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KNOWLEDGE, ATTITUDES, AND COUNSELING PRACTICES REGARDING *ECHINACEA PURPUREA* AMONG PHARMACISTS IN TAFILAH, JORDAN: THE ROLE OF CONTINUING PROFESSIONAL DEVELOPMENT

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ABSTRACT

Background: The increasing use of herbal medicines has strengthened the role of pharmacists in providing evidence-based counseling regarding their appropriate and safe use. *Echinacea purpurea* is widely used as a natural product, particularly for respiratory conditions, yet its use raises important considerations concerning evidence of efficacy, safety, contraindications, and potential herb-drug interactions. This study assessed the knowledge, attitudes, and practices (KAP) of pharmacists regarding *Echinacea purpurea* in Tafilah Governorate, Jordan, and examined the relationship between continuing professional development (CPD) and pharmacists' knowledge and professional practice.

Methods: A cross-sectional descriptive study was conducted among licensed pharmacists practicing in Tafilah Governorate, Jordan. Data were collected electronically using a structured and validated self-administered questionnaire assessing demographic and professional characteristics, knowledge, attitudes, counseling and dispensing practices, barriers, and CPD-related educational needs. A total of 134 pharmacists participated. Descriptive statistics, independent-samples t-test, one-way analysis of variance, chi-square test, Spearman's rank correlation, one-sample t-test, and multiple linear regression were used for data analysis.

Results: Pharmacists demonstrated moderate knowledge of *E. purpurea* ($9.2 \pm 2.1/16$), with greater awareness of common uses than of safety-related issues. Knowledge was highest regarding use for the common cold 104 pharmacists (77.6%) and lower regarding autoimmune disease contraindications 74 pharmacists (55.2%) and adverse effects such as skin rash 80 pharmacists (59.7%). Attitudes were generally favorable ($42.5 \pm 5.4/60$), whereas practice scores were moderate ($18.3 \pm 3.2/25$). Only 51 pharmacists (38.1%) routinely asked about patients' medical history, while 58 pharmacists (43.3%) relied on the internet, leaflets, or other informal sources for information. CPD was positively correlated with knowledge ($r = 0.43$) and practice ($r = 0.46$), and knowledge, attitudes, and CPD significantly predicted practice behavior ($R^2 = 0.48$, adjusted $R^2 = 0.45$, $p < 0.001$).

Conclusion: Pharmacists demonstrated favorable attitudes toward their professional role but important gaps in safety-related knowledge and evidence-based counseling practice. Targeted CPD programs focusing on herb-drug interactions, special populations, safety, and evidence-based information resources may strengthen pharmacist competence and support safer use of *E. purpurea* in Jordan.

Keywords: Continuing professional development, *Echinacea purpurea*, Herbal medicine, Knowledge attitudes and practices (KAP), Patient counseling.

1 INTRODUCTION

The use of herbal medicines and natural products has increased globally, partly because consumers frequently perceive natural products as safer, more accessible, and more culturally acceptable alternatives or complements to conventional medicines. This trend has been associated with increasing self-medication and preventive healthcare practices, particularly in settings where herbal products are readily available through community pharmacies and other retail channels [1-3]. The World Health Organization has emphasized the importance of appropriate regulation, safety monitoring, pharmacovigilance, and evidence-based approaches to traditional and complementary medicine [1, 4].

Jordan is not exempt from this growing interest in herbal medicine. Herbal remedies are used by a substantial proportion of the population, and the availability of natural products has increased alongside consumer interest in self-care and complementary medicine [2, 5]. Cultural influences and the integration of complementary and alternative medicine into health-seeking behaviors have also contributed to the use of herbal products in Jordan and the broader Middle East [3, 6]. At the same time, patients may perceive herbal medicines as inherently safe and may use them without adequate professional supervision [7, 8]. This perception increases the importance of professional counseling concerning appropriate use, dosage, contraindications, adverse effects, and potential herb-drug interactions.

Echinacea purpurea (purple coneflower) is among the most widely used herbal medicinal products and is commonly associated with the prevention and treatment of upper respiratory tract infections, particularly the common cold [9, 10]. The plant contains several bioactive constituents, including alkamides, caffeic acid derivatives, polysaccharides, and glycoproteins, which have been associated with immunomodulatory, anti-inflammatory, and antioxidant activities [11]. Experimental evidence has suggested effects involving macrophage activity, cytokine release, and immune-cell responses, providing a pharmacological rationale for its proposed use in respiratory infections [3, 12].

Nevertheless, the clinical evidence concerning the efficacy of *E. purpurea* remains inconsistent. Differences in plant species, extract composition, dosage, preparation, administration period, and study design have contributed to variability in clinical outcomes [10, 13]. Although *E. purpurea* is generally considered well tolerated in healthy adults when used for short periods, adverse effects and allergic reactions may occur, particularly among individuals sensitive to plants of the Asteraceae family [14]. The immunomodulatory properties of the herb also warrant caution in individuals with autoimmune diseases, immunodeficiencies, or those receiving immunosuppressive therapy [6, 15].

Potential herb-drug interactions, including possible effects on cytochrome P450-mediated metabolism, may also be clinically relevant for patients receiving certain conventional medicines [3, 16]. The pharmacist therefore has an important role in bridging the gap between the availability of herbal products and their safe and rational use.

Pharmacists are frequently accessible to patients seeking advice regarding non-prescription medicines and natural products and may be required to assess evidence, identify contraindications, recognize potential interactions, and provide patient-centered counseling [3, 13]. However, research conducted in Jordan and other settings has demonstrated variability in pharmacists' knowledge, confidence, preparedness, and professional practice in different areas of patient care [13, 15, 17].

The Knowledge-Attitudes-Practices (KAP) framework provides a useful approach for examining the relationship between pharmacists' factual knowledge, professional attitudes, and actual counseling behaviors. Previous research has suggested that knowledge alone may not be sufficient to produce effective practice unless it is accompanied by favorable professional attitudes, appropriate training, and access to reliable evidence-based information [18-20]. Continuing professional development may therefore represent an important mechanism for maintaining and strengthening pharmacists' competence, particularly in rapidly evolving areas such as herbal and complementary medicine [21, 22].

Despite the increasing availability and use of herbal products in Jordan, empirical evidence specifically evaluating pharmacists' knowledge, attitudes, and counseling practices regarding *E. purpurea* remains limited. Existing studies have largely focused on broader aspects of herbal medicine use or on pharmacy practice in other clinical areas, while smaller governorates remain comparatively under-researched [10, 23-30].

This is particularly relevant in Tafilah Governorate, where local evidence regarding pharmacists' competence in herbal medicine counseling is scarce. Therefore, this study aimed to assess the knowledge, attitudes, and counseling and dispensing practices of pharmacists regarding *E. purpurea* in Tafilah Governorate, Jordan. A secondary objective was to examine the association between pharmacists' engagement in CPD and their knowledge and professional practice concerning *E. purpurea*.

2 MATERIALS AND METHODS

2.1 Study Design and Setting

A cross-sectional descriptive study was conducted among licensed pharmacists practicing in Tafilah Governorate, Jordan. The cross-sectional design was selected to assess knowledge, attitudes, practices, and professional characteristics at a specific point in time and to identify potential relationships that could inform future longitudinal or interventional research [2, 3, 6]. Tafilah Governorate was selected because of the limited available evidence concerning pharmacists' practices related to herbal and complementary medicines in this setting. Previous studies have predominantly focused on larger urban centers, highlighting the need for region-specific evidence [2, 5, 23].

2.2 Study Population and Sampling

The study population comprised licensed pharmacists registered with the Jordan Pharmacists Association (JPA) and practicing in Tafilah Governorate. According to official JPA records, a total of 27 pharmacies in Tafilah Governorate were found (<https://www.jpa.org.jo/fy-stwr>), the target population consisted of 190 pharmacists. The required sample size was initially calculated using a finite population formula based on a 95% confidence level, an assumed prevalence of 50%, and a 5% margin of error. The calculated target sample was approximately 140 pharmacists. A total of 140 responses were initially received. After excluding six respondents who either declined consent or did not practice in Tafilah Governorate, 134 valid responses were included in the final analysis. A convenience sampling approach was used, with the questionnaire distributed through professional networks and local pharmacy communication groups.

2.3 Questionnaire Development and Validation

Data were collected using a structured, self-administered electronic questionnaire see Appendix (1) developed using Google Forms. The questionnaire was informed by previous research examining pharmacists' knowledge, attitudes, and practices regarding herbal and complementary medicines, with particular emphasis on *E. purpurea* and herbal supplements in Jordan [2, 3, 6]. Items were also informed by research addressing pharmacists' counseling practices and professional preparedness in relation to non-prescribed medicines in Jordan [10]. The questionnaire included demographic and professional characteristics, knowledge of *E. purpurea*, attitudes toward herbal medicine and professional responsibility, counseling and dispensing practices, CPD exposure, barriers to reliable information, and educational needs. Content validity was assessed through expert review by academic pharmacists and professionals with relevant expertise in herbal medicine and survey research. The questionnaire was revised based on expert feedback to improve clarity, relevance, and appropriateness. A pilot study was conducted among eligible pharmacists who were not included in the final analysis. Reliability was assessed using Cronbach's alpha.

2.4 Measurement of Study Variables

Knowledge was assessed using 16 items addressing indications, therapeutic applications, dosage, safety, contraindications, herb-drug interactions, and applied scenarios. Correct answers were assigned one point, while incorrect and "do not know" responses received zero points. Total knowledge scores ranged from 0 to 16. Scores below 50% were classified as poor, 50-75% as moderate, and above 75% as good, consistent with approaches used in previous studies of pharmacists' knowledge concerning herbal medicines [3, 6]. Attitudes were assessed using 12 five-point Likert-scale items ranging from strongly disagree (1) to strongly agree (5). Negatively worded items were reverse-coded, and higher total scores indicated more positive attitudes. Attitude scores were classified as negative, neutral, or positive according to predefined percentage cutoffs. The scoring approach was consistent with methods used in previous studies assessing pharmacists' attitudes and professional preparedness [13, 15]. Practice was assessed using six items addressing counseling frequency, interaction checking, dispensing behaviors, and applied knowledge. Responses were scored numerically, with higher scores indicating better counseling and dispensing practices. Practice scores were categorized as poor, moderate, or good using predefined percentage thresholds [3, 6]. Educational needs and CPD preferences were assessed descriptively using dichotomous response items.

2.5 Data Collection and Ethical Considerations

Data collection was conducted from 14 January 2026 to 19 April 2026. Eligible pharmacists were approached in person or electronically and were provided with information regarding the study objectives, procedures, and voluntary nature of participation. Electronic informed consent was obtained before questionnaire completion. The questionnaire link

was distributed through WhatsApp and professional communication groups. No identifying information was collected. Data were coded and stored securely on password-protected devices accessible only to the research team. Ethical approval was obtained from the Deanship of Scientific Research and Postgraduate Studies at Jerash University (Approval No. 2026/2025/3/4; approval date: 3 January 2026). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

2.6 Statistical Analysis

Data were analyzed using SPSS version 25 or later. Descriptive statistics were used to summarize demographic and professional characteristics and KAP scores. Continuous variables were presented as means and standard deviations, while categorical variables were summarized as frequencies and percentages. An independent-samples t-test was used to compare knowledge scores according to gender. One-way ANOVA was used to compare knowledge scores across educational qualification groups. Chi-square analysis was used to examine the association between practice setting and counseling frequency. Spearman's rank correlation coefficient was used to examine associations among knowledge, attitudes, practice, and CPD. A one-sample t-test was used to compare the mean knowledge score against the predefined 70% reference threshold. Multiple linear regression was used to examine whether knowledge, attitudes, and CPD predicted practice behavior. Statistical significance was set at $p < 0.05$.

3 RESULTS

3.1 Sociodemographic and Professional Characteristics

A total of 134 pharmacists were included in the analysis, as illustrated in Table 1. The sample was predominantly female (65.7%, $n = 88$), while male pharmacists accounted for 34.3% ($n = 46$). The mean age was 29.4 ± 7.2 years. The largest age group was 26-35 years (48.5%), followed by pharmacists younger than 25 years (32.8%). Regarding professional experience, 41.8% had 1-5 years of experience and 19.4% had less than one year.

Table 1: Sociodemographic and Professional Characteristics of Respondents (N=134)

Variable / Classification	Frequency (n)	Percentage (%)
Gender		
Female	88	0.657
Male	46	0.343
Age Groups		
< 25 years	44	0.328
26-35 years	65	0.485
> 35 years (Calculated residual)	25	0.187
Professional Experience		
< 1 year	26	0.194
1-5 years	56	0.418
> 5 years (Calculated residual)	52	0.388
Educational Qualification		
Bachelor of Pharmacy / PharmD	105	0.784
Master's Degree	22	0.164
PhD	7	0.052
Practice Setting		
Community Pharmacy	75	0.56
Hospital Pharmacy	43	0.321
Clinics / Academic settings	16	0.119

The mean professional experience was 6.8 ± 5.9 years. Most participants held a Bachelor of Pharmacy or PharmD degree (78.4%), while 16.4% held a master's degree and 5.2% held a PhD. Community pharmacies represented the most common practice setting (56.0%), followed by hospital pharmacies (32.1%) and clinics or academic settings (11.9%).

3.2 Knowledge of *Echinacea purpurea*

The mean knowledge score was 9.2 ± 2.1 out of 16, indicating a moderate overall level of knowledge according to the predefined scoring system. Knowledge was generally higher for common therapeutic uses than for safety-related considerations, as shown in Figure 1. A total of 104 pharmacists (77.6%) correctly identified the common cold as a use of *E. purpurea*. In comparison, 91 participants (67.9%) responded correctly to the item concerning influenza. Only 80 pharmacists (59.7%) correctly identified skin rash as a potential adverse effect, while 74 (55.2%) correctly recognized autoimmune disease as a condition in which *E. purpurea* may be unsuitable. A further 80 participants (59.7%) correctly recognized that the herb is available in multiple dosage forms. The one-sample t-test showed that the mean knowledge score differed significantly from the predefined 70% reference threshold ($t = -3.42$, mean difference = -1.26 , $p = 0.001$), indicating that the observed knowledge level was significantly below the expected benchmark.

3.3 Attitudes Toward *Echinacea purpurea* and CPD

The mean attitude score was 42.5 ± 5.4 out of 60, indicating generally favorable attitudes toward herbal medicine counseling, professional responsibility, and CPD. Participants generally recognized the professional responsibility of pharmacists to counsel patients about herbal products. The median rating for the usefulness of previous CPD sessions was 4, corresponding to a perception that such activities were useful. However, participants demonstrated limited confidence in their formal preparation. The median response to the statement that pharmacists in Tafilah were adequately trained to answer herbal medicine-related questions was 2. Participants also identified limited access to reliable information as an important barrier. Overall, these findings suggest a discrepancy between positive professional attitudes and pharmacists' confidence in their training and access to evidence-based resources.

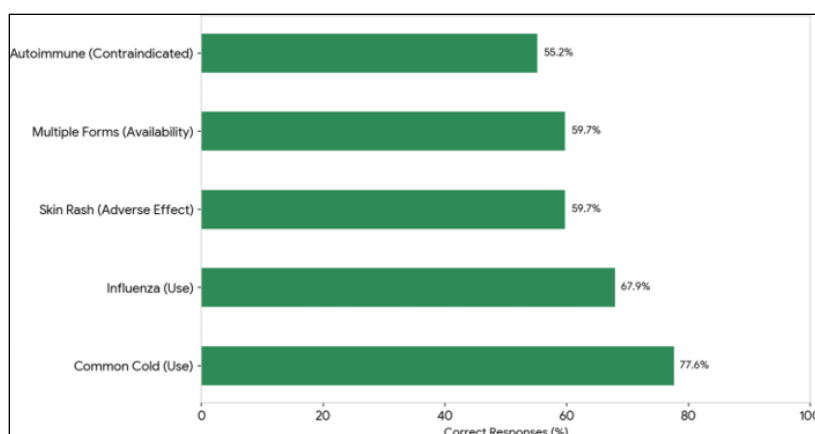


Figure 1: Correct Knowledge Items Breakdown

3.4 Counseling and Professional Practice

The mean practice score was 18.3 ± 3.2 , indicating a moderate level of counseling and dispensing practice. Regarding information sources, 43.3% of participants reported relying on internet resources, leaflets, or other informal sources. Scientific journals were reported by 31.3%, while 25.4% relied primarily on knowledge obtained through university education. A total of 84 pharmacists (62.7%) reported that they always or often counseled patients about potential drug-herb interactions. In addition, 97 participants (72.4%) reported that they would refuse to dispense *E. purpurea* in unsafe circumstances. However, only 51 pharmacists (38.1%) reported routinely asking about patients' medical history before dispensing or recommending herbal products. This finding indicates an important gap in systematic patient assessment as shown in Figure 2.

3.5 Educational Needs and CPD Preferences

The findings demonstrated a strong interest in additional CPD and professional education. Drug-herb interactions were identified as an educational priority by 82.1% of participants, while 80.6% expressed interest in education concerning special populations. Face-to-face workshops were preferred by 82.1% of participants, and 77.6% expressed interest in mobile applications for interaction checking. Overall, 82.8% indicated an interest in additional CPD. These findings indicate substantial demand for practical, clinically oriented education addressing the safety and appropriate use of herbal medicines as shown in Figure 2.

3.6 Reliability Analysis

The questionnaire demonstrated acceptable internal consistency, as shown in Figure 3. Cronbach's alpha was 0.82 for the knowledge scale, 0.78 for the attitude scale, 0.75 for the barriers scale, and 0.71 for the practice scale. The overall questionnaire demonstrated a Cronbach's alpha of 0.86.

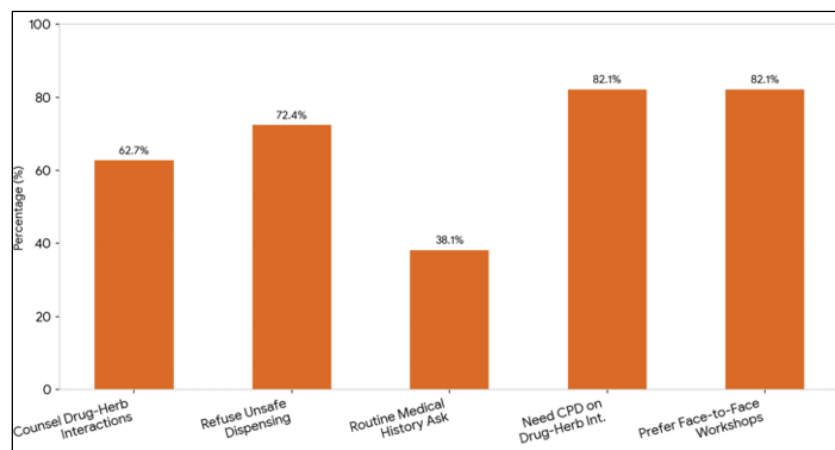


Figure 2: Key practices and Educational Needs

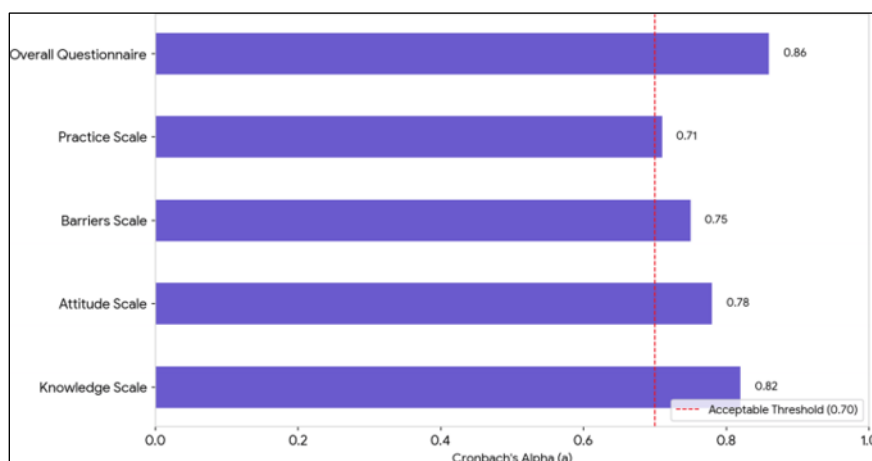


Figure 3: Reliability Analysis

3.7 Inferential Analysis

No statistically significant difference in knowledge scores was observed according to gender. Male pharmacists had a mean knowledge score of 10.48 ± 2.31 compared with 10.92 ± 2.14 among female pharmacists ($t = 1.84$, $p = 0.068$). Knowledge scores also did not differ significantly according to educational qualification ($F = 2.215$, $p = 0.113$). The association between practice setting and counseling frequency was not statistically significant ($\chi^2 = 2.87$, $p = 0.238$).

3.8 Correlation Analysis

Table 2: Spearman's Rank Correlation Matrix for Principal Study Domains

Domain	Knowledge	Attitudes	Practice	CPD Exposure
Knowledge	1.00	0.32*	0.41*	0.43*
Attitudes	0.32*	1.00	0.47*	0.38*
Practice	0.41*	0.47*	1.00	0.46*
CPD Exposure	0.43*	0.38*	0.46*	1.00

* Correlation is significant at the $p < 0.05$ level (2-tailed).

Spearman's correlation analysis demonstrated significant positive relationships among the principal study domains see Table 2. Knowledge was positively correlated with attitudes ($r = 0.32$, $p < 0.05$) and practice ($r = 0.41$, $p < 0.05$). Attitudes were positively correlated with practice ($r = 0.47$, $p < 0.05$). CPD was positively correlated with knowledge ($r = 0.43$, $p < 0.05$), attitudes ($r = 0.38$, $p < 0.05$), and practice ($r = 0.46$, $p < 0.05$). These findings indicate that greater CPD engagement was associated with higher knowledge and better reported professional practice.

3.9 Multiple Linear Regression

Multiple linear regression was conducted to identify predictors of pharmacists' practice behavior; it is illustrated in Table 3. The overall regression model was statistically significant and explained 48% of the variance in practice scores ($R^2 = 0.48$; adjusted $R^2 = 0.45$; $F(3,130) = 12.67$; $p < 0.001$). Knowledge was a significant positive predictor of practice ($B = 0.45$, $SE = 0.10$, $\beta = 0.36$, $t = 4.50$, $p = 0.001$). Attitudes were also positively associated with practice ($B = 0.32$, $SE = 0.08$, $\beta = 0.29$, $t = 3.75$, $p = 0.001$). CPD was a significant positive predictor of practice behavior ($B = 0.51$, $SE = 0.12$, $\beta = 0.33$, $t = 4.25$, $p = 0.001$). Collectively, these findings suggest that knowledge, professional attitudes, and continuing education are important factors associated with pharmacists' reported counseling and dispensing practices.

Table 3: Multiple Linear Regression Analysis Predicting Pharmacists' Practice Behavior

Predictor Variable	Unstandardized B	SE	Standardized β	t-value	p-value
Constant	Unspecified	-	-	-	-
Knowledge Score	0.45	0.1	0.36	4.5	0.001
Professional Attitudes	0.32	0.08	0.29	3.75	0.001
CPD Engagement	0.51	0.12	0.33	4.25	0.001

Note: Model Statistics: $R^2 = 0.48$; Adjusted $R^2 = 0.45$; $F(3,130) = 12.67$; $p < 0.001$.

4 DISCUSSION

The present study assessed pharmacists' knowledge, attitudes, and practices regarding *E. purpurea* in Tafilah Governorate, Jordan, while examining the relationship between CPD and professional competence. The findings demonstrate a consistent pattern of moderate knowledge and practice, generally favorable attitudes, and significant positive relationships among knowledge, attitudes, CPD, and professional practice.

The mean knowledge score was 9.2 ± 2.1 out of 16, indicating moderate knowledge. Pharmacists demonstrated greater familiarity with general therapeutic uses than with safety-related issues and contraindications. The strongest knowledge item concerned the use of *E. purpurea* for the common cold, whereas lower levels of knowledge were observed for autoimmune disease-related contraindications and adverse effects. This pattern is consistent with previous literature suggesting that pharmacists may be more familiar with indications and general uses of herbal products than with safety issues and herb-drug interactions [3].

The finding that knowledge was significantly below the predefined 70% benchmark ($t = -3.42$, $p = 0.001$) is clinically relevant. The ability to identify a common indication does not necessarily ensure safe counseling. Pharmacists must also be able to identify patients at increased risk, assess concurrent medication use, and communicate potential adverse effects and uncertainties in the evidence. Previous research has similarly emphasized the need to strengthen pharmacists' knowledge concerning herbal medicine safety and interactions [3].

The knowledge gaps identified in the present study are particularly important because *E. purpurea* has a complex pharmacological and clinical profile. Its bioactive constituents have been associated with immunomodulatory activity, while its clinical effectiveness may vary according to product composition and preparation [11,12]. In addition, potential safety concerns involving allergic reactions, immune-mediated conditions, and possible interactions with conventional medicines require pharmacists to obtain relevant patient information before recommending or dispensing the product [16].

The attitudes of pharmacists were generally favorable, with a mean score of 42.5 ± 5.4 . Participants appeared to recognize the professional importance of herbal medicine counseling and CPD. Nevertheless, they reported limited confidence in the adequacy of their training and highlighted difficulties accessing reliable information. This pattern suggests a potential gap between professional attitudes and perceived competence. Similar discrepancies have been described in pharmacy practice research in Jordan. Studies addressing pharmacists' readiness for vaccination services and breastfeeding support have demonstrated generally positive professional attitudes alongside gaps in education, training, and preparedness [13,15]. Likewise, studies addressing natural-product counseling have emphasized the

importance of improving pharmacists' access to reliable evidence and strengthening their preparedness to provide patient-centered counseling [10,17].

The practice findings further support the presence of a knowledge-to-practice gap. Although 62.7% of participants reported always or often counseling patients regarding drug-herb interactions and 72.4% reported refusing dispensing in unsafe situations, only 38.1% routinely asked about patients' medical history. This is important because appropriate herbal medicine counseling requires patient assessment rather than simply providing product information.

The reliance on internet sources, leaflets, and other informal information sources by 43.3% of participants also raises concerns regarding the consistency and quality of information available to pharmacists. The importance of reliable information resources has been emphasized in previous studies, which have identified access to evidence-based information as an important component of safe herbal medicine counseling [13,15]. The World Health Organization similarly emphasizes the importance of evidence-based approaches, safety monitoring, and appropriate regulation in traditional and complementary medicine [1,4].

The positive correlations observed among knowledge, attitudes, and practice support the conceptual basis of the KAP framework. Knowledge was positively associated with practice, while attitudes demonstrated an even stronger relationship with practice. These findings suggest that factual knowledge may be necessary but insufficient to ensure appropriate professional behavior. Positive professional attitudes and confidence may also contribute to the translation of knowledge into actual counseling behavior [18,19].

One of the most important findings of the present study was the positive association between CPD and both knowledge and practice. CPD was positively correlated with knowledge ($r = 0.43$) and practice ($r = 0.46$). In addition, multiple regression demonstrated that knowledge, attitudes, and CPD were significant predictors of practice, with the model explaining 48% of the variance in practice behavior. These findings are consistent with the broader literature emphasizing CPD as an important mechanism for maintaining professional competence and supporting improvements in healthcare practice [21,22].

The significant association between CPD and professional practice is particularly relevant because CPD represents a potentially modifiable factor that can be addressed through structured educational interventions. However, because the current study was cross-sectional, the observed relationships should not be interpreted as evidence that CPD directly causes improvements in knowledge or practice. It is possible that pharmacists who are more motivated toward professional development are also more likely to engage in better counseling practices. Longitudinal and interventional research is therefore needed to determine whether structured CPD programs directly improve pharmacists' competence in herbal medicine counseling.

The educational needs identified by participants provide important practical implications. Drug-herb interactions and special populations were among the most frequently identified educational priorities. These preferences correspond closely with the knowledge gaps observed in the study and suggest that future CPD programs should emphasize clinically relevant topics rather than general information about herbal products.

The strong interest in face-to-face workshops and mobile interaction-checking applications also indicates that pharmacists may benefit from blended educational approaches combining practical training with accessible digital decision-support tools. Such interventions could potentially improve the availability of reliable information and facilitate more consistent counseling at the point of care. The present study also provides geographically specific evidence from Tafilah Governorate. Previous research has often concentrated on larger urban centers, while smaller governorates have received less attention [20-23]. Local contextual factors, including access to professional development opportunities and evidence-based resources, may influence pharmacists' knowledge and practice. The present findings therefore support the need for regionally tailored educational interventions.

The findings have implications for pharmacy education and professional practice in Jordan. Undergraduate and postgraduate pharmacy programs may benefit from strengthening education concerning herbal medicine safety, herb-drug interactions, evidence appraisal, and patient counseling. At the professional level, CPD programs should focus on practical clinical decision-making, including the assessment of patient history, identification of contraindications, recognition of potential interactions, and communication of uncertainty regarding efficacy.

4.1 Limitations

This study has several limitations that should be acknowledged. First, its cross-sectional design precludes the establishment of causal relationships between CPD, knowledge, attitudes, and practice, as noted above. Second, the data were collected from a single governorate (Tafilah), which may limit the generalizability of the findings to other regions of Jordan or other countries with different healthcare infrastructures, educational resources, and cultural attitudes

toward herbal medicine. Third, the study relied on self-reported practice behaviors, which are susceptible to social desirability bias and may not accurately reflect actual clinical counseling or dispensing activities. Fourth, the assessment focused exclusively on *E. purpurea*; therefore, the findings may not be directly transferable to pharmacists' handling of other herbal or complementary medicines with distinct safety profiles and interaction risks. Finally, the study did not objectively measure pharmacists' actual CPD participation or clinical performance, instead relying on self-reported engagement and perceived competence. Future research employing interventional, longitudinal, and objective observational designs across multiple governorates is necessary to confirm and extend these findings.

5 CONCLUSIONS

Pharmacists in Tafilah Governorate demonstrated moderate knowledge and counseling practices regarding *Echinacea purpurea*, alongside generally favorable attitudes toward herbal medicine counseling and continuing professional development. However, important gaps were identified in safety-related knowledge, contraindication recognition, systematic patient assessment, and access to reliable evidence-based information. The pharmacists demonstrated greater familiarity with common therapeutic applications than with safety considerations. Although many reported counseling about drug-herb interactions and refusing dispensing in unsafe situations, fewer routinely assessed patients' medical histories before recommending or dispensing herbal products. CPD was positively associated with knowledge and professional practice, while knowledge, attitudes, and CPD were significant predictors of practice behavior. These findings support the implementation of structured, evidence-based CPD programs focused on herb-drug interactions, special populations, contraindications, adverse effects, patient assessment, and evidence-based counseling. Strengthening pharmacists' access to reliable information and providing practical, targeted continuing education may improve professional competence and contribute to safer and more rational use of *E. purpurea* and other herbal medicines in Jordan.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

Statement of ethical approval

The proposed study is ethically aligned with internationally accepted principles for human subject research. It presents minimal risk, ensures participant confidentiality, and promotes scientific and public health benefits. The research team is committed to upholding the highest standards of academic integrity and research ethics.

Statement of informed consent

Informed consent for treatment and open access publication was obtained or waived by all participants in this study. College of Pharmacy Ethical Committee issued approval 2026/2025/3/4.

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

- Concept and design: Suhaib Ibrahim Alkhamaiseh, Mohammad Tawfiq Alquabeh.
- Acquisition, analysis, or interpretation of data: Suhaib Ibrahim Alkhamaiseh, Mohammad Tawfiq Alquabeh.
- Drafting of the manuscript: Suhaib Ibrahim Alkhamaiseh, Mohammad Tawfiq Alquabeh.
- Critical review of the manuscript for important intellectual content: Suhaib Ibrahim Alkhamaiseh, Mohammad Tawfiq Alquabeh.
- Supervision: Suhaib Ibrahim Alkhamaiseh.

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