cancer prevention, but conclusive evidence in humans is limited. While these ingredients show promise, more research, including clinical trials, is necessary to confirm their preventive effects on colorectal cancer.

The statement that states ginger as an alternative to prescription medications for nausea and vomiting also received about 80% of the responses as Strongly Agree/Agree. Ginger is well-documented for its anti-nausea properties and has been studied for its effectiveness in treating nausea and vomiting, especially in pregnancy and chemotherapy-induced nausea. Many studies support its use as an alternative to prescription medications in certain cases. However, individual responses may vary, and consulting with a healthcare professional is advisable.

Overall, all the five opinion-based questions have at least 70% of the respondents either strongly agree or agree. The percentages of respondents disagreeing with the questions are considerably lower, with three out of five questions having no responses for "strongly disagree", with the highest (8.6%) being the response to the second question.

The average standard deviation of 0.9192 indicated a higher value due to more varied choices of responses compared to the knowledge-based questions. The average variance value is 0.6769, indicating that there are values scattered around the mean. Like standard deviation, a higher value for variance is due to more response choices. The second question, regarding chamomile tea, has the highest variance value of 0.9684, as it has the most moderate agreement among the respondents, with 8.6% responding with a strongly disagree, and 17.1% with disagree responses, giving a slightly even distribution of the responses.

Table 4 Opinion Based Statements (Total *n*=35 for 1,2.3 &5; *n*=34 for 4)

#	**Statements**	**SA (*n*, %)**	**A (*n*, %)**	**DA (*n*, %)**	**SDA *n* (%)**	**Mean* LK±S.D.**	**Variance**
1	Slippery Elm is very effective in the treatment of GERD and other gastrointestinal ailments.	14 (40)	13 (37.1)	8 (22.9)	0 (0%)	1.8286±0.7853	0.6168
2	The compound in Chamomile tea is effective against GERD, inflammation, and gastrointestinal cancer.	14 (40)	12 (34.3)	6 (17.1)	3 (8.6)	1.9429±0.9684	0.9378
3	Due to their anti-inflammatory properties, both Aloe Vera and Ginger can prevent colorectal cancer	12 (34.3)	13 (37.1)	10 (28.6)	0 (0)	1.9429±0.8023	0.6437
4	Ginger is an effective alternative to prescription medications in treating nausea and vomiting.	14 (41.2)	13 (38.2)	7 (20.6)	0 (0)	1.7941±0.7699	0.5927
5	Aloe vera's anti-inflammatory compounds combined with its soothing properties is effective in treating GERD in a short amount of time.	14 (40)	16 (45.7)	4 (11.4)	1 (2.9)	1.7714±0.7702	0.5933
	Average	39.1%	38.4%	20.1%	2.3%	1.856±0.9192	0.6769

*LK= Likert Score: 1=Strongly Agree (SA), 2= Agree (A), 3= Disagree (DA); 4= Strongly Disagree (SDA); S.D.=standard Deviation

4. Discussion

About 53.6% of the respondents answered the five questions correctly for the knowledge-based questions. Most of the respondents, with an average of 74.1% responded with TRUE for each question, and an average of 22.9% answered FALSE for each question. Out of the five questions, three have TRUE as the correct answer, and two have FALSE as the correct answer. Promotion of Interleukin 10 and inhibition of TNF-alpha is the mechanism of action of aloe vera in treating GERD. The response to this question is TRUE. A 2015 study investigated the efficacy and safety of aloe vera

syrup for the treatment of GERD. It was found out that the glycoprotein extracted from the plant can increase interleukin 10, which is the negative mediator of inflammation, and decrease TNF-alpha, which is a positive mediator for inflammation [8].

Slippery elm has little or no clinical evidence of its efficacy in treating GERD. The answer to question 2 is TRUE. Clinical trials or studies for slippery elm for treating GERD are limited, if any [10]. However, slippery elm has been used by Native Americans to treat various ailments including gastrointestinal-related problems.

Apigenin-7-glucoside assists in the formation of mucilaginous substances to protect the gastric and esophageal mucosa. The answer to question 3 is FALSE. Slippery elm, not apigenin-7glucoside by itself, can form mucilaginous substances to protect the gastric and esophageal mucosa. Apigenin-7-glucoside from chamomile (German chamomile) has been found to inhibit TNA-alpha, thus reducing inflammation [13]**.** The positive effect of ginger and artichoke leaf for the treatment of dyspepsia lasts for one month. The answer to this statement is FALSE. The treatment is effective only for 14 days [12]. The compounds in Ginger have interactions with 5HT3, 5HT4, and cholinergic receptors for the treatment of gastrointestinal ailments. The answer to this question is TRUE [10]. Activation of 5HT3 can lead to symptoms of nausea and vomiting. By blocking this receptor, ginger has an antiemetic effect, similar to the mechanism of action of prescription drug ondansetron. 5HT4 agonism induces gut motility, allowing for quicker stomach emptying which can assist in the prevention of gastric acid refluxing into the esophagus. Cholinergic agonism can assist in gut motility [11].

The survey data on the opinion-based questions revealed that most of the respondents replied with a positive attitude toward the potential benefits of natural remedies in treating GERD. On average, over 77% of the participants showed agreement, with about a-22% disagreement rate. Nearly 86% of the respondents agree that aloe vera's soothing properties and anti-inflammatory extracts are effective in the treatment of GERD. The data on chamomile tea showed moderate response with a standard deviation score of 0.9684, indicating that it has a wide distribution of responses. It is worth noting that over three-quarters of the respondents overall have a strong positive attitude toward using natural remedies in treating GERD despite the inconsistency of knowledge levels regarding the pharmacology of these products.

The survey results of this research provide an insight into the potential uses of natural remedies for treating GERD. Although the knowledge levels of surveyed students about these products were variable, the respondents showed an overall strong positive attitude toward using natural remedies in treating GERD. The limitations of this research include the small sample size, and lack of diversity. Improvements to the research may include expanding sample size and diversity, such as background, education, and occupation that may have the potential to provide more valuable data.

5. Conclusion

In this survey involving 39 respondents, the True and False knowledge-based questions, on average, were answered correctly by only about half (53.6%) of the respondents, with a large majority answering TRUE (about 75%). However, the respondents have an overall strong agreement for utilizing natural remedies for the treatment of GERD. Approximately 85.7% of the responses either strongly agree or agree on utilizing aloe vera to treat GERD, followed by ginger (79.4%). Strong disagreement was minimal, ranging from 0.0% to 8.6%.

This study presents several limitations. The sample size is relatively small and lacks adequate diversity. Furthermore, the True and False knowledge-based questions are based on the mechanism of action of various natural remedies; the cohort of first-year pharmacy students in this survey may not have a full understanding of pharmacology as it relates to the mechanism of action of these products. The study can be improved by recruiting participants such as healthcare professionals, non-first-year medical students, or non-first-year pharmacy students.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was not required from the survey participants, because it was part of a Drug Informatics course given by BH, one of the authors.

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