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RESEARCH ARTICLE

A Cross-Sectional Survey on the Attitudes of Future Pharmacists Towards Phytotherapeutic Product Use and Safety

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SUMMARY

Phytotherapeutic products are widely used in both traditional and modern healthcare systems and are often perceived as risk-free due to their natural origin. However, a lack of adequate education, particularly among future healthcare professionals, can lead to significant safety concerns. This study aimed to evaluate the knowledge, attitudes, and perceptions of pharmacy students regarding the safe use of herbal products. A cross-sectional survey was conducted with 274 students enrolled in a Faculty of Pharmacy in Türkiye. A validated 57-item Likert-type scale was used to assess four key factors: common usage scenarios, safety and regulatory knowledge, practices related to obtaining and using herbal products, and risk perception with a professional approach. Findings revealed that only 26.3% of the students had previously received education on herbal products, while 85% expressed interest in such training. Male students scored significantly higher in common use (Factor 1, p = .023), and safety and regulatory knowledge (Factor 2, p = .002), whereas female students scored significantly higher in risk perception (Factor 4, p = .039). Age was not a significant factor. Notably, fourth-year students had lower scores in risk perception, indicating a possible curriculum gap during the clinical transition phase. Students who had prior education scored significantly higher in risk awareness. The scale showed high internal consistency (Cronbach's α = 0.908). These results highlight the need for structured and evidence-based phytotherapy education within pharmacy curricula, particularly during critical periods such as clinical training. Correcting the misconception that "natural" equals "safe" and ensuring students gain the competence to guide patients effectively is essential for promoting medication safety and supporting informed patient decisions.

Keywords: *Pharmacy, pharmacy students, phytotherapy, attitude, herbal products, education.*

Geleceğin eczacılarının bitkisel ürünlerin kullanımı ve güvenliğine yönelik tutumları üzerine kesitsel bir anket çalışması

ÖZ

Fitoterapötik ürünler hem geleneksel hem de modern sağlık sistemlerinde yaygın biçimde kullanılmakta ve doğal kökenli olmaları nedeniyle çoğu zaman risksiz olarak algılanmaktadır. Ancak yeterli bilgiye sahip olunmaması, özellikle sağlık profesyoneli adayları arasında, önemli güvenlik risklerine yol açabilir. Bu çalışma, Türkiye'de bir eczacılık fakültesinde öğrenim gören 274 öğrencinin bitkisel ürünlerin güvenli kullanımı konusundaki bilgi, tutum ve algılarını değerlendirmeyi amaçlamıştır. Kesitsel olarak yürütülen çalışmada, dört temel faktörü içeren (yaygın kullanım, güvenlik/mevzuat bilgisi, kullanım uygulamaları ve risk algısı/mesleki yaklaşım) ve 57 maddeden oluşan geçerli ve güvenilir bir Likert tipi ölçek kullanılmıştır. Bulgular, öğrencilerin yalnızca %26,3'ünün bitkisel ürünler konusunda daha önce eğitim aldığını, ancak %85'inin bu eğitimi almak istediğini göstermiştir. Erkek öğrenciler yaygın kullanım (Faktör 1, p = .023) ile güvenilirlik ve denetim (Faktör 2, p = .002) boyutlarında anlamlı derecede daha yüksek puan alırken, kadın öğrenciler risk algısı (Faktör 4, p = .039) boyutunda anlamlı derecede daha yüksek puan almıştır. Yaş değişkeni anlamlı fark yaratmamıştır. Dördüncü sınıf öğrencilerinin risk algısı puanlarında belirgin bir düşüş gözlenmiş, bu durum müfredattaki klinik geçiş sürecinde bir boşluk olabileceğini düşündürmüştür. Eğitim almış öğrenciler risk farkındalığında anlamlı olarak daha yüksek puanlar elde etmiştir. Ölçeğin iç tutarlılığı oldukça yüksektir (Cronbach's α = 0,908). Sonuçlar, eczacılık müfredatına yapılandırılmış, kanıta dayalı fitoterapi eğitiminin entegrasyonunun gerekliliğini ortaya koymaktadır.

Anahtar Kelimeler: *Eczacılık, eczacılık öğrencileri, fitoterapi, tutum, bitkisel ürünler, eğitim.*

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INTRODUCTION

Phytotherapeutic products are medicinal preparations derived from plants or plant parts, and used for the prevention or treatment of diseases based on traditional knowledge and scientific evidence. These products include herbal medicines, standardized plant extracts, and medicinal teas, and they constitute a major component of traditional and complementary medicine systems worldwide (WHO, 2019). Traditional medicine remains an integral part of healthcare delivery, particularly in low- and middle-income countries, but its use has also increased substantially in developed societies due to cultural acceptance, accessibility, and patient preference for "natural" therapies (Ekor, 2014; Tilburt & Kaptchuk, 2008). The WHO estimates that a significant proportion of the global population relies on traditional medicine as a primary or complementary healthcare modality, underscoring the continued relevance of phytotherapeutic products in modern medical practice (WHO, 2019).

Despite their widespread use, phytotherapeutic and other natural products are commonly perceived by the public as inherently safe due to their natural origin. This assumption represents a critical misconception, as numerous studies have demonstrated that herbal products may cause adverse reactions, toxicity, contamination-related harm, and clinically significant herb–drug interactions (Izzo, Hoon-Kim, Radhakrishnan, & Williamson, 2016; Posadzki, Watson, & Ernst, 2013). The lack of stringent regulatory oversight in many countries further contributes to variability in product quality, composition, and labeling accuracy, increasing the risk of inappropriate use (Barnes, Anderson, & Phillipson, 2007; Heinrich, Barnes, Prieto-Garcia, Gibbons, & Williamson, 2017). Consequently, the irrational use of phytotherapeutic products may compromise patient safety, particularly among individuals with chronic diseases, polypharmacy, or vulnerable physiological conditions.

Healthcare professionals play a central role in ensuring the rational, safe, and evidence-based use of phytotherapeutic products. Among these professionals, pharmacists are uniquely positioned due to their accessibility, pharmacological expertise, and frequent involvement in patient counseling. Studies conducted among community pharmacists in various countries have evaluated their knowledge, attitudes, and practices related to complementary and alternative medicines, revealing significant gaps in safety awareness and patient counseling behaviors. Strengthening pharmacists' competence in this area is therefore essential for improving medication safety and promoting informed patient decision-making (Abudalo et al., 2022; Hijazi et al., 2019; Naja et al., 2024; Thin et al., 2022).

Survey-based studies have been widely used to assess knowledge, attitudes, and practices related to phytotherapeutic product use among healthcare professionals, including physicians, pharmacists, and nurses (Hilal & Hilal, 2017; Jafari, Zanganeh, Kazemi, Lael-Monfared, & Tehrani, 2021; Tahir et al., 2023). However, research focusing specifically on healthcare students, particularly pharmacy students, remains comparatively limited. This gap is noteworthy, as students represent future healthcare providers whose attitudes and preparedness will directly influence clinical practice and patient safety.

In light of these considerations, the present study conducts a cross-sectional survey to examine the knowledge, attitudes, and perceptions of future pharmacists regarding the use and safety of phytotherapeutic products. By investigating the factors that shape these attitudes within a population whose professional identity is rooted in medication expertise, this study aims to address a critical gap in pharmacy education. Through this approach, we seek to generate evidence-based insight into students' preparedness to provide safe and informed guidance on phytotherapeutic therapies and to identify areas in which curricular reinforcement may be required.

MATERIALS AND METHODS

Study design

This study was conducted as a quantitative, cross-sectional, survey-based empirical investigation to assess the knowledge and attitudes toward the safe use of herbal products among pharmacy students. The research was carried out at the Faculty of Pharmacy, İnönü University, Türkiye. A cross-sectional approach was selected to capture measurable data on attitudes and perceptions at a single point in time, allowing for the exploration of associations between key demographic and behavioral variables (Creswell & Creswell, 2017). A 5-point Likert-type scale was employed to quantify participants' attitudes toward the safe use of herbal products, as such instruments are widely validated for measuring behavioral tendencies and belief systems (DeVellis & Thorpe, 2021). Furthermore, the online survey format was chosen to ensure wide accessibility among students and to encourage more honest and unbiased responses through perceived anonymity (Wright, 2005).

Study setting and timeline

The study was conducted at the Faculty of Pharmacy, İnönü University, located in Malatya, Türkiye. Data collection occurred between 1 November and 1 December 2025. An online survey (Google Forms) was employed to facilitate anonymous participation, reduce response bias, and enable access to students across different academic years.

Study population and sampling

The target population for this study comprised all currently enrolled undergraduate students (Years 1–5) at the Faculty of Pharmacy, İnönü Universitytrkey, during the study period (N = 536). A census sampling approach was adopted, aiming to invite the entire student population rather than employing random sampling methods. The minimum required sample size was determined to be 200 participants, based on reliability considerations for scale validation and supported by G*Power analysis (alpha error probability = 0.05, statistical power = 0.80, and a medium effect size assumption). The primary inclusion criterion was active enrollment in the Faculty of Pharmacy at İnönü University. Questionnaires with incomplete or missing responses were excluded from the final analysis, which constituted an implicit exclusion criterion. No other exclusion criteria were applied.

Data collection instrument

The data was collected using an electronic questionnaire comprised of two main instruments.

Demographic information form

This form included five items gathering basic information on participants' age, gender, year of study, prior formal education on herbal products, and interest in receiving further education on this subject. Prior formal education was defined as having received structured training on herbal products either within the undergraduate pharmacy curriculum (e.g., compulsory or elective courses) or outside the university setting through certified or officially recognized educational programs. These items were included for descriptive purposes only and were not part of the validated scale.

Attitudes toward safe use of herbal products scale

Attitudes towards the safe use of herbal products were assessed using the 57-item, 5-point Likert scale developed and validated by Yıldız (2021). The instrument was originally developed for use among healthcare professionals (including physicians and nurses) to reveal their knowledge, attitudes, and behaviors regarding herbal products. The scale's construct validity was confirmed through Explanatory Factor Analysis (EFA), which demonstrated that the 57 items were gathered into four sub-dimensions explaining 40.263% of the total variance (Yıldız, 2021). These four subdimensions cover:

- Frequent use scenarios of herbal products
- Safety and regulatory perception
- Practices related to the collection, purchase, and usage of herbs

- Risk perceptions and healthcare professionals' attitudes

The original study reported high item-total score correlation and strong internal consistency, confirming the scale's reliability. In the present study, the original validated scale was used without modification. No additional items were added to the scale, and all psychometric analyses were conducted exclusively using the original 57 items. The questionnaire items were derived from the original validated scale; however, to preserve the integrity of the assessment tool and in accordance with ethical considerations regarding intellectual property, the full item set is not reproduced in this manuscript. The original instrument is publicly accessible through the cited source. In the present study, the scale's psychometric properties—specifically its internal consistency (Cronbach's alpha) and factorial structure—will be re-evaluated within a pharmacy student population to ensure its continued validity for this specific target group.

Data collection procedure

Data collection was performed via an online platform (Google Forms) to ensure broad reach and participant anonymity. Access to the questionnaire was granted only after the participants provided informed consent digitally. The estimated completion time for the survey was 15–20 minutes. To maintain data quality and prevent duplicate entries, each participant was intended to receive a single-use link, and only one response per IP address was accepted.

Variables

The study utilized the following variables for analysis.

Dependent Variable: The primary dependent variable was the Total attitude score towards the safe use of herbal products (continuous variable).

Independent Variables: Key independent variables examined for their potential influence on attitudes included Gender (categorical: binary), Year of study (categorical: 5 levels), and Status of prior education on herbal products (categorical: binary).

Statistical analysis

Data analysis will be performed using SPSS version 26.0. The significance threshold for all inferential tests was set at $p < 0.05$.

Descriptive statistics

Frequencies, percentages, means, and standard deviations will be reported for all relevant demographic and scale variables.

Inferential statistics

To compare differences in attitude scores across groups, appropriate inferential tests will be selected based on the assessment of data distribution characteristics: For comparisons based on binary variables (Gender and prior education), the Independent samples t-test (parametric) or the Mann–Whitney U test (non-parametric) was used. For comparisons across multiple groups (Year of study), the One-way ANOVA with Tukey HSD post-hoc test (parametric)was employed.

Reliability and validity analysis

Internal consistency of the attitude scale will be assessed using Cronbach's alpha (α) coefficient, with $\alpha \geq 0.70$ indicating acceptable reliability.

Study limitations

The primary limitation of the study is the reliance on self-reported data collected online, which may introduce response bias or variability in participation. However, the full population recruitment strategy (census) and the anonymity of the data collection process are expected to mitigate these risks.

Ethics approval

This study was approved by the Ethics Committee of İnönü University (2025/8100). Participants' informed consent was obtained before the survey questions.

RESULTS

A total of 274 pharmacy students participated in the study. Of these, 198 (72.3%) were female, and 76 (27.7%) were male, with a mean age of 20.90 ±1.87

years. When asked about prior exposure to education or training on the safe use of herbal phytotherapeutic products, 72 students (26.3%) reported having received such training, while 202 students (73.7%) indicated no prior experience. Despite the low prior exposure, interest in receiving education on this topic was notably high: 233 students (85.0%) expressed a willingness to take a course or training on the safe use of herbal products, whereas only 41 students (15.0%) declined (Figure 1.). These findings suggest a significant educational gap alongside a strong demand for structured learning opportunities in the area of herbal product safety among pharmacy students.

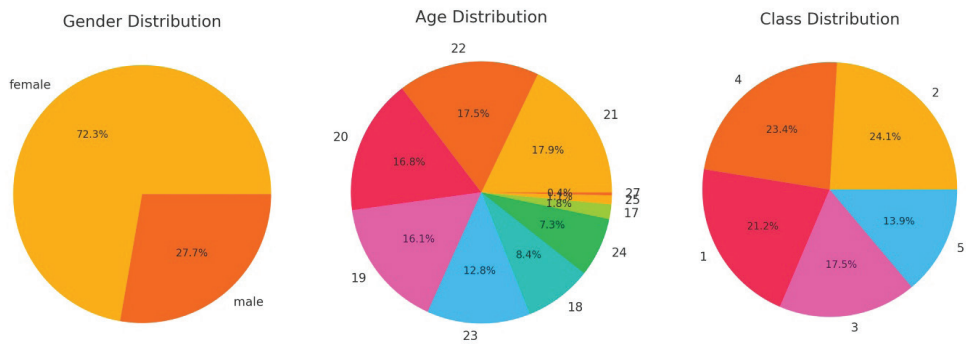

Figure 1. Demographic Distribution of the Pharmacy Student Sample.

Figure 2 presents the gender-based distribution of the study's pharmacy students (N=274) across four educational categories concerning herbal products. Female students constitute the vast majority across the entire sample and consistently represent the largest group in all categories examined. Specifically, 56 female and 16 male students reported having received prior formal education on herbal products. Conversely, the largest segment was the group that had not taken such a course (142 females, 60 males). Crucially, a significantly high level of interest in future education was observed, with 233 students (85% of the total sample) indicating their willingness to enroll in a course on the safe use of herbal products; this cohort comprised 168 females and 65 males. Only a small minority (30 females, 11 males) expressed no desire to pursue this specialized education. These findings underscore that female pharmacy students dominate both the current educational engagement and the prospective interest in herbal product studies within this population.

The reliability analysis demonstrated that all four factors exhibited acceptable to excellent internal consistency. Cronbach's alpha coefficients were .931 for Factor 1 (Common Situations Where Herbal Products Are Frequently Used), .756 for Factor 2 (Safety and Regulation of Herbal Products), .878 for Factor 3 (Harvesting, Purchasing, and Use of Medicinal Plants), and .861 for Factor 4 (Risks of Herbal Products and the Healthcare Professionals' Approach). The overall reliability for the total scale (57 items) was high ($\alpha = .908$), indicating strong internal consistency across all items (Table 1.).

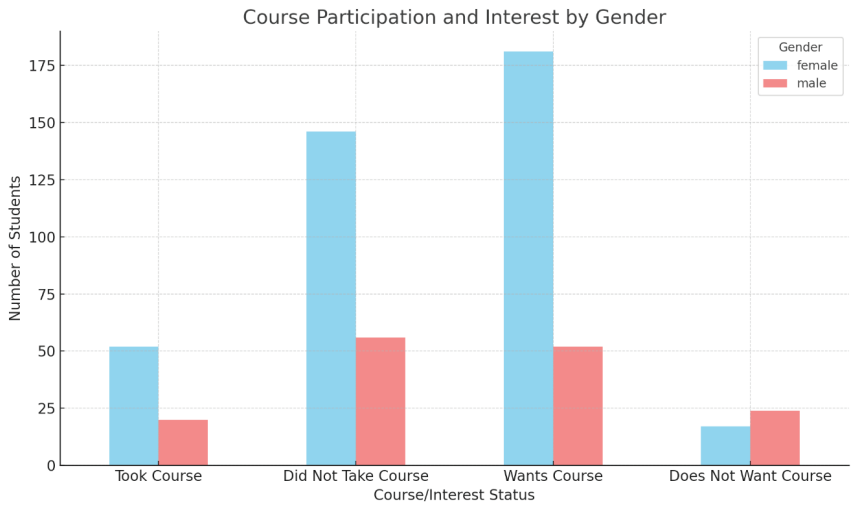

Figure 2. Distribution of Course Participation and Interest by Gender

Table 1. Internal consistency reliability of the attitude scale and its subscales as assessed by Cronbach's alpha coefficients.

Factor	Factor name	n	Cronbach's Alpha
Factor 1	Frequent use scenarios of herbal products	17	.931
Factor 2	Safety and Regulation of Herbal Products	18	.756
Factor 3	Practices related to the collection, purchase, and usage of herbs	14	.878
Factor 4	Risk perceptions and healthcare professionals' attitudes	8	.861
Total		57	.908

In terms of gender-based differences (Table 2.), statistically significant differences were found in Factors 1, 2, and 4. Male students scored significantly higher than females in Factor 1 (M = 65.14 vs. 61.35, p = .023) and Factor 2 (M = 64.63 vs. 60.13, p = .002) whereas female students scored significantly higher in Factor 4 (M = 34.84 vs. 33.61, p = .039). No significant difference was observed in Factor 3 (p = .387). These results suggest that male students tend to report slightly higher agreement with statements related to common usage situations, regulatory aspects, and risk perception of herbal products compared to their female counterparts.

Table 2. Comparison of attitude scale factor scores according to gender.

	Gender	N	Mean	Std. Deviation	Std. Error Mean	p value
Factor 1	Female	198	61.3485	12.43235	.88353	.023
	Male	76	65.1447	11.85547	1.35992	
Factor 2	Female	198	60.1313	7.48080	.53164	.002
	Male	76	64.6316	11.69369	1.34136	
Factor 3	Female	198	55.6263	5.55011	.39443	.387
	Male	76	54.7763	7.81554	.89650	
Factor 4	Female	198	34.8434	4.21392	.29947	.039
	Male	76	33.6053	4.95602	.56849	

When comparing students based on age (Table 3.), no statistically significant differences were found across any of the four factors ($p > .05$). Students younger than 20 and those aged 20 and above showed similar levels of response in all domains, indicating that age was not a discriminating variable in perceptions or knowledge levels regarding herbal products.

Table 3. Comparison of attitude scale factor scores according to age group (<20 years vs. ≥20 years)

	Age	N	Mean	Std. Deviation	Std. Error Mean	p value
Factor 1	<20	118	62.0169	12.20479	1.12354	.655
	≥20	156	62.6923	12.52693	1.00296	
Factor 2	<20	118	61.7881	8.17423	.75250	.517
	≥20	156	61.0705	9.68545	.77546	
Factor 3	<20	118	55.9322	5.45334	.50202	.200
	≥20	156	54.9808	6.79133	.54374	
Factor 4	<20	118	35.0085	4.03509	.37146	.101
	≥20	156	34.1154	4.72872	.37860	

When comparing factor scores across class levels (1st through 5th year students), no statistically significant differences were observed for Factor 1 ($p = .799$), Factor 2 ($p = .102$), or Factor 3 ($p = .160$) (Table 4.), indicating relatively consistent perceptions of commonly encountered herbal product usage scenarios, regulatory understanding, and knowledge related to harvesting and purchasing practices across academic years.

However, for Factor 4 (Risk perceptions and healthcare professionals' attitudes), a statistically significant difference was found ($p = .002$). Notably, 4th-year students scored lower (M = 32.53) than students in other years (e.g., 1st-year: M = 35.29; 5th-year: M = 35.37), suggesting a potential gap or decreased awareness regarding risk-related aspects of herbal products during this academic phase.

Table 4. Comparison of attitude scale factor scores across academic year (class level)

	Class	N	Mean	Std. Deviation	Std. Error Mean	p value
Factor 1	1	58	63.7069	12.02484	1.57894	.799
	2	66	62.1515	14.09009	1.73437	
	3	48	60.7292	11.85684	1.71139	
	4	64	62.8906	12.21516	1.52689	
	5	38	62.1316	10.87067	1.76346	
	Total	274	62.4015	12.37122	.74737	
Factor 2	1	58	62.7759	9.40333	1.23472	.102
	2	66	61.2727	8.05471	.99147	
	3	48	62.8542	11.36435	1.64030	
	4	64	61.0625	9.00771	1.12596	
	5	38	58.1053	5.97648	.96951	
	Total	274	61.3796	9.05670	.54714	

	Class	N	Mean	Std. Deviation	Std. Error Mean	p value
Factor 3	1	58	56.0862	6.14813	.80729	.160
	2	66	56.0303	5.02599	.61866	
	3	48	55.7708	8.11943	1.17194	
	4	64	53.6563	5.79605	.72451	
	5	38	55.6579	6.19623	1.00516	
	Total	274	55.3905	6.25737	.37802	
Factor 4	1	58	35.2931	4.24681	.55763	**.002**
	2	66	34.8485	3.66792	.45149	
	3	48	35.0000	4.27262	.61670	
	4	64	32.5313	5.03943	.62993	
	5	38	35.3684	4.44438	.72097	
	Total	274	34.5000	4.45757	.26929	

Comparisons based on prior education or training on herbal products revealed a statistically significant difference in Factor 3 (Harvesting, Purchasing, and Use of Medicinal Plants), with students who had prior education scoring higher than those without (M = 56.65 vs. 54.94, p = .046) (Table 5.). No statistically significant differences were observed in Factors 1, 2, or 4 (p > .05).

Table 5. Comparison of attitude scale factor scores according to prior education on herbal products.

	Prior Education on Herbal Products	N	Mean	Std. Deviation	Std. Error Mean	p value
Factor 1	Yes	72	61.7500	12.70993	1.49788	**.604**
	No	202	62.6337	12.27198	.86345	
Factor 2	Yes	72	61.1667	8.87789	1.04627	**.817**
	No	202	61.4554	9.14017	.64310	
Factor 3	Yes	72	56.6528	5.64728	.66554	**.046**
	No	202	54.9406	6.41410	.45129	
Factor 4	Yes	72	35.2083	4.40530	.51917	**.117**
	No	202	34.2475	4.45967	.31378	

Comparisons based on interest in receiving education on herbal products showed a statistically significant difference in Factor 4 (Risks of Herbal Products and the Healthcare Professionals' Approach), with students who expressed interest scoring higher than those who did not (M = 34.85 vs. 32.49, p = .021) (Table 6.). No statistically significant differences were observed in Factors 1–3 (p > .05).

Table 6. Comparison of attitude scale factor scores according to interest in receiving education on herbal products.

	Interest in receiving education	N	Mean	Std. Deviation	Std. Error Mean	p value
Factor 1	Yes	233	62.0386	12.29849	.80570	.248
	No	41	64.4634	12.73400	1.98872	
Factor 2	Yes	233	61.0558	8.49855	.55676	.263
	No	41	63.2195	11.69725	1.82680	
Factor 3	Yes	233	55.7082	5.60717	.36734	.151
	No	41	53.5854	8.99715	1.40512	
Factor 4	Yes	233	34.8541	4.00809	.26258	.021
	No	41	32.4878	6.12830	.95708	

DISCUSSION

The present cross-sectional survey examined the attitudes of pharmacy students at İnönü University toward the safe use of phytotherapeutic products, revealing important insights into educational preparedness, gender-based differences, and the influence of prior training. The findings underscore both the strengths and gaps in current pharmacy education regarding herbal medicine safety and highlight the need for curriculum enhancement in this domain.

A striking finding of this study was the substantial educational gap coupled with overwhelming student interest in phytotherapy training. Only 26.3% of participants reported having received prior education on the safe use of herbal products, yet 85.0% expressed willingness to undertake formal training in this area. This pattern aligns closely with international evidence demonstrating consistent student demand for complementary and alternative medicine (CAM) education despite inadequate curricular coverage (Abd Wahab, Sakthong, & Winit-Watjana, 2016; Ogaji, Lubayo, & Aliyu, 2021). In Nigeria, 99.1% of pharmacy students supported adding CAM topics to the undergraduate curriculum (Ibrahima & Lawal, 2022), while 89.1% of U.S. pharmacy students and pharmacists desired more instruction in herbal products (Mahmoud, Yousif, & Arbab, 2024). The convergence of these findings across diverse educational contexts suggests a global recognition among future pharmacists that phytotherapy competence is essential for contemporary practice, yet formal training opportunities remain insufficient. The high level of interest observed in the present study may reflect students' awareness of the prevalence of herbal product use in clinical practice and their anticipated role in patient counseling. Given that herbal medicines constitute a major component of healthcare delivery worldwide, particularly in Türkiye, where traditional medicine maintains cultural significance, pharmacy students appear to recognize the professional imperative to develop evidence-based competence in this area. This readiness to learn represents a valuable opportunity for curriculum developers to integrate structured phytotherapy education that addresses both efficacy and safety considerations.

The present study identified statistically significant gender differences across multiple dimensions of herbal product attitudes. Male students scored significantly higher than females in Factor 1 (common usage situations) and Factor 2 (safety and regulation), whereas females scored significantly higher in Factor 4 (risk perception and professional approach) ($p = .039$). These findings contrast with the heterogeneous pattern of gender effects reported in international literature, where results vary by country, cultural context, and specific CAM modality (Ahmad et al., 2015; James & Bah, 2014; Jamshed, Khan, Ahmad, & Elkalmi, 2016).

In some settings, male pharmacy students demonstrated more favorable attitudes toward traditional medicine systems. For instance, male final-year pharmacy students in Andhra Pradesh, India, were significantly more likely to hold positive beliefs about AYUSH (Ayurveda, Yoga, Unani, Siddha, and Homeopathy) medicines (OR = 4.62, 95% CI: 2.37–8.99) compared to females (Ahmad et al., 2015). Conversely, Malaysian pharmacy students revealed that females were more likely to express cautious safety perceptions regarding CAM use (p = 0.007) (Jamshed et al., 2016). On the other hand, in Sierra Leone, no significant difference in the overall positive attitude toward CAM was observed between male and female undergraduate pharmacy students (James & Bah, 2014).

The higher scores among male students in the present study, particularly in safety and regulatory domains (Factor 2), may reflect differential exposure to information sources, varying levels of engagement with pharmacological coursework, or distinct patterns of health-seeking behavior. However, the absence of a universal directional pattern in the literature suggests that gender differences in herbal medicine attitudes are shaped by complex interactions between cultural norms, educational exposure, and individual experiences rather than inherent biological or psychological factors. Further qualitative research is warranted to elucidate the mechanisms underlying these gender-based variations in the Turkish pharmacy education context.

No statistically significant differences were observed between students younger than 20 years and those aged 20 and above across any of the four attitude factors. This finding suggests that chronological age within the narrow range of undergraduate pharmacy students does not substantially influence perceptions of herbal product use and safety. The homogeneity of attitudes across age groups may reflect the relatively uniform life stage and educational exposure of undergraduate students, who typically progress through the curriculum at similar developmental phases. This result underscores that educational interventions targeting herbal medicine competence need not be age-differentiated within the pharmacy student population but should instead focus on year of study and prior training exposure as more relevant stratification variables.

Analysis across class levels revealed a concerning pattern: while Factors 1, 2, and 3 showed no significant differences across academic years, Factor 4 (risk perceptions and healthcare professionals' attitudes) demonstrated significant variation (p = 0.002), with fourth-year students scoring notably lower (M = 32.53) compared to first-year (M = 35.29) and fifth-year students (M = 35.37). This U-shaped pattern suggests a potential gap in risk awareness during the fourth year of pharmacy education, precisely when students are preparing for clinical rotations and patient-facing responsibilities.

Several explanations may account for this phenomenon. Fourth-year students may be experiencing curriculum overload focused on conventional pharmacotherapy, inadvertently deprioritizing attention to complementary medicine safety. Alternatively, the transition from theoretical learning to clinical preparation may create cognitive dissonance, wherein students prioritize evidence-based conventional treatments while temporarily undervaluing the clinical significance of herbal product risks. This finding is particularly concerning given that inadequate awareness of herb-drug interactions and adverse effects represents a major patient safety issue (Barnes et al., 2007; Heinrich et al., 2020). Studies have documented that over half of medical students are unaware that herbs can cause herb-drug interactions, and only 38.6% of Malaysian pharmacy students correctly answered questions about herbal product use with digoxin (Heinrich et al., 2020; Jamshed et al., 2016).

The recovery of risk awareness in fifth-year students may reflect the impact of clinical exposure, where real-world patient encounters reinforce the im-

portance of comprehensive medication history-taking, including herbal products. However, the temporary decline in fourth-year students warrants targeted curriculum intervention to ensure continuous reinforcement of herbal product safety throughout the educational continuum.

Students who had received prior education on herbal products scored significantly higher in Factor 3 (Harvesting, Purchasing, and Use of Medicinal Plants) compared to those without such training ($p = .046$) (Table 5.). In addition, students who expressed interest in receiving further education scored significantly higher in Factor 4 (risk perception and professional approach) ($p = .021$) (Table 6.). Together, these findings provide empirical support for the value of structured phytotherapy education and for students' motivation to engage with herbal product safety. The positive association between prior training and risk awareness aligns with international evidence demonstrating that curricular exposure improves students' knowledge, attitudes, and readiness for clinical integration of herbal medicine guidance (AbouZid, 2015; Hasen & Hashim, 2021). Furthermore, studies examining health professionals' awareness of herbal medicine safety reveal that having formal training is significantly associated with a higher awareness status, highlighting the role of education in promoting safer practices and better patient risk assessment, while Egyptian pharmacy students participating in active learning assignments reported improved knowledge and communication skills regarding herbal products (Thin et al., 2022). These findings collectively reinforce the principle that structured, evidence-based education—rather than incidental exposure or personal use—is essential for developing professional competence in phytotherapy counseling. However, the absence of significant differences in Factors 1, 2, and 3 suggests that prior education may have been narrowly focused on safety and risk aspects without comprehensively addressing common usage scenarios, regulatory frameworks, or practical harvesting and purchasing considerations. This highlights the need for holistic curriculum design that integrates multiple dimensions of herbal product knowledge, including efficacy evidence, quality assurance, legal regulation, and patient communication strategies.

The attitude scale demonstrated strong psychometric properties within the pharmacy student population, with Cronbach's alpha coefficients ranging from 0.756 to 0.931 for individual factors and 0.908 for the overall scale. These values indicate acceptable to excellent internal consistency, confirming the reliability of the instrument for assessing pharmacy students' attitudes toward herbal product safety. The successful adaptation of Yıldız's (2021) scale, originally developed for healthcare professionals, to a student population validates its applicability across different stages of professional development and supports its use in future educational research.

A critical issue highlighted by the literature and relevant to the present findings is the persistent misconception that herbal products are inherently safe due to their natural origin. Studies have documented that 46.85% of medical students considered herbal medicines risk-free (Heinrich et al., 2020), and community pharmacists reported alarmingly low rates of routine herbal product counseling: 50% never or rarely ask patients about herbal use, 80% rarely or never document it, and only 25% always discuss potential side effects (Braun & Cohen, 2014). This gap between perceived safety and actual risk represents a significant threat to patient safety, particularly given the well-documented potential for herb-drug interactions, contamination, adulteration, and adverse effects associated with phytotherapeutic products (Izzo et al., 2016; Moreira, Teixeira, Monteiro, De-Oliveira, & Paumgartten, 2014; Posadzki et al., 2013).

The present study's findings regarding risk perception (Factor 4) suggest that Turkish pharmacy students recognize the importance of professional caution regarding herbal products, particularly when they have received formal training. However, the lower scores among fourth-year students and those without

prior education indicate that this awareness is fragile and requires continuous reinforcement throughout the curriculum. Pharmacy educators must explicitly address the "natural equals safe" fallacy and emphasize that the absence of synthetic processing does not guarantee safety, efficacy, or quality.

The convergence of findings from the present study and the international literature points to several evidence-based recommendations for enhancing pharmacy education in phytotherapy:

Mandatory integration of phytotherapy modules

Given the high student demand (85.0% in the present study; >87% internationally) and documented knowledge gaps, phytotherapy should be incorporated as a mandatory component of the pharmacy curriculum rather than an elective offering (Abd Wahab et al., 2016; Ibrahima & Lawal, 2022; Ogaji et al., 2021). This integration should occur longitudinally across multiple years to ensure continuous exposure and reinforcement, with particular attention to the fourth year when risk awareness appears to decline.

Evidence-based content emphasizing safety and efficacy

Curriculum content must balance traditional knowledge with rigorous scientific appraisal of efficacy, safety, and quality (Abd Wahab et al., 2016; Hasen & Hashim, 2021). Key topics should include:

- **Herb-drug interactions**: Mechanisms, clinical significance, and patient counseling strategies
- **Adverse effects**: Recognition, reporting, and management
- **Product quality issues**: Standardization, contamination, adulteration, and regulatory frameworks
- **Evidence appraisal**: Critical evaluation of phytotherapy research and clinical guidelines
- **Legal and ethical considerations**: Scope of practice, professional liability, and informed consent

Active and experiential learning methods

Passive lecture-based instruction has proven insufficient for developing practical competence in herbal medicine counseling (AbouZid, 2015). Effective educational strategies include:

- **Problem-based learning**: Case studies involving patients using herbal products alongside conventional medications
- **Community-based assignments**: Interviews with traditional healers, herbalists, or patients to understand real-world usage patterns
- **Simulation exercises**: Role-playing patient counseling scenarios involving herbal product inquiries
- **Clinical integration**: Supervised documentation of herbal product use during pharmacy practice experiences

Egyptian pharmacy students who participated in active learning assignments involving community interviews reported significant improvements in knowledge and communication skills (AbouZid, 2015), demonstrating the value of experiential approaches.

Practical counseling skills development

Students must be trained in specific competencies essential for safe herbal product counseling (Braun & Cohen, 2014):

- Systematic documentation of herbal product use in patient medication histories
- Effective communication strategies for discussing herb-drug interactions without dismissing patients' cultural beliefs
- Point-of-care information retrieval skills using reliable databases (e.g., Natural Medicines Database, Cochrane Reviews)
- Collaborative practice with physicians and other healthcare providers regarding patients using herbal therapies

Addressing gender-specific educational needs

While the mechanisms underlying gender differences in herbal medicine attitudes remain unclear, educators should be aware that male and female students may approach phytotherapy topics with different perspectives and learning needs. Curriculum design should incorporate diverse teaching methods and case examples that resonate with students of all genders, while avoiding stereotypical assumptions about gendered health behaviors.

Continuous assessment and feedback

The fourth-year decline in risk awareness observed in the present study highlights the importance of continuous assessment throughout the curriculum. Regular formative assessments, reflective exercises, and feedback mechanisms can help identify and address knowledge gaps before students enter clinical practice.

Limitations and future research directions

Several limitations of the present study warrant acknowledgment. First, the reliance on self-reported data introduces potential response bias, although the anonymity of the online survey format likely mitigated this concern. Second, the cross-sectional design precludes causal inference regarding the relationship between prior education and attitudes; longitudinal studies tracking students' knowledge development throughout their pharmacy education would provide more robust evidence. Third, the study was conducted at a single institution in Türkiye, limiting generalizability to other cultural and educational contexts. Multi-institutional and international comparative studies would enhance understanding of how cultural factors shape pharmacy students' attitudes toward phytotherapy.

Future research should employ mixed-methods approaches combining quantitative surveys with qualitative interviews to elucidate the mechanisms underlying gender differences and the fourth-year knowledge gap. Additionally, intervention studies evaluating the effectiveness of specific educational strategies (e.g., active learning modules, clinical integration programs) on students' knowledge, attitudes, and counseling behaviors would provide actionable evidence for curriculum development. Finally, longitudinal follow-up of graduates into professional practice would clarify whether educational interventions translate into improved patient counseling and safety outcomes in real-world pharmacy settings.

CONCLUSION

This study reveals that Turkish pharmacy students demonstrate substantial interest in phytotherapy education despite limited prior training, with significant gender differences and a concerning decline in risk awareness during the fourth year of study. Prior education positively influences students' recognition of herbal product safety concerns, supporting the value of formal curricular integration. The findings align with international evidence documenting widespread educational gaps in pharmacy programs globally and underscore the urgent need for comprehensive, evidence-based phytotherapy modules that emphasize safety, herb-drug interactions, and practical counseling skills. By addressing these educational deficiencies, pharmacy schools can better prepare future pharmacists to serve as competent, trusted advisors on the safe and rational use of phytotherapeutic products, ultimately enhancing patient safety and healthcare quality.

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AUTHOR CONTRIBUTION STATEMENT

S.R.O.D: Conceptualization, survey design, methodology, visualization, interpretation, writing. C.C.S: Data analysis. Ş.Y: Survey distribution. İ.İ.T.C: Supervision. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

Abd Wahab, M. S., Sakthong, P., & Winit-Watjana, W. (2016). Pharmacy students' attitudes and perceptions about complementary and alternative medicine: a systematic review. *The Thai Journal of Pharmaceutical Sciences, 40*(2), 102-114. https://doi.org/10.56808/3027-7922.1932

AbouZid, S. (2015). An active learning assignment to improve pharmacy students' knowledge of herbal medicine. *Journal of Applied Pharmaceutical Science, 5*(3), 106-108. https://doi.org/10.7324/JAPS.2015.50318

Abudalo, R., Abudalo, R., Alqudah, A., Abuqamar, A., Abdelaziz, A., Alshawabkeh, M., & Taha, L. (2022). Pharmacy practitioners' practice, awareness, and knowledge about herbal products and their potential interactions with cardiovascular drugs. *F1000Research, 11*, 912. https://doi.org/10.12688/f1000research.121709.2

Ahmad, A., Khan, M. U., Kumar, B. D., Kumar, G. S., Rodriguez, S. P., & Patel, I. (2015). Beliefs, attitudes, and self-use of Ayurveda, yoga, and naturopathy, Unani, Siddha, and homeopathy medicines among senior pharmacy students: An exploratory insight from Andhra Pradesh, India. *Pharmacognosy Research, 7*(4), 302. https://doi.org/10.4103/0974-8490.158438

Barnes, J., Anderson, L. A., & Phillipson, J. D. (2007). *Herbal medicines*. Pharmaceutical Press.

Braun, L., & Cohen, M. (2014). *Herbs and natural supplements: An evidence-based guide* (Vol. 2): Elsevier Health Sciences.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*: Sage Publications.

DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications*: Sage Publications.

Ekor, M. (2014). The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Frontiers in Pharmacology, 4*, 177. https://doi.org/10.3389/fphar.2013.00177

Hasen, G., & Hashim, R. (2021). Current awareness of health professionals on the safety of herbal medicine and associated factors in the south west of Ethiopia. *Journal of Multidisciplinary Healthcare*, *14*, 2001-2008. https://doi.org/10.2147/JMDH.S321765

Heinrich, M., Appendino, G., Efferth, T., Fürst, R., Izzo, A. A., Kayser, O., . . . Viljoen, A. (2020). Best practice in research–overcoming common challenges in phytopharmacological research. *Journal of Ethnopharmacology, 246*, 112230. https://doi.org/10.1016/j.jep.2019.112230

Heinrich, M., Barnes, J., Prieto-Garcia, J., Gibbons, S., & Williamson, E. M. (2017). *Fundamentals of Pharmacognosy and Phytotherapy E-Book: Fundamentals of Pharmacognosy and Phytotherapy E-Book*: Elsevier Health Sciences.

Hijazi, M. A., Shatila, H., El-Lakany, A., Ela, M. A., Kharroubi, S., Alameddine, M., & Naja, F. (2019). Beliefs, practices, and knowledge of community pharmacists regarding complementary and alternative medicine: national cross-sectional study in Lebanon. *BMJ Open, 9*(3), e025074. https://doi.org/10.1136/bmjopen-2018-025074

Hilal, M., & Hilal, S. (2017). Knowledge, attitude, and utilization of herbal medicines by physicians in the Kingdom of Bahrain: a cross-sectional study. *Journal of the Association of Arab Universities for Basic and Applied Sciences, 24*, 325-333. https://doi.org/10.1016/j.jaubas.2016.11.001

Ibrahima, A., & Lawal, B. (2022). Assessment of awareness, use, attitude, and the perceived need for Complementary and Alternative Medicine (CAM) education, among undergraduate pharmacy students. *Nigerian Journal of Pharmaceutical Research, 18*(2), 143-155. https://dx.doi.org/10.4314/njpr.v18i2.6

Izzo, A. A., Hoon-Kim, S., Radhakrishnan, R., & Williamson, E. M. (2016). A critical approach to evaluating clinical efficacy, adverse events, and drug interactions of herbal remedies. *Phytotherapy Research, 30*(5), 691-700. https://doi.org/10.1002/ptr.5591

Jafari, A., Zanganeh, M., Kazemi, Z., Lael-Monfared, E., & Tehrani, H. (2021). Iranian healthcare professionals' knowledge, attitudes, and use of complementary and alternative medicine: a cross sectional study. *BMC Complementary Medicine and Therapies, 21*(1), 244. https://doi.org/10.1186/s12906-021-03421-z

James, P. B., & Bah, A. J. (2014). Awareness, use, attitude, and perceived need for Complementary and Alternative Medicine (CAM) education among undergraduate pharmacy students in Sierra Leone: a descriptive cross-sectional survey. *BMC Complementary and Alternative Medicine, 14*(1), 438. https://doi.org/10.1186/1472-6882-14-438

Jamshed, S. Q., Khan, M. U., Ahmad, A., & Elkalmi, R. M. (2016). Knowledge, perceptions, and attitudes toward complementary and alternative medicines among pharmacy students of a Malaysian Public University. *Journal of Pharmacy and Bioallied Sciences, 8*(1), 34-38. https://doi.org/10.4103/0975-7406.171686

Mahmoud, E. I., Yousif, M. A., & Arbab, A. H. (2024). Attitude and practice of pharmacy students toward traditional herbal medicines, Sudan. *Integrated Pharmacy Research and Practice*, *13*, 61-68. https://doi.org/10.2147/IPRP.S465056

Moreira, D. d. L., Teixeira, S. S., Monteiro, M. H. D., De-Oliveira, A. C. A., & Paumgartten, F. J. (2014). Traditional use and safety of herbal medicines. *Revista Brasileira de Farmacognosia, 24*(2), 248-257. https://doi.org/10.1016/j.bjp.2014.03.006

Naja, F., Abbas, N., Khaleel, S., Zeb, F., Osaili, T. A., Obaid, R. S., . . . Hassan, H. (2024). Beyond pillbox: a national cross-sectional study on the attitudes, practices, and knowledge of community pharmacists regarding complementary and alternative medicine. *BMC Complementary Medicine and Therapies, 24*(1), 107. https://doi.org/10.1186/s12906-024-04391-8

Ogaji, I., Lubayo, J., & Aliyu, F. O. (2021). Willingness of bachelor of pharmacy (B. Pharm.) students to be custodians of Complementary and Alternative Medicine (CAM): case study of Kenyatta University, Nairobi. *Journal of Pharmacy & Bioresources, 18*(1), 53-63. https://doi.org/10.4314/jpb.v18i1.8

Posadzki, P., Watson, L., & Ernst, E. (2013). Herb–drug interactions: an overview of systematic reviews. *British Journal of Clinical Pharmacology, 75*(3), 603-618. https://doi.org/10.1111/j.1365-2125.2012.04350.x

Tahir, A. H., Tanveer, M., Shahnaz, G., Saqlain, M., Ayub, S., & Ahmed, A. (2023). Knowledge, attitude, and perceptions of healthcare professionals towards complementary and alternative medicine: a cross-sectional survey from twin cities of Pakistan. *BMC Complementary Medicine and Therapies, 23*(1), 432. https://doi.org/10.1186/s12906-023-04187-2

Thin, S. M., Thet, D., Li, J. Y., Nakpun, T., Nitadpakorn, S., Phanudulkitti, C., . . . Kittisopee, T. (2022). A systematic review of community pharmacist practices in complementary medicine. *Pharmacy Practice, 20*(3), 2697. https://doi.org/10.18549/PharmPract.2022.3.2697

Tilburt, J. C., & Kaptchuk, T. J. (2008). Herbal medicine research and global health: an ethical analysis. *Bulletin of the World Health Organization, 86*, 594-599. https://doi.org/10.2471/BLT.07.042820

WHO. (2019). *WHO global report on traditional and complementary medicine 2019*. World Health Organization.

Wright, K. B. (2005). Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer-Mediated Communication, 10*(3), JCMC1034. https://doi.org/10.1111/j.1083-6101.2005.tb00259.x

Yıldız, K. (2021). *Bitkisel ürünlerin güvenli kullanımına yönelik tutum ölçeği geliştirilmesi* (Doctoral dissertation, Selçuk University, Konya, Türkiye). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/