Attitudes and perceptions of pharmacy students toward pharmacognosy and related competencies of the national core education program in Türkiye

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ABSTRACT

Background and Aims: Competency-based education (CBE) and the use of natural health products have been increasingly discussed in pharmacy. The national core education program of Türkiye has 108 mandatory competencies. This study investigated pharmacy students' thoughts about pharmacognosy and their preparedness to provide related competencies.

Methods: A descriptive online survey consisting of a 35-item questionnaire was administered to pharmacy students in Türkiye between June and July 2023. A 3-point Likert scale was used to assess students' opinions. Data were analyzed using SPSS 23.0 ($P < 0.05$).

Results: A total of 404 students in the third, fourth, and fifth years from 19 different faculties participated in the study. The interest in pharmacognosy was high, and students attributed significant value and importance to the field. Most of the students believed that their pharmacognosy education (67.1%) is sufficient, particularly on herbal medicinal plants (62.4%) and traditional and complementary medicine (59.2%). However, their satisfaction rates with education on marine pharmacognosy (10.4%) and drugs sourced from animals (30.2%) and microorganisms and minerals (32.2%) were low. Students rated their preparedness toward related competencies at concerning levels. The lowest value was observed in homeopathy (21.0%). Students felt more confident in academic and industrial practices (52.4%) than in community and hospital pharmacy requirements (35.3%). The impacts of national accreditation status and the education model of the faculties were found to be limited.

Conclusion: An overall review may be needed to adapt the field to outcome-based education or CBE.

Keywords: competency, integrated curriculum, pharmacognosy outcomes, pharmacy

INTRODUCTION

Pharmacy education is fundamental in healthcare systems for supplying contemporary, qualified pharmaceutical professionals meeting several societal needs and expectations. Similar to medical and other healthcare education systems, it has been undergoing major paradigm changes to align with the priorities of the 21st century. These global changes include a shift from time-based education (TBE) to competency-based education (CBE). Briefly, traditional TBE defines the systems mostly relying on fulfilling the admission and curriculum criteria at a predetermined time interval. TBE mainly focuses on the processes, whereas the graduates (end products) are almost the only thing that matters in CBE. CBE systems aim to provide graduates equipped to deal with all demands of the stakeholders. Too much emphasis on the outcomes while ignoring the time spent on learning and becoming a professional

has been the main criticism of the CBE models (Anderson & Arakawa, 2021; Hodges, 2010; McMullen, Arakawa, Anderson, Pattison, & McGrath, 2023; Park, Hodges, & Tekian, 2016). However, a worldwide consensus has emerged regarding the planning, adaptation, and development of CBE systems in pharmacy education. One of the main topics of the Pharmacy Education Action Plan prepared by the World Health Organization, United Nations Educational, Scientific and Cultural Organization, and International Pharmaceutical Federation was developing a competency framework for pharmaceutical services (Anderson et al., 2008; Bruno, Bates, Brock, & Anderson, 2010). The "National Qualifications Framework for Higher Education" in Türkiye was announced in 2001 as a part of the Bologna Process according to the Lisbon Strategy published by the European Union. This general process was carried out by all programs of all universities in Türkiye. A more detailed, comprehensive, and field-specific study named the "National Phar-

macy Core Education Program (NPCEP)" was conducted by the Council of Deans of Faculties of Pharmacy of Türkiye in 2015. The implementation of this guide by all pharmacy faculties in the country became mandatory in the same year. Furthermore, the NPCEP has become a fundamental part of the first and yet only national accreditation program of Türkiye for pharmacy faculties (National Society of Assessment and Accreditation of Pharmacy Education [ECZAKDER]). The study was revised in 2019, and 108 competencies are available in the current version. However, this document was prepared as a guide and did not propose any obligatory curriculum or education methods. Thus, although a few faculties developed novel hybrid systems (e.g., integrated and modular) to ensure that their graduates have the essential competencies, most of them reached a compromise by mapping their course contents with the competencies and some changes in their curricula. These hybrid systems are still time/content/discipline restricted but are enriched with new CBE applications and measurement/assessment techniques.

The use of natural health products is increasing and breaking new records every year. The growing popularity of traditional/complementary/alternative/integrative medicine applications contributes greatly to this increase. The definition and terminology of natural health products and these fields of medicine are tremendously variable from country to country. Nevertheless, there is a common opinion that these products should be included in the pharmacists' scope of practice as a public health requirement (Geldenhuys, Cudnik, Krinsky, & Darvesh, 2015; Homberg et al., 2021; Lee et al., 2018). However, as the variety and use of these products increase, the expectations and needs of patients, users, and other healthcare professionals have undergone a significant evolution at the same time. Questions arise about the education of natural health products in pharmacy, which is mainly the responsibility of the field of pharmacognosy. Pharmacognosy may be the oldest modern science and the very first core of the pharmacy profession. It is generally defined as dealing with natural crude drugs (e.g., sourced from plants, animals, microorganisms, algae, and minerals) and their metabolites applicable to any pharmaceutical field (Cahlíková et al., 2020; Sarker, 2012). Pharmacognosy is a multidisciplinary field. However, since the 19th century, chemical disciplines such as isolation and analytical phytochemistry, preparative organic chemistry, and structure elucidation methods stand out in traditional approaches after biological disciplines including macroscopic and microscopic analyses, ethnobotany, biochemistry, pharmacology, and toxicology. Along with these disciplines, modern approaches impose new responsibilities on pharmacognosy education about pharmaceutical care in areas such as clinical pharmacognosy, traditional/complementary/alternative/integrative medicine, rational use of natural health products, drug interactions, and wellness because most healthcare professionals do not have adequate education or time to focus on the source of drugs they use (Cahlíková et al., 2020; Geldenhuys et al., 2015; Kinghorn,

2002; Tiralongo & Wallis, 2008; Zhang, Phipps, & McDaniel, 2017). This metamorphism can actually be described as a return to the spirit, as the original roots of the field lay on "materia medica," knowledge of drugs and pharmacology.

This descriptive questionnaire study aimed to investigate students' perceptions of pharmacognosy, its education, and their preparedness to provide related competencies of the NPCEP in Türkiye.

MATERIALS AND METHODS

Research population

This study was conducted among pharmacy students between June and July 2023. The study population included the third, fourth, and fifth year students from all faculties in Türkiye. The total number of students was determined as approximately 12,900 according to the quotas of 49 pharmacy faculties in Türkiye (YÖK, 2023). However, the minimum sample size was 374, using OpenEpi Version 3.01 under the following parameters: design effect 1 (unknown prevalence), 5% error level, 95% confidence interval, and 80% power, without sample selection (OpenEpi, 2023). Students who agreed to participate in the study were included. Questionnaires with incomplete, contradictory, and/or inappropriate answers in the data collection form were excluded.

Survey form and data collection

Data were collected using an online survey developed by the authors. The survey comprised an informed consent form and 13 questions asked in four sections. The questions in the first section were about the sociodemographic and personal aspects of the participants. In the second and third sections, students' thoughts about pharmacognosy and its education were probed. The last section was about preparedness of the participants toward pharmacognosy-related national competencies provided by the NPCEP of Türkiye in 2019. These questions were designed with respect to the required learning levels given by the same program. The final version of the questionnaire was determined after applying the survey to 10 individuals to check for possible deficiencies. A 3-point Likert scale was used to assess students' opinions. "This is a security question, if you are reading this please check 'Not sure'" was added to the Likert scale sections of the questionnaire. The data of the students who provided a different answer to this proposition were excluded from the analysis. In this way, the validity and reliability of the Likert scale questions were tested.

Data analysis

Data analysis of the survey was conducted using IBM SPSS (Statistical Package for Social Sciences Version 23.0; SPSS,

Inc., Chicago, Illinois, USA). Descriptive statistics were presented as numbers and percentages for categorical variables and means, standard deviations, and minimum, and maximum values for numerical variables. The chi-square test families (Pearson chi-square test and Fisher exact test) were used to compare categorical variables in independent groups. The level of statistical significance was set as $P < 0.05$.

Ethics approval

This study was approved by the Ethics Committee of Dicle University Faculty of Medicine (17.05.2023/160). Official invitations consisting of information about the study, ethical approval, and link to the online survey were sent to all faculties. Participants' informed consent was obtained before the survey questions.

RESULTS AND DISCUSSION

Of the 459 pharmacy students who participated in the survey, 404 were eligible for the study. Table 1 summarizes the key characteristics of the respondents. The number of female students surveyed was more than three times higher than that of males. The distribution of the students in the third and fourth years was homogeneous. However, the rate of the fifth year students was 10% less than those of the others. Of the students, 95% and 67% had grade point averages of >2.5 and >3, respectively. Different factors, particularly parents, affect and sometimes even determine students' profession choices in the first place. This may significantly influence how students define the profession and its education. However, 82.4% of the participants stated that the choice was their own. These characteristics imply a willing and academically successful population. The students were from 19 different faculties. Of these faculties, 21.5% provided a hybrid (e.g., integrated/modular) course model, and 72.8% had accreditation certificates (including full and conditional) given by the National Society of Assessment and Accreditation of Pharmacy Education (ECZAKDER).

Pharmacognosy and its education

Pharmacognosy is a highly multidisciplinary field and may be considered the very first core of the pharmacy profession. Its ancient history causes extraordinary fractionation and the emergence of new disciplines over centuries. This fractionating has reached such great proportions upon the specialization trends of modern science that it has become questionable whether there is a certain discipline left from pharmacognosy. However, crucial needs in natural health products, natural crude drugs, discovery of new molecules, and intersections of biology and chemistry with the increasing incidence of traditional/complementary/alternative/integrative medicine

Table 1. Key characteristics of the participants (n = 404)

Characteristics	n	%
Sex		
Female	309	76.5
Male	95	23.5
Age (min, 20; max, 37)	(Year, mean ± SD)	22.6 ± 1.6
Year in school		
Third	158	39.1
Fourth	156	38.6
Fifth	86	21.3
Above fifth	4	1.0
Grade point average		
0–2.00 (0–53.33)	4	1.0
2.01–2.50 (53.56–65)	16	4.0
2.51–3.00 (65.23–76.66)	113	28.0
3.01–3.50 (76.90–88.33)	209	51.7
3.51–4.00 (88.56–100)	62	15.3
Course model		
Time/discipline based	317	78.5
Hybrid (integrated/modular)	87	21.5
National accreditation status of the faculty		
Yes	294	72.8
No	110	27.2
Own choice of profession?		
Yes	333	82.4
No	71	17.6

practices make pharmacognosy-educated pharmacists essential (Cahlíková et al., 2020; Sarker, 2012; Steinhoff & Committee, 2013; Zhang et al., 2017). This claim is consistent with the current results revealing that 91.3% of the students believed that "pharmacognosy is indispensable for pharmacy education." Furthermore, 85.4% of the students believed that "pharmacognosy courses make them feel they are in the faculty of pharmacy," and 71.8% believed that they will use what they learned in pharmacognosy courses in their professional life. Opinions of the students from different years (third, fourth, and fifth) and subjected to different education models on all three propositions did not significantly differ (Table 2). However, the number of students who agreed with the first two opinions was significantly lower in accredited schools. Seventy percent of the students believed that the courses given by the Pharmacognosy Department were interesting. However, 30% of them stated that they would choose pharmacognosy elective courses as their first choice. In addition, 22.4% stated that they would choose pharmacognosy topics for graduating projects (asked to third and fourth year students). Nevertheless, 24.5% of the students planning master's or PhD degree in education (n = 151) stated that pharmacognosy would be their first choice. This rate may be high considering all fields of pharmacy. It should be noted that the percentages of students who would not choose pharmacognosy elective courses or project topics or choose these as their last choice were only 13.1% and 17.4%, respectively.

Pharmacognosy education in Türkiye is provided in two main sections: theoretical and practical courses (laboratory). Of the

Table 2. Thoughts of the surveyed pharmacy students about pharmacognosy and its education (n = 404)

Questions	Total	Year in school				Accreditation			Education model (hybrid)		
		Third	Fourth	Fifth	P^a	Yes	No	P^a	Yes	No	P^a
	n (%)	n (%)	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Pharmacognosy courses are indispensable for pharmacy education.											
Agree	369 (91.3)	144 (91.1)	144 (92.3)	81 (90.0)		262 (89.1)	107 (97.3)		78 (89.7)	291 (91.8)	
Not sure	20 (5.0)	9 (5.7)	8 (5.1)	3 (3.3)	0.522[b]	19 (6.5)	1 (0.9)	**0.026[b]**	5 (5.7)	15 (4.7)	0.717
Disagree	15 (3.7)	5 (3.2)	4 (2.6)	6 (6.7)		13 (4.4)	2 (1.8)		4 (4.6)	11 (3.5)	
Pharmacognosy courses make me feel like I am in the faculty of pharmacy.											
Agree	345 (85.4)	135 (85.4)	135 (86.5)	75 (83.3)		244 (83.0)	101 (91.8)		69 (79.3)	276 (87.1)	
Not sure	41 (10.1)	17 (10.8)	13 (8.3)	11 (12.2)	0.844[b]	36 (12.2)	5 (4.5)	**0.05[b]**	13 (14.9)	28 (8.8)	0.159
Disagree	18 (4.5)	6 (3.8)	8 (5.1)	4 (4.4)		14 (4.8)	4 (3.6)		5 (5.7)	13 (4.1)	
I will use my pharmacognosy knowledge in my professional life.											
Agree	290 (71.8)	114 (72.1)	113 (72.4)	63 (70.0)		207 (70.4)	83 (75.5)		61 (70.1)	229 (72.2)	
Not sure	91 (22.5)	35 (22.2)	34 (21.8)	22 (24.4)	0.993	72 (24.5)	19 (17.3)	0.247	20 (23.0)	71 (22.4)	0.806
Disagree	23 (5.7)	9 (5.7)	9 (5.8)	5 (5.6)		15 (5.1)	8 (7.3)		6 (6.9)	17 (5.4)	
My education on herbal medicinal plants is sufficient.											
Agree	252 (62.4)	92 (58.2)	110 (70.5)	50 (55.6)		193 (65.6)	59 (53.6)		45 (51.7)	207 (65.3)	
Not sure	119 (29.5)	51 (32.3)	37 (23.7)	31 (34.4)	0.112	81 (27.6)	38 (34.5)	**0.059**	34 (39.1)	85 (26.8)	0.059
Disagree	33 (8.2)	15 (9.5)	9 (5.8)	9 (10.0)		20 (6.8)	13 (11.8)		8 (9.2)	25 (7.9)	
My education on marine pharmacognosy is sufficient.											
Agree	42 (10.4)	21 (13.3)	16 (10.3)	5 (5.6)		33 (11.2)	9 (8.2)		8 (9.2)	34 (10.7)	
Not sure	152 (37.6)	71 (44.9)	52 (33.3)	29 (32.2)	**0.013**	105 (35.7)	47 (42.7)	0.368	30 (34.5)	122 (38.5)	0.655
Disagree	210 (52.0)	66 (41.8)	88 (56.4)	56 (62.2)		156 (53.1)	54 (49.1)		49 (56.3)	161 (50.8)	
My education on animal crude drugs is sufficient.											
Agree	122 (30.2)	54 (34.2)	46 (29.5)	22 (24.4)		90 (30.6)	32 (29.1)		24 (27.6)	98 (30.9)	
Not sure	152 (37.6)	63 (39.9)	55 (35.3)	34 (37.8)	0.237	107 (36.4)	45 (40.9)	0.698	31 (35.6)	121 (38.2)	0.578
Disagree	130 (32.2)	41 (25.9)	55 (35.3)	34 (37.8)		97 (33.0)	33 (30.0)		32 (36.8)	98 (30.9)	
My education on crude drugs of microorganisms and minerals is sufficient.											
Agree	130 (32.2)	51 (32.3)	54 (34.6)	25 (27.8)		104 (35.4)	26 (23.6)		33 (37.9)	97 (30.6)	
Not sure	144 (35.6)	68 (43.0)	48 (30.8)	28 (31.1)	**0.039**	94 (32.0)	50 (45.5)	**0.023**	18 (20.7)	126 (39.7)	**0.004**
Disagree	130 (32.2)	39 (34.7)	54 (34.6)	37 (41.1)		96 (32.7)	34 (30.9)		36 (41.4)	97 (29.7)	
My education on traditional and complementary medicine is sufficient.											
Agree	239 (59.2)	87 (55.1)	100 (64.1)	52 (57.8)		172 (58.5)	67 (60.9)		48 (55.2)	191 (60.3)	
Not sure	112 (27.7)	52 (32.9)	35 (22.4)	25 (27.8)	0.342	84 (28.6)	28 (25.5)	0.823	23 (26.4)	89 (28.1)	0.258
Disagree	53 (13.1)	19 (12.0)	21 (13.5)	13 (14.4)		38 (12.9)	15 (13.6)		16 (18.4)	37 (11.7)	
Pharmacognosy course materials are sufficient.											
Agree	242 (59.9)	98 (62.0)	102 (65.4)	42 (46.7)		179 (60.9)	63 (57.3)		49 (56.3)	193 (60.9)	
Not sure	107 (26.5)	36 (22.8)	37 (23.7)	34 (37.8)	**0.033**	76 (25.9)	31 (28.2)	0.805	23 (26.4)	84 (26.5)	0.520
Disagree	55 (13.6)	24 (15.2)	17 (10.9)	14 (15.6)		39 (13.3)	16 (14.5)		15 (17.2)	40 (12.6)	
In general, my education about pharmacognosy is sufficient.											
Agree	271 (67.1)	107 (67.7)	111 (71.2)	53 (58.9)		202 (68.7)	69 (62.7)		53 (60.9)	218 (68.8)	
Not sure	101 (25.0)	39 (24.7)	36 (23.1)	26 (28.9)	0.276	69 (23.5)	32 (29.1)	0.484	24 (27.6)	77 (24.3)	0.258
Disagree	32 (7.9)	12 (7.6)	9 (5.8)	11 (12.2)		23 (7.8)	9 (8.2)		10 (11.5)	22 (6.9)	

$P < 0.05$; a, Pearson test; b, Fisher exact test.

participants, 35.6%, 59.4%, and 5.0% defined the content of the theoretical courses as more than enough, sufficient, and insufficient, respectively. For the practical courses, the rates were 9.6%, 71.8%, and 18.6%, respectively. The results showed that pharmacy students may have a demand for changing the theoretical/practical content ratio in favor of laboratory practices. Furthermore, the results did not show any significant differences regarding accreditation status and education model.

Herbal medicinal plants, crude marine drugs, and drugs from other biological sources (e.g., animals and microorganisms) with traditional and complementary medicine are almost the main actors of all pharmacognosy definitions. Thus, the opinions of the students about their education on these topics were questioned (Table 2). Despite the relatively high percentage of the students who agreed that their pharmacognosy education is generally sufficient (67.1%), the mean percentage of the agreeing students on each aforementioned topic was 38.9%. This difference may indicate that the students did not have a common idea about the scope of pharmacognosy. The satisfaction rates

of the students with the education of herbal medicinal plants and traditional and complementary medicine were relatively high (62.4% and 59.2%, respectively). This may be a result of the emphasis on phytochemistry and phytotherapy in the curricula. However, these results cannot provide any ignorance about the dramatic results of marine drugs. Of the students, 89.6% either defined the education of marine pharmacognosy as insufficient (52.0%) or not sure about it (37.6%). The responses did not show any significant difference regarding either the accreditation status of the faculties or the education model. All drugs of natural origin are within the scope of pharmacognosy, and this includes marine sources as much as terrestrial sources. Marine pharmacognosy is a challenge to the field because of its brutal environment with little known living organisms and their taxonomy. More than 70% of the earth is covered by water, and the biodiversity of life in oceans is glamorous. In addition, tough external factors in the environment can cause unique secondary metabolites. Thus, its education as a part of pharmacognosy has become crucial (Bisaria, Sinha, Srivastava, & Singh, 2020; Cahlíková et al., 2020; Kinghorn, 2002).

The current results suggest an emphasis on this topic in the national curricula of Türkiye, which is a peninsula surrounded by sea on three sides. Significant improvement in the third and fourth year students' opinions may indicate a precession; however, there is still a long way to reach sufficient levels. The results for animal, microorganism, and mineral sources are also concerning. In particular, recent developments in biotechnology regarding isolation or production of new pharmaceutical compounds using microorganisms are remarkable (Verpoorte, 2000). Education and research in this field deserve more attention in pharmacognosy.

Students' opinions on the education of herbal medicinal plants significantly differed in favor of accreditation but not in the year in school and education model. However, no significant differences were observed in any of the three parameters for the "In general, my education about pharmacognosy is sufficient" proposition. In addition, the least agreement rate with the proposition was determined in the fifth year students. Pharmacognosy course materials were found to be sufficient by 59.9% of students, with a significant decrease in the fifth year students (46.7%). These two low rates of the fifth year students may be caused by the fifth year curricula structured mostly with elective courses and mandatory internships, which may convert their expectations from theoretical knowledge to community practice. Thus, more elective courses regarding students' possible internship needs should be considered.

National competencies related to pharmacognosy

The NPCEP of Türkiye has 108 competencies. It cannot be denied that each course, more or less, contributes to all competencies. Otherwise, it should be reconsidered and revised according to CBE. However, most courses are meant to be responsible or one of the major contributors for a particular competency. Ten competencies were selected regarding this fact. Some of the selected competencies may involve pharmacognosy, pharmaceutical botany, and pharmacology or other fields as major actors together. It should be noted that all related courses are not given under the same department in all faculties. For instance, courses dealing with medicinal teas, identification of plants, drug/natural product interactions, or supplements can be found under one of the aforementioned departments in different faculties. Such competencies and education, measurement, and assessment of the courses aimed at these competencies should be considered opportunities not to be missed for collaboration. All competencies were defined with different learning levels ranging from 1 (lowest) to 4 (highest) in the NPCEP. Level 1 requires knowledge about the topic and to provide guidance, whereas level 2 stipulates conducting the practice with the help of a source/guide/instruction or with assistance. Graduates should be able to provide competency without assistance in general practices at level 3. In contrast, level 4 includes handling complicated cases without any help.

All selected competencies require learning levels between 1 and 3. They were divided into two main parts. Competencies more related to community and hospital pharmacy (CH), and others more related to academic and industrial pharmacy (AI). CH competencies include preparing medicinal teas, providing consultancy on medicinal teas, homeopathy, traditional herbal medicinal products, rational and safe use of supplements, and detecting and evaluating drug/natural product interactions. AI competencies include obtaining active substances/excipients from natural sources, identifying medicinal, poisonous, or narcotic plants, performing quality-control operations on natural sources, preparing traditional herbal medicinal products, and developing active compounds/excipients from natural sources. The mean rate of students who believed that they have competencies related to CH was 35.3%, whereas that for AI was 52.4% (Table 3). Although both rates were disturbingly low, these results indicated that students felt more prepared for academic or industrial issues than for patient-oriented duties such as consultancy and guidance on pharmaceutical care. A pharmacist is usually defined as a healthcare professional dealing with all aspects of the supply and use of medicines (World Health Organization, 2019). This process involves research, development, and production of all kinds of medicines, and pharmacists are crucial actors in every step. However, the number of needed workforces in the pharmacies is much higher. Furthermore, it is obvious that most pharmacy graduates are employed in community and hospital pharmacies in Türkiye. Thus, a review and improvement of the curricula and/or educational techniques may be considered for all these competencies, particularly for CH-related ones. Consultancy and guidance duties require communication skills and a multidisciplinary perspective. These may be some of the missing pieces that prevent students from feeling more confident about these competencies. Furthermore, consulting and guiding patients/users/healthcare professionals are core aspects of pharmacology and clinical pharmacy. Thus, further collaborations in these fields should be considered.

The highest self-confidence was found in identifying plants (67.6%), performing quality-control operations (63.1%), and obtaining active substances/excipients (62.6%). The lowest preparedness was observed in identifying homeopathic products and providing guidance on this subject (21.0%). Homeopathy practices are part of the "Traditional and Complementary Medicine Practices Regulation (27.10.2014, 29158)" in Türkiye, and the supply of homeopathic products is restricted to pharmacies only. Despite the recently reported high awareness of pharmacy students in Türkiye (Renda, Gökkaya, Kandemir, Özyiğit, & Kurt, 2023), the current results revealed extremely low confidence in the related competency.

As the competencies are expected to be the results of the entire education, the perceptions of the fifth year students may be more significant. The mean rates of self-confidence of the fifth year students were 39.32% and 51.12% for CH- and AI-

Table 3. Pharmacy students' thoughts on their preparedness for related national competencies (n = 404)

Competencies	Total	Year in school				Accreditation			Education model (hybrid)		
		Third	Fourth	Fifth	P^a	Yes	No	P^a	Yes	No	P^a
I can prepare medicinal teas and provide consultancy without assistance in general practice (CH).	n (%)	n (%)	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Agree	171 (42.3)	49 (31.0)	78 (50.0)	44 (48.9)		128 (43.5)	43 (39.1)		45 (51.7)	126 (39.7)	
Not sure	152 (37.6)	64 (40.5)	57 (36.5)	31 (34.4)	0.001	105 (35.7)	47 (42.7)	0.431	22 (25.3)	130 (41.0)	**0.026**
Disagree	81 (20.1)	45 (28.5)	21 (13.5)	15 (16.7)		61 (20.7)	20 (18.2)		20 (23.0)	61 (19.2)	
I am knowledgeable about how homeopathy is practiced, and I can identify homeopathic products and provide guidance on this subject (CH).											
Agree	85 (21.0)	24 (15.2)	41 (26.3)	20 (22.2)		64 (21.8)	21 (19.1)		23 (26.4)	62 (19.6)	
Not sure	186 (46.0)	69 (43.7)	72 (46.2)	45 (50.0)	0.033	132 (44.9)	54 (49.1)	0.728	34 (39.1)	152 (47.9)	0.249
Disagree	133 (32.9)	65 (41.1)	43 (27.6)	25 (27.8)		98 (33.3)	35 (31.8)		30 (34.5)	103 (32.5)	
I can provide consultancy on traditional herbal medicinal products without assistance in general practice (CH).											
Agree	138 (34.2)	40 (25.3)	61 (39.1)	37 (41.1)		104 (35.4)	34 (30.9)		35 (40.2)	103 (32.5)	
Not sure	185 (45.8)	70 (44.3)	73 (46.8)	42 (46.7)	0.000	130 (44.2)	55 (50.0)	0.571	34 (39.1)	151 (47.6)	0.315
Disagree	81 (20)	48 (59.3)	22 (14.1)	11 (12.2)		60 (20.4)	21 (19.1)		18 (20.7)	63 (19.9)	
I can provide consultancy on the rational and safe use of supplements without assistance in general practice (CH).											
Agree	184 (45.5)	58 (36.7)	77 (49.4)	49 (54.4)		137 (46.6)	47 (42.7)		38 (43.7)	146 (46.1)	
Not sure	166 (41.1)	63 (39.9)	69 (44.2)	34 (37.8)	0.000	115 (39.1)	51 (46.4)	0.373	36 (41.4)	130 (41.0)	0.864
Disagree	54 (13.4)	37 (23.4)	10 (6.4)	7 (7.8)		42 (14.3)	12 (10.9)		13 (14.9)	41 (12.9)	
I can detect and evaluate drug/natural product interactions without assistance in general practice (CH).											
Agree	135 (33.4)	47 (29.7)	61 (39.1)	27 (30.0)		106 (36.1)	29 (26.4)		29 (33.3)	106 (33.4)	
Not sure	185 (45.8)	60 (38.0)	76 (48.7)	49 (54.4)	0.000	128 (43.5)	57 (51.8)	0.172	40 (46.0)	145 (45.7)	0.999
Disagree	84 (20.8)	51 (32.3)	19 (12.2)	14 (15.6)		60 (20.4)	24 (21.8)		18 (20.7)	66 (20.8)	
I can obtain active substances/excipients from natural sources with the help of a source/guide/instruction or with assistance (AI).											
Agree	253 (62.6)	97 (61.4)	102 (65.4)	54 (60.0)		183 (62.2)	70 (63.6)		52 (59.8)	201 (63.4)	
Not sure	103 (25.5)	39 (24.7)	36 (23.1)	28 (31.1)	0.543	73 (24.8)	30 (27.3)	0.548	20 (23.0)	83 (26.2)	0.212
Disagree	48 (11.9)	22 (13.9)	18 (11.5)	8 (8.9)		38 (12.9)	10 (91.)		15 (17.2)	33 (10.4)	
I can identify medicinal, poisonous, or narcotic plants with the help of a source/guide/instruction or with assistance (AI).											
Agree	273 (67.6)	102 (64.6)	111 (71.2)	60 (66.7)		199 (67.7)	74 (67.3)		61 (70.1)	212 (66.9)	
Not sure	105 (26.0)	43 (27.2)	37 (23.7)	25 (27.8)	0.673	78 (26.5)	27 (24.5)	0.657	24 (27.6)	81 (25.6)	0.206
Disagree	26 (6.4)	13 (8.2)	8 (5.1)	5 (5.6)		17 (5.8)	9 (8.2)		2	24 (7.6)	
I can perform quality-control operations on natural resources with the help of a source/guide/instruction or with assistance (AI).											
Agree	255 (63.1)	97 (61.4)	105 (67.3)	53 (58.9)		183 (62.2)	72 (65.5)		50 (57.5)	205 (64.7)	
Not sure	118 (29.2)	45 (28.5)	40 (25.6)	33 (36.7)	0.221	90 (30.6)	28 (25.5)	0.534	32 (36.8)	86 (27.1)	0.195
Disagree	31 (7.7)	16 (10.1)	11 (7.1)	4 (4.4)		21 (7.1)	10 (9.1)		5 (5.7)	26 (8.2)	
I can prepare traditional herbal medicinal products without assistance in general practice (AI).											
Agree	117 (29.0)	41 (25.9)	47 (30.1)	29 (32.2)		89 (30.3)	28 (25.5)		30 (34.5)	87 (27.4)	
Not sure	190 (47.0)	66 (34.7)	83 (53.2)	41 (45.6)	**0.024**	132 (44.9)	58 (52.7)	0.370	34 (39.1)	156 (49.2)	0.231
Disagree	97 (24.0)	51 (32.3)	26 (16.7)	20 (22.2)		73 (24.8)	24 (21.8)		23 (26.4)	74 (23.3)	
I am knowledgeable about developing active compounds/excipients from natural sources and can provide guidance (AI).											
Agree	160 (39.6)	48 (30.4)	78 (50.0)	34 (37.8)		123 (41.8)	37 (33.6)		38 (43.7)	122 (38.5)	
Not sure	170 (42.1)	72 (45.6)	59 (37.8)	39 (43.3)	**0.005**	117 (39.8)	53 (48.2)	0.259	33 (37.9)	137 (43.2)	0.632
Disagree	74 (18.3)	38 (24.1)	19 (12.2)	17 (18.9)		54 (18.4)	20 (18.2)		16 (18.4)	58 (18.3)	

$P < 0.05$; a, Pearson test; CH, community and hospital pharmacy; AI, academic and industrial pharmacy.

related competencies, respectively. Statistically significant differences were observed in seven competencies regarding the year in school (Table 3). Among them, the fifth year students stated more confidence than the third and fourth year students in only three competencies: providing consultancy on traditional herbal medicinal products (41.1%), providing consultancy on the rational and safe use of supplements (54.4%), and preparing traditional herbal medicinal products (32.2%) with still concerning levels. No significant difference was determined in the preparedness of students for the competencies regarding the accreditation status of the faculties. However, a slightly increased confidence was observed in all CH-related and three AI-related competencies in favor of accreditation. Only a significant difference regarding the education model emerged in preparing medicinal teas and providing consultancy with a higher confidence in students who are subject to hybrid models.

Limitations and strengths

This descriptive questionnaire study reflects the participants' opinions. No sample selection was performed. Therefore, the results may not be valid for the entire population. There are 49 faculties in Türkiye and Turkish Republic of Northern Cyprus. However, the study included participants from 19 of them. All students considered knowing all the mentioned terms about the field. This study was conducted via an online form. Possible environmental influences were not known. Participants were asked to perform a self-evaluation of the competencies without a tangible condition. To the best of the authors' knowledge, this is the first study to evaluate the thoughts and attitudes of pharmacy students studying in Türkiye toward pharmacognosy education and national competencies. Thus, it may lead to more studies on the adaptation of the field to CBE in Türkiye. Fur-

thermore, the study provides premise findings on the impact of national accreditation and education models on the topic.

CONCLUSION

This descriptive questionnaire study investigated the attitudes and perceptions of pharmacy students regarding pharmacognosy and related competencies of the NPCEP in Türkiye. The interest in pharmacognosy was high, and students attributed significant value and importance to the field. However, a revision may be needed regarding the elective courses and the rate of practical (laboratory) courses of pharmacognosy. Most of the students believed that their pharmacognosy education (67.1%) was sufficient, particularly on herbal medicinal plants (62.4%) and traditional and complementary medicine (59.2%). However, most of them responded to the questions about their education on marine pharmacognosy and drugs sourced from animals, microorganisms, and minerals either as insufficient or not sure. Students felt more prepared toward academic and industrial practices (52.4%) such as isolation of natural compounds and performing quality-control operations than community and hospital pharmacy requirements (35.3%) including consultancy and guidance about natural health products. The lowest self-confidence was observed in identifying homeopathic products and providing guidance on the subject (21.0%). The impacts of national accreditation status of the faculties and hybrid (e.g., integrated/modular) education models were limited. An overall review may be needed to adapt the field to outcome-based education or CBE. However, further and periodic studies scoping with a higher number of students are needed.

Informed Consent: Written consent was obtained from the participants.

Peer Review: Externally peer-reviewed.

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