



## Pharmacy Students Knowledge and Attitude towards Herbal Medications

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### Research Article

Please cite this paper as: Sneha Sura, Amrita Chabria, Sujit S. Sansgiry. Pharmacy Students Knowledge and Attitude towards Herbal Medications. IJPTP, 2012,3(3),301-307.

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### Abstract

**Objectives:** The objective of this study was to assess and compare pharmacy students' knowledge and attitude towards herbal medications. This study further examined factors associated with attitude formation towards herbal medications and contrasted it by the year students were enrolled in the program. **Methods:** A prospective, cross-sectional study was conducted by distributing a pre-validated instrument to doctor of pharmacy students at a University. A 15-item questionnaire was used to measure knowledge (1 = true and 2 = false) and 16-item questionnaire for determining the attitude (1 = strongly disagree to 5 = strongly agree) towards herbal medications. Descriptive analyses, analysis of variance (ANOVA), and tukey's test were conducted to evaluate the pharmacy students' knowledge and attitude towards herbal medications. The logistic regression model was used to determine factors associated with attitude towards herbal medications. **Results:** Of the 175 surveys used, majority (77%) believed their knowledge of herbal medications was insufficient to practice as a pharmacist. The average herbal medications knowledge score was  $9.3 \pm 1.8$ . Students in the third ( $10.0 \pm 1.4$ ) and fourth ( $9.6 \pm 1.2$ ) year had higher herbal knowledge scores compared to second year ( $8.6 \pm 2.1$ ) students. However, the average attitude towards herbal medications was similar across all groups, second ( $3.1 \pm 0.4$ ), third ( $3.0 \pm 0.4$ ), and fourth year ( $2.9 \pm 0.4$ ), respectively. Almost 92% of students reported a need to learn more about herbal medications. Students with higher herbal knowledge scores had positive attitude towards herbal medications (OR = 1.27; 95% CI: 1.03 – 1.57). **Conclusions:** Students had inadequate knowledge about herbal

medications and desired for more information. Higher knowledge leads to a positive attitude towards herbal medications among pharmacy students. With the increasing use of herbal medications in US, there may be a greater need to educate pharmacy students through didactic courses in this area to enhance their knowledge and attitude.

**Keywords:** *herbal medications, curriculum, attitudes, knowledge*

### Introduction

Herbal medications are popular products used by consumers and recommended by pharmacists.<sup>1</sup> Herbal medications are considered as a part of complementary and alternate medicines (CAM), a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional/allopathic medicines. In 2007, about 4 in 10 adults in US used some form of CAM; of which, herbal medications were the most widely used form of the CAM.<sup>2</sup> In the US, use and sales of herbal medications has greatly increased in the past two decades.<sup>3-5</sup> The use of herbal medication increased from 12.1% in 1997 to 17.7% in 2007.<sup>2,3</sup> In 2010, the total sales of herbal products were estimated at \$5.2 billion, a 22.9% increase from 2000.<sup>6</sup> Although the use of herbal medications is increasing in the US, herbal medications are not closely regulated by the US Food and Drug Administration (FDA) and are sold in retail locations as over-the-counter products (OTC).<sup>7</sup>

In the US, most of the herbal medications are purchased from any store without any oversight by a health professional. With increasing use of herbal medications, there is increase in the number of consumer inquiries to pharmacists for evidence-based information.<sup>8,9</sup> A recent study conducted in the US reported that pharmacists continue to receive more questions regarding herbals medications.<sup>10</sup> As a healthcare professional, pharmacists should be able to provide evidence based information about herbal medications to patients. Moreover, they should be able to improve medication safety by avoiding herb-drug



interaction. Hence, it is important to consider pharmacists' role, knowledge and attitude regarding herbal medications.

Several studies have indicated that pharmacists may lack knowledge about herbal medications to provide adequate counseling.<sup>8,9,11</sup> Moreover, pharmacists have attained low scores on herbal medication knowledge.<sup>9,11</sup> Pharmacists in Virginia and North Carolina scored on average 6.3 on a possible 15 points on a herbal knowledge assessment highlighting the greater need of pharmacy training program in this area.<sup>8</sup> Pharmacists who have had previous continuing education in herbal medications scored higher than pharmacists who have not. Thus it is important to continue to educate pharmacists regarding herbal medications.<sup>8</sup>

The education about herbal medications begins during pharmacy school. Professional pharmacy organizations such as American Association of Colleges of Pharmacy (AACP), American Colleges of Clinical Pharmacy (ACCP) and National Association of Boards of Pharmacy (NABP) have recognized the need for herbal education and taken initiatives to integrate CAM education in pharmacy curriculum.<sup>12,13</sup> The study assessing CAM education in pharmacy schools found that eight out of ten schools in the US offered herbal medication education but topics were not consistently covered.<sup>12</sup> A study conducted on Canadian pharmacy students found that students who took herbal courses had higher knowledge scores compared to who did not.<sup>14</sup> No study in the US has evaluated pharmacy student's knowledge and only one study evaluated their attitude towards herbal medications.<sup>15</sup> The study found that students had positive attitude towards CAM.

A variety of herbal medication education strategies exists and tracking changes in students' attitudes is one strategy to document successful and effective herbal medication instructions. Pharmacy students' ability to learn about herbal medications may be influenced not only by the availability of information provided in the degree curriculum, but also by additional factors such as the student's prior use, self-motivation to learn, and overall beliefs and attitude towards herbal medications.

Pharmacy schools have an obligation to their students and the public to prepare graduates who are ready to enter contemporary pharmacy practice. Since pharmacy students are future pharmacists who are the first point of contact to provide herbal medication information to patients, it is important to know their knowledge and attitude. Furthermore, in the US several federal agencies such as National Center for Complementary and Alternative Medicine (NCCAM) and National Institutes of Health's (NIH) office of Dietary and Supplements provide evidence about the herbal medications to improve awareness among healthcare professionals regarding herbal medications. The current study will evaluate pharmacy students' knowledge and attitude towards herbal medications. Furthermore, the

association of herbal medication knowledge towards attitude formation has not been examined. Thus, the purpose of this study was to assess and compare pharmacy students' knowledge and attitude towards herbal medications and to examine the factors that might be associated with attitude formation towards herbal medications.

## Material and Method

### *Sample and Study design*

This study utilized a cross-sectional survey design and was conducted by administering a questionnaire to pharmacy students who had completed at least one semester at the University. Since this survey was administered during October - November 2010, the sample consisted of students in the second, third and fourth year of their pharmacy curriculum. Students were exposed to information on herbal medications through lectures within a series of over-the-counter (OTC) medication courses during their second and third year.

### *Study Instrument*

A questionnaire was designed to collect information on pharmacy students' knowledge and attitude towards herbal medications. The consent form was attached to the questionnaire explaining the study purpose. The survey questions were consisted of three major sections. Section one included statements regarding pharmacy students' attitude towards herbal medications. This section consisted of seventeen statements with a "Likert" scale from 1 (strongly disagree) through 5 (strongly agree). Section two included fifteen herbal medication knowledge statements in a "true" or "false" choice format. Questions for both sections were taken from previous published literature and modified as per the need for this study.<sup>8,13,16</sup> Section three included demographic (age, race, and gender), other background data (year of enrolment and work experience) and assess past herbal use. The questionnaire was initially validated by two professors and one pharmacist for content before data collection.

### *Data Collection Process*

Students in the second and third year were recruited when they were taking classes, while the fourth year students who are typically on clinical rotations were recruited during an on-campus day. The permission was taken from the professor in-charge of the class to administer the survey. The questionnaire was administered only once to each of the three classes and was distributed before the class started and collected at the end of the class. Participation in this study was voluntary and participants were assured that information provided would remain anonymous. The



study was approved by the institutional review board for the protection of human subjects.

**Statistical Analysis**

Data were coded and individual responses were entered into "epi info", the survey database software (version 3.5.1). Data were analyzed using the SAS statistical package (version 9.2, SAS Inc) with a priori set alpha level of 0.05. Reliability analyses for the domains were carried out by calculating a "Cronbach's coefficient alpha". A score of 0.7 and higher indicated acceptable reliability of the domains measured.<sup>17,18</sup> Descriptive analyses, Spearman correlation analysis, analysis of variance (ANOVA), and Tukey's test were conducted to evaluate pharmacy students' knowledge and attitude towards herbal medications.

To examine factors of attitude formation, we estimated a logistic regression model using the attitude formation as the dependent variable and all other variables in the model as independent variables. For the attitude responses, all responses with any degree of agreement and neutral responses were grouped together as positive responses ( $\geq 3$ ) and all responses with any degree of disagreement were grouped together as negative responses ( $< 3$ ). The logistic model controlled for age, race, sex, year of enrolment, coursework received and work experience.

**Results**

**Sample Characteristics**

A total of 175 students completed the survey, representing 85% of the response rate. The response rate of second, third and fourth year students was 93.4%, 69.3%, and 84.6% respectively. The sample characteristics of second, third and fourth year pharmacy students were reported in table 1. The mean ( $\pm$ SD) age of pharmacy students was 26.2 ( $\pm 3.4$ ) years and approximately two-thirds were female. Majority of the students were Asians (48%) followed by Whites (37.7%), Hispanics (8%) and African Americans (5.7%). More than 70% of students had work experience in chain pharmacy (Table 1).

information on herbal medications?				
Yes	5 (7.3)	23 (45.1)	42 (76.4)	70 (40)
No	64 (92.8)	28 (54.9)	13 (23.6)	105 (60)
Based on courses you have taken, do you have adequate knowledge about herbal medications to practice as a pharmacist?				
Yes	3 (4.4)	5 (9.8)	32 (58.2)	40 (22.9)
No	66 (95.6)	46 (90.2)	23 (41.8)	135 (77.1)
Do you need more information regarding herbal medications?				
Yes	61 (88.4)	49 (96.1)	51 (92.7)	161 (92)
No	8 (11.6)	2 (3.9)	4 (7.3)	14 (8)
Where do you feel you received the majority of your herbal medications information?				
Pharmacy Courses	10 (14.5)	32 (62.8)	41 (74.6)	83 (47.4)
Books	6 (8.7)	2 (3.9)	7 (12.7)	15 (8.6)
Internet	37 (53.6)	15 (29.4)	20 (36.4)	72 (41.1)
Journals	5 (7.3)	1 (2.0)	8 (14.6)	14 (8)
Others	23 (33.3)	7 (13.7)	3 (5.5)	33 (18.9)

**Table 1: Sample characteristics by year enrolled**

The foremost sources of information with respect to herbal medications were pharmacy courses (47.4%) and internet (41.1%). Only 22.9% students reported that they had adequate knowledge about herbal medications to practice as a pharmacist. Nine out of ten students (92%) acknowledged that they needed additional information about herbal medications to enhance their knowledge and apply it to the practice. Moreover, 41 students (38.7%) from third and fourth year reported that they did not receive any information about herbal medications from the courses (Table 2).

**Students Knowledge regarding Herbal Medications**

Individual statements comprising the herbal medications knowledge test along with the number of correct responses and percentage are listed in table 2. The mean ( $\pm$ SD) knowledge score across all groups was 9.3 $\pm$ 1.8 (maximum 15). Third year students (10.0 $\pm$  1.4) had slightly better knowledge scores compared to fourth (9.6 $\pm$ 1.2) and second year (8.6 $\pm$ 2.1) students. ANOVA and tukey's post hoc analysis revealed statistically significant difference between second and third year as well as second and fourth year (P-value:  $< 0.0001$ ); whereas, there was no significant difference between third and fourth years students.

**Students Attitude towards Herbal Medications**

Table 3 contains the mean scores and standard deviations for attitudinal questions overall and by class. The Cronbach's coefficient alpha value for scales measuring attitude was 0.7, an acceptable reliability. The overall mean attitude score was towards neutral (3.0 $\pm$ 0.4). The average attitude towards herbal

Characteristics	Frequency (%)			
	2 <sup>nd</sup> year (N =69)	3 <sup>rd</sup> year (N =51)	4 <sup>th</sup> year (N =55)	Total (N =175)
Age (Mean $\pm$ SD)	24.8 $\pm$ 2.8	25.9 $\pm$ 2.7	28.1 $\pm$ 3.7	26.1 $\pm$ 3.4
Gender				
Female	48 (69.6)	39 (76.5)	30 (54.5)	117 (66.9)
Male	21 (30.4)	12 (25.5)	25 (45.5)	58 (33.1)
Race				
White	25 (36.2)	18 (35.3)	23 (41.8)	66 (37.7)
African American	5 (7.3)	3 (5.9)	3 (5.5)	11 (6.3)
Asian	36 (52.2)	25 (49.0)	23 (41.8)	84 (48)
Hispanic	3 (4.4)	5 (9.8)	6 (10.9)	14 (8)
Work Experience				
Independent Pharmacy	60 (87.0)	5 (9.8)	8 (14.6)	22 (12.6)
Chain Pharmacy	44 (63.8)	43 (84.3)	41 (74.6)	128 (73.1)
Institutional/Hospital	61 (88.4)	4 (7.8)	16 (29.1)	28 (16)
Other	4 (5.8)	2 (3.9)	3 (5.5)	9 (5.1)
No	18 (26.1)	4 (7.8)	45 (81.8)	32 (18.3)
Have you received or completed any courses that provided				



medications was similar across all 3 years; 3.1±0.4 (second year), 3.0±0.4 (third year) and 3.0±0.4 (fourth year) respectively (p = 0.25). Students reported positive attitude towards herbal medications for personal and family use (Table 3). They indicated a favorable attitude towards efficacy of herbal medications. However, they agreed with statements that herbal medications are a form of quackery and a threat to public health. Students disagreed with the notion that the herbal medications are well accepted by FDA and the National Association of Boards of Pharmacy (NABP). Moreover, pharmacy students felt that doses of commercially marketed herbal medications are not well standardized (Table 3).

**Table 2: Pharmacists' responses to herbal medications knowledge questions**

Knowledge statements	Correct responses (%)			
	2 <sup>nd</sup> year (N = 69)	3 <sup>rd</sup> year (N = 51)	4 <sup>th</sup> year (N = 55)	Total (N = 175)
St. John's Wort is most commonly used for depression	35 (50.7)	51 (100)	55 (100)	141 (80.6)
Ginseng may cause an increased risk of bleeding	39 (56.5)	42 (82.4)	50 (90.9)	131 (74.9)
Grapefruit Juice is metabolized through the CYP450 system	55 (79.7)	48 (94.1)	52 (94.6)	155 (88.6)
Saw Palmetto is commonly used for treatment of headache	41 (59.4)	44 (86.3)	52 (94.6)	137 (78.3)
Fish oil can help decrease the risk of heart attack and stroke	64 (92.8)	49 (96.1)	52 (94.6)	165 (94.3)
Ginseng should be used in caution in patients with renal dysfunction	43 (62.3)	40 (78.4)	39 (70.9)	122 (69.7)
Cranberry juice has been shown to be effective in treating urinary tract infections	12 (17.4)	22 (43.1)	20 (36.4)	54 (30.9)
Kava is most commonly used for anxiety	41 (59.4)	32 (62.8)	31 (56.4)	104 (59.4)
St. John's Wort is contraindicated in pregnancy	62 (89.9)	46 (90.2)	49 (89.1)	157 (89.7)
An adverse drug effect of St. John's Wort is photodermatitis	40 (58)	26 (51)	32 (58.2)	98 (56)
Feverfew is safe for use in pregnant women	27 (39.1)	10 (19.6)	4 (7.3)	41 (23.4)
Prolonged use of kava can cause skin discoloration	25 (36.2)	19 (37.3)	18 (32.7)	62 (35.4)
An adverse effect of saw palmetto is hair loss	39 (56.5)	26 (51)	20 (36.4)	85 (48.6)
Echinacea is commonly used for the treatment of cold and flu symptoms	14 (20.3)	7 (13.7)	5 (9.1)	26 (14.9)
Glucosamine plus chondroitin may reduce knee pain or slow the progression of Osteoarthritis	58 (84.1)	50 (98.0)	49 (89.1)	157 (89.7)

**Effect of Herbal Medication Knowledge on Attitude Formation**

Herbal medication knowledge had a significant effect on positive attitude formation; one unit increase in knowledge

increased the odds of positive attitude formation by 27% (OR = 1.27; 95% CI: 1.03 – 1.57). Students who had work experience were 4.1 times more likely to have positive attitude towards herbal medications (OR = 4.09; 95% CI: 1.40 – 11.98). Age, gender and year of enrolment were not significantly associated with the attitude formation in the logistic regression model tested (Table 4).

**Table 3: Students' attitude towards herbal medications**

Attitude statements	Mean±SD			
	2 <sup>nd</sup> year (N =69)	3 <sup>rd</sup> year (N =51)	4 <sup>th</sup> year (N =55)	Total (N=175)
I have used herbal medications for self-treatment before	3.1±1.4	3.4±1.3	3.5±1.2	3.3±1.3
Someone in my immediate family has used herbal medicines frequently in the past	3.8±1.2	3.8±1.1	3.9±0.8	3.8±1.1
Herbal medications are efficacious	3.6±0.9	3.4±0.9	3.3±0.6	3.4±0.8
As a consumer, I have actively sought information regarding herbal medicines	2.7±1.2	2.9±1.1	3.5±1.0	3.0±1.1
Herbal medications are threat to public health	3.7±0.9	3.8±0.8	3.2±0.9	3.6±0.9
Herbal medications can be safely used with a prescription medication	3.2±0.9	2.6±0.9	2.9±1.1	2.9±1.0
Most herbal medications have a high degree of placebo effect	2.8±0.8	2.9±0.8	2.7±0.8	2.8±0.9
Herbal medications are a good economical alternative to conventional medicines for patients who self-select	3.1±0.9	2.8±0.9	2.4±1.0	2.8±1.0
The quality of herbal medications is well accepted by FDA	2.3±0.8	2.0±0.9	1.6±0.6	2.0±0.8
Herbal medications are well accepted by the National Association of Boards of Pharmacy	2.5±0.8	2.2±0.9	2.1±0.8	2.3±0.8
The doses of commercially marketed herbal medications have been well standardized	2.4±0.9	2.1±0.9	1.8±0.9	2.1±0.9
Herbal medications are only a form of quackery	3.7±0.9	3.6±0.8	3.6±0.8	3.6±0.8
Herbal medications should be sold only in a pharmacy	2.9±1.0	3.3±1.2	3.3±0.9	3.1±1.0
Carrying herbal medications may have a negative influence on a pharmacy's image	3.7±0.7	3.8±1.0	3.7±0.9	3.7±0.8
The profit potential is high with herbal medications	3.3±0.8	3.4±0.8	3.4±0.8	3.4±0.8
Carrying herbal medications may increase my liability	2.9±1.0	2.8±0.8	2.7±0.9	2.8±0.9



**Table 4: Multiple logistic regression to assess effect of independent variables on attitude formation towards herbal medications**

Variable	Odds ratio (95% C.I.)
Age	0.95 (0.84 – 1.06)
Gender	
Male	Reference
Female	1.25 (0.61 – 2.59)
Race	
White	Reference
Asian	0.35 (0.17 – 0.72)
Hispanic	0.97 (0.28 – 3.35)
African American	0.35 (0.08 – 1.54)
Year of enrollment	
Fourth year	Reference
Third year	1.28 (0.52 – 3.15)
Second year	2.05 (0.70 – 5.96)
Knowledge	1.27 (1.03 – 1.57)
Coursework received	0.53 (0.22 – 1.27)
Work experience	4.09 (1.40 – 11.98)

## Discussion

Findings of this study showed that overall herbal medications knowledge score of pharmacy students was 9.3 out of 15 and perceived that they had inadequate knowledge about herbal medications. Overall, pharmacy students had neutral attitude towards herbal medications. The study also demonstrated that third and fourth year pharmacy students had higher knowledge compared to second year students which could be due to herbal medication information provided to them through OTC coursework. Whereas, the attitude towards herbal medications remained neutral throughout the year enrolled. Logistic regression model revealed that knowledge was positively associated with attitude towards herbal medications.

Use of herbal medications is increasing in the US and as a result pharmacist will continue to receive more questions pertaining to herbal medications indications, contraindications, doses and herb-drug interactions. Therefore it is important for pharmacists to have sufficient knowledge about herbal medications to counsel patients. One previous study found that pharmacists had on average low knowledge test scores (6.3 out of 15) on herbal medications; the study concluded that pharmacists with prior continuing education on herbal medication had higher knowledge scores (7.4±3.1) compared with the one who did not receive this education (5.3±3.1) ( $p = <0.001$ ).<sup>8</sup> Contrary to previous study, our study found the higher knowledge test scores (9.3 out of 15). This might be due to the education provided in the integrated coursework. However, this higher knowledge may not be sufficient as it

was not at a higher end and there is still a scope for further improvement in the knowledge. Hence, it is important that pharmacists receive prior education regarding herbal medications. Herbal medication information has been incorporated into curriculum in many pharmacy schools mostly through elective coursework or by integrating herbal medication lectures in other required course such as OTC, pharmacology or therapeutics.<sup>12</sup>

Third and fourth year students had higher knowledge compared to second year students. This could be explained due to their exposure to herbal medication information in the integrated coursework. In this study, herbal medication knowledge was provided to third year students through one coursework and to fourth year students through two courseworks. Whereas, second year students had not received any formal herbal medication knowledge through pharmacy courseworks. Therefore, providing herbal medication knowledge might increase student's knowledge which could be helpful to practice as a pharmacist. Prior study conducted on Canadian pharmacy students also found that mandatory herbal coursework had positive effect on knowledge.<sup>14</sup>

The current study found pharmacy students' neutral attitude towards herbal medications. A prior study conducted at University of Minnesota found that pharmacy faculty and students had positive attitude towards herbal medications; they also felt that CAM therapies should be included in the pharmacy curriculum.<sup>15</sup> Another study performed on South University's third year pharmacy students found that required coursework addressing CAM and herbal medications significantly changed students' attitudes toward the subject and their likelihood to recommend these therapies to consumers.<sup>19</sup>

This is the first study to identify the association between herbal medication knowledge and attitude among pharmacy students. In the logistic regression model, knowledge was positively associated with herbal medication attitude. This implies that higher knowledge regarding herbal medications can improve students' attitude. One strategy to improve knowledge can be through mandatory coursework related to herbal medications. It has been shown that mandatory coursework and practice can positively influence students' knowledge and attitude towards herbal medications.<sup>14</sup> However, students in our study received herbal medications education which was integrated in the OTC coursework; they do not have a course exclusively dedicated to herbal medications. So, in order to improve the knowledge, there is a greater need for pharmacy students to be trained in this area through mandatory coursework in their curriculum. Furthermore, it has been shown that learning, lectures



and practice experience can also positively influence students' attitude towards herbal medications.<sup>20</sup> Hence, for students to have positive attitude, knowledge should be increased. This can be achieved by including mandatory coursework related to herbal medications into the pharmacy school's curriculum.

As consumer's use of these products continues to increase, the viability of the pharmacist as information source increases in importance. In today's litigious climate, health professionals may feel the need of herbal medication information to protect themselves in a clinical environment where patients' use of these products often. Pharmacists should consider the opportunity to counsel patients regarding herbal medications. For this, it is imperative that they have a strong knowledge base on these products. The education received in pharmacy schools may not be enough. Pharmacists may consider taking continuing education credits of these topics. Also pharmacy schools should offer specific courses on herbal medications to prepare students with adequate knowledge to practice.

### Limitations

Several limitations to this study exist. First, the result of this study may not be generalized nationally since the sample consisted primarily from one University. Different universities may have a different teaching curriculum for herbal medications. Second, the sample size used to conduct this study was small. Finally, due to the lack of a controlled environment, students had access to personal device assistants and the internet and could have utilized these resources to aide them in answering the knowledge questionnaire.

### Conclusion

In conclusion, the study indicated that pharmacy students had inadequate knowledge about herbal medications to apply to practice. Moreover, the attitude towards herbal medications was neutral but increased with knowledge. Also knowledge was significantly different after taking a course.

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#### **AUTHORS' CONTRIBUTIONS**

Authors contributed equally to all aspects of the study.

#### **PEER REVIEW**

Not commissioned; externally peer reviewed

#### **CONFLICTS OF INTEREST**

The authors declare that they have no competing interests