İSTANBUL UNIVERSITY PRESS

RESEARCH ARTICLE / ARAŞTIRMA MAKALESİ
Journal of Advanced Research in Health Sciences / Sağlık Bilimlerinde İleri Araştırmalar Dergisi 2024
DOI: 10.26650/JARHS2024-1341284

EVALUATION OF PHARMACY EMPLOYEES' USAGE OF HERBAL PRODUCTS AND KNOWLEDGE ABOUT FOOD–DRUG INTERACTIONS

ECZANE ÇALIŞANLARININ BİTKİSEL ÜRÜN KULLANIMININ VE BESİN–İLAÇ ETKİLEŞİMLERİ HAKKINDAKİ BİLGİLERİNİN DEĞERLENDİRİLMESİ

Yasemin ERTAŞ ÖZTÜRK[1], Onur YILDIRAN[2], Beyza BAYCAN[3], Semiha KADIOĞLU[4]

[1]Ondokuz Mayıs University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Samsun, Türkiye
[2]Yozgat Şehir Hospital, Unit of Nutrition and Dietetics, Yozgat, Türkiye
[3]Ondokuz Mayıs University, Institute of Graduate Education, Postgraduate Student, Samsun, Türkiye
[4]Aslife Health Club, Nutrition and Dietetics Consultancy Services, Trabzon, Türkiye

ORCID ID: Y.E.Ö. 0000-0002-8232-103X; O.Y. 0000-0002-2797-2630; B.B. 0000-0001-6875-9767; S.K. 0000-0003-3621-5057

Citation/Atıf: Ertaş Öztürk Y, Yıldıran O, Baycan B, Kadıoğlu S. Evaluation of pharmacy employees' usage of herbal products and knowledge about food–drug interactions. Journal of Advanced Research in Health Sciences 2024. Advance Online Publication. https://doi.org/10.26650/JARHS2024-1341284

ABSTRACT

Objective: This study was conducted to determine and compare herbal product use, attitudes toward herbal products, and the knowledge about food–drug interactions of pharmacy employees.

Materials and Methods: This descriptive cross-sectional study included 132 pharmacy employees, comprising 67 pharmacists, 40 pharmacy technicians, and 25 pharmacy foremen. Demographic characteristics of the participants, herbal product use and attitudes toward herbal products, questions concerning food–drug interactions, and the Food–Drug Interaction Knowledge Level Scale were evaluated. Data were collected through a web-based questionnaire and analyzed using appropriate statistical methods.

Results: Pharmacists used herbal products (p=0.008) and counseled more (p<0.001) than pharmacy technicians/foremen. Most pharmacy employees received questions from patients regarding herbal products. A total of 73.8% of pharmacy technicians/foremen believed that herbal products exert fewer side effects than conventional drugs, and 91.0% of pharmacists believed that herbal products are not regulated and that there is an interaction between conventional drugs and herbal products. The mean Food–Drug Interaction Knowledge Level Scale score of pharmacists was 13.4±3.96, whereas that of pharmacy technicians/foremen was 7.9±5.46 (p<0.001). Good or very good knowledge about food–drug interactions was found among 79.1% of pharmacists and 33.8% of pharmacy technicians/foremen. Profession (pharmacist vs pharmacy technician/foreman) and having additional education on herbal products significantly affected the scale scores (p<0.001 and p=0.019, respectively).

Conclusion: Pharmacy employees are an important health group who provide counseling on herbal product use and food–drug interactions. Pharmacists' knowledge about food–drug interactions was higher than that of pharmacy technicians/foremen. Therefore, lifelong learning should be a part of the lives of these professional groups as in every profession.

Keywords: Alternative Medicine, complementary medicine, food–drug interaction, herbal medicine use

ÖZ

Amaç: Bu çalışma ile eczane çalışanlarının bitkisel ürün kullanımı, bitkisel ürünlerle ilgili tutumları ve besin-ilaç etkileşimleri hakkındaki bilgilerinin belirlenerek karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem: Çalışma tanımlayıcı tipte kesitsel bir çalışmadır. Çalışmaya 67 eczacı, 40 eczane teknikeri ve 25 eczane kalfası olmak üzere toplam 132 eczane çalışanı katılmıştır. Çalışmanın verileri bireylerin demografik özellikleri, bitkisel ürün kullanımı ve bitkisel ürünler hakkındaki tutumları, besin-ilaç etkileşimine dair sorular ve Besin-İlaç Etkileşimi Bilgi Düzeyini Saptamaya Yönelik Ölçek'i içeren sorulardan oluşmuştur. Veriler web tabanlı bir anket aracılığıyla toplanmış ve uygun istatistiksel yöntemler kullanılarak değerlendirilmiştir.

Bulgular: Eczacıların bitkisel ürünleri eczane teknikerleri/kalfalarına göre daha fazla kullandığı (p=0,008) ve daha fazla danışmanlık yaptığı (p<0,001) belirlenmiştir. Çoğu eczane çalışanı bitkisel ürünler hakkında hastalardan soru almaktadır. Eczane teknikerleri/kalfalarının %73,8'i bitkisel ürünlerin geleneksel ilaçlara göre daha az yan etkisi olduğunu, eczacıların %91,0'i ise bitkisel ürünlerin denetlenmediğini ve geleneksel ilaçlarla bitkisel ürünler arasında etkileşim olduğunu düşünmektedir. Ölçek sonuçlarına göre eczacıların ortalama ölçek puanları 13,4±3,96 iken eczane teknikerleri ve kalfalarının ortalama ölçek puanları 7,9±5,46'dır (p<0,001). Eczacıların %79,1'i eczacı teknikeri/kalfalarının ise %33,8'i iyi ve çok iyi düzeyde besin-ilaç etkileşimi bilgisine sahiptir. Meslek grubunun (eczacı ve eczane teknikeri/kalfası) ve bitkisel ürünler hakkında ek eğitim almanın ölçek puanlarını anlamlı olarak etkilediği tespit edilmiştir (p<0,001 ve p=0,019).

Sonuç: Eczane çalışanları bitkisel ürün kullanımı ve besin-ilaç etkileşimi konusunda danışmanlık yapan önemli bir sağlık grubudur. Eczacıların besin-ilaç etkileşimi bilgisi eczacı teknikeri/kalfasından yüksektir. Bu nedenle yaşam boyu öğrenme her meslekte olduğu gibi bu meslek gruplarında da hayatın bir parçası olmalıdır.

Anahtar Kelimeler: Alternatif Tıp, besin ilaç etkileşimi, bitkisel ilaç kullanımı, tamamlayıcı tıp

Corresponding Author/Sorumlu Yazar: Yasemin ERTAŞ ÖZTÜRK **E-mail:** yasemin.ertasozturk@omu.edu.tr

Submitted/Başvuru: 11.08.2023 • **Revision Requested/Revizyon Talebi:** 06.12.2023 • **Last Revision Received/Son Revizyon:** 13.12.2023 • **Accepted/Kabul:** 24.01.2024 • **Published Online/Online Yayın:** 13.05.2024

This work is licensed under Creative Commons Attribution-NonCommercial 4.0 International License

INTRODUCTION

Complementary and alternative medicine (CAM) approaches have become popular in recent years. The usage rate of these methods has been found to be 26% on average in European countries (1). A study reported that CAM usage in patients with cancer varied from 15% to 73%, with the average being 36% (2). Another study conducted in Türkiye showed that the usage rate of CAM was 22%–84% with an average of 46.2% (3). Patients with hypertension showed a CAM usage rate of 13%–86% (4). A small-scale study conducted in our country reported a CAM usage rate of 60%, indicating that CAM methods are used at varying rates in different disease groups and in the general population (5).

CAM methods are categorized as alternative medical therapies, biology-based therapies, manipulative and body-based therapies, and mind-body therapies (6). The usage of herbal medicines and herbal products is prominent among these methods (4, 7). In Türkiye, there is a lack of legal CAM applications; however, traditional and complementary medicine (T&CM) practices have been regulated by the Ministry of Health. Phytotherapy is a T&CM practice included in the regulation (8). Considering the products sold in pharmacies, there has been an increase in the use of herbal products over the years (9, 10).

Food–drug interactions are generally defined as those originating from the physical, chemical, physiological, or pathophysiological relationship between a drug and a food/nutrient or nutritional state (11). Although food or nutrients may affect the absorption, transport, metabolism, and excretion of drugs, drugs may also affect nutrient metabolism and nutritional status. This interaction between nutrients and drugs may result in failure to obtain the expected effect of nutrients and drugs, resulting in alteration of the pharmacokinetic and/or pharmacodynamic effect of the drug and thus failure in treatment (12). For instance, grapefruit juice is a CYP3A4 inhibitor and may increase the effect of the drug by more than five times when taken together with drugs. The use of some drugs may affect the function of the gastrointestinal system and result in loss of body electrolytes and fluid (13). Undesirable effects such as increased/decreased drug efficacy, toxicity, and changes in the patient's health status that may occur as a consequence of food–drug interactions should be considered by healthcare professionals in all areas of the healthcare system (12).

Pharmacists are the first healthcare professionals consulted by patients for drugs and herbal products (14). They have the responsibility of counseling individuals regarding the appropriate use of herbal products and drugs (15). Considering the widespread use of herbal products and drugs throughout the world and the important effect of nutrient–drug interactions on treatments, pharmacy employees should have the knowledge about the use of herbal products, their interactions with drugs, and health effects (16). In Türkiye, pharmacists take compulsory and elective courses on herbal products throughout their education and core education program to emphasize lifelong learning (17). Conversely, pharmacy technicians and foremen may also consult patients. However, there are limited data regarding the current attitudes toward herbal products and food–drug interactions among this profession. Therefore, this study was conducted to determine and compare the knowledge of pharmacy employees regarding food–drug interactions and attitudes toward herbal products.

MATERIAL and METHODS

A total of 132 pharmacy employees (67 pharmacists, 40 pharmacy technicians, and 25 pharmacy foremen) from 51 pharmacies participated in this descriptive study. Participants were included in the study after obtaining their written informed consent. The Ondokuz Mayıs University Clinical Research Ethics Committee approved this study (Date: 30.04.2021, No: 2021/249).

Data were collected online using Google Forms through a questionnaire, including "9 questions" on sociodemographic characteristics (age, sex, and educational status) and employment status (work experience and pharmacy ownership status), "4 questions" on herbal product practices (herbal product sale, use, and consultancy), "5 questions" on attitudes toward herbal products, and "3 questions" on food–drug interactions and the Food–Drug Interaction Knowledge Level Scale. When generating the survey questions, the knowledge and attitudes of pharmacy employees regarding herbal products and nutrient–drug interactions were determined.

The knowledge of pharmacy employees about food–drug interactions was determined using the Food–Drug Interaction Knowledge Level Scale developed by Karagöz et al. (18). The scale consists of 21 items in total. Each question has three options, viz., "True," "False," and "Don't know." In the evaluation, each appropriate answer is equal to 1 point, and the others (incorrect and unknown) are equal to 0. Those who chose the "False" option in items 1 and 11 and those who chose the "True" option in the other items of the scale received 1 point for each item. When the total scores of the scale are evaluated, 0–5, 6–11, 11–15, and 16–21 points indicate "low," "moderate," "good," and "very good" knowledge level, respectively. Cronbach's alpha coefficient of the scale is 0.731 (18).

Data were analyzed using the SPSS 20 (IBM SPSS Corp., Armonk, NY, USA) package program. We tested whether the data were suitable for normal distribution. Quantitative data were expressed as median (minimum–maximum), and qualitative data were expressed as percentage (%) (number). Comparisons were performed with two groups (as pharmacists and pharmacy technicians/foremen). The significance of the differences between two groups was determined using chi-square or Fisher's exact test. The significance of the differences between the mean values of two groups was determined using the independent samples t-test. Linear regression analysis was used to obtain the determinants of individuals' food–drug interaction scale scores. The significance level was accepted as 0.05.

RESULTS

The majority of participants was women (69.7%), pharmacists (50.8%), and had an undergraduate degree (43.2%). A total of 63.6% of the participants had no additional education on herbal products other than undergraduate education (Table 1).

Table 1: Descriptive data of participants

Data*	Descriptive statistics
Age (year)	27 (19–62)
Work experience (year)	4 (1–33)
Sex (women)	69.7 (92)
Chronic disease (yes)	16.7 (22)
Profession	
Pharmacist	50.8 (67)
Pharmacy technician	30.3 (40)
Pharmacy foremen	18.9 (25)
Education level	
Primary and secondary education	3.8 (5)
High school	28.8 (38)
Associate degree	15.9 (21)
Bachelor's degree	43.2 (57)
Master's degree	8.3 (11)
Status of the graduated school	
State	88.6 (117)
Private	11.4 (15)
Ownership	
Owner	25.0 (33)
Employee	75.0 (99)
Additional education on herbal products	
Yes	36.4 (48)
No	63.6 (84)

*: Quantitative data are expressed as median (minimum–maximum), and qualitative data are expressed as percentage (%) (number)

Table 2: Herbal product practices and attitudes and opinion on food–drug interactions according to pharmacy employee groups

Questions	Positive (yes/I agree) response (%, n)				
	Total (n=132)	Pharmacists (n=67)	Pharmacy technicians/ foremen (n=65)	Chi-square/ Fisher's exact test value	p
I sell herbal products in pharmacy.	84.1 (111)	88.1 (59)	80.0 (52)	1.602	0.206
I use herbal products for self-treatment.	78.8 (104)	88.1 (59)	69.2 (45)	6.999	**0.008**
I counsel patients on the use of herbal products.	81.1 (107)	95.5 (64)	66.2 (43)	18.535	**<0.001**
I receive questions from patients about the use of herbal products.	87.1 (115)	94.0 (63)	80.0 (52)	5.788	**0.016**
Herbal products have beneficial effects.	97.0 (128)	98.5 (66)	95.4 (62)	1.087	0.297
Herbal products have fewer side effects than conventional medicines.	53.8 (71)	34.3 (23)	73.8 (48)	20.728	**<0.001**
Herbal products have a placebo effect.	56.8 (75)	61.2 (41)	52.3 (34)	1.062	0.303
Herbal products are adequately regulated.	21.2 (28)	9.0 (6)	33.8 (22)	12.231	**<0.001**
Herbal products have significant interactions with conventional medicines.	81.1 (107)	91.0 (61)	70.8 (46)	8.835	**0.003**
I inform patients about the interactions of the medicines they buy with food/drinks.	88.6 (117)	94.0 (63)	83.1 (54)	3.930	**0.047**
Patients ask me if the medicines they buy interact with any food/drink.	66.7 (88)	59.7 (40)	73.8 (48)	2.970	0.085
I think I have sufficient knowledge about the interactions of foods/drinks with medicines.	56.8 (75)	62.7 (42)	50.8 (33)	1.910	0.167

%: Percentage, n: Number

Table 3: Knowledge about food–drug interactions according to pharmacy employee groups

Scale items	True response (n, %)				
	Total (n=132)	Pharmacist (n=67)	Pharmacy technicians/ foremen (n=65)	Chi-square value	p
1.* "The fasting status of an individual does not change effectiveness of a drug"	90.2 (119)	97.0 (65)	83.1 (54)	7.219	**0.007**
2. "Some antiulcer drugs, such as sucralfate, should be taken on an empty stomach as they bind to the protein in the nutrients"	75.0 (99)	79.1 (53)	70.8 (46)	1.223	0.269
3. "Energy restricted diets may increase sensitivity of certain stimulant drugs such as amphetamine"	55.3 (73)	61.2 (41)	49.2 (32)	1.910	0.167
4. "Taking a lipophilic drug with high fatty food/meal increases toxicity of the drug"	47.0 (62)	56.7 (38)	36.9 (24)	5.189	**0.023**
5. "Propranolol having antihypertensive effect increases the bioavailability of drugs, if taken with a high-carbohydrate meal"	22.0 (29)	20.9 (14)	23.1 (15)	0.092	0.762
6. "High fiber diets bind bile and diminish acids, and thus increases excretion of some drugs"	49.2 (65)	58.2 (39)	40.0 (26)	4.377	**0.036**
7. "High fiber and pectin foods delay absorption of some drugs such as digoxin"	39.4 (52)	47.8 (32)	30.8 (20)	3.990	**0.046**
8. "In general, a protein-poor diet causes a decrease in half-life of drugs and plasma clearance by decreasing albumin levels"	42.4 (56)	58.2 (39)	26.2 (17)	13.879	**<0.001**
9. "Due to the components found in its chemical structure, grapefruit juice increases the blood concentration of calcium channel blocker drugs such as Felodipine"	63.6 (84)	80.6 (54)	46.2 (30)	16.914	**<0.001**
10. "Chemotherapeutic drugs' bioavailability increases with grapefruit juice"	35.6 (47)	32.8 (22)	38.5 (25)	0.455	0.500
11.* "Vegetables containing vitamin K such as broccoli, cabbage, spinach, etc. increase the efficacy of warfarin-containing anticoagulant drugs"	23.5 (31)	34.3 (23)	12.3 (8)	8.903	**0.003**
12. "Taking Parkinson's disease drugs such as Levadopa, Methyldopa with protein-rich foods decreases the absorption of the drug"	36.4 (48)	40.3 (27)	32.3 (21)	0.910	0.340
13. "Anticonvulsant drugs such as phenobarbital and phenytoin may disrupt folic acid, vitamin D and vitamin K metabolism"	53.0 (70)	68.7 (46)	36.9 (24)	13.339	**<0.001**
14. "Antacid group drugs such as sodium bicarbonate reduce calcium absorption"	53.8 (71)	73.1 (49)	33.8 (22)	20.488	**<0.001**
15. "As antihypertensive drugs containing ACE inhibitors cause hyperkalemia, they should not be consumed with foods rich in potassium such as bananas and green leafy vegetables"	51.5 (68)	74.6 (50)	27.7 (18)	29.098	**<0.001**
16. "Long-term use of steroids adversely affects calcium metabolism"	71.2 (94)	88.1 (59)	53.8 (35)	18.839	**<0.001**
17. "Cyclosporin-containing immunosuppressive drugs may increase blood pressure by increasing the sodium and water retention in the body"	49.2 (65)	71.6 (48)	26.2 (17)	27.313	**<0.001**
18. "Drugs such as thiazides and loop diuretics trigger hypokalemia by increasing potassium excretion"	47.7 (63)	65.7 (44)	29.2 (19)	17.561	**<0.001**
19. "Antacids and proton pump inhibitors adversely affect iron absorption by changing gastric pH"	56.8 (75)	80.6 (54)	32.3 (21)	31.357	**<0.001**
20. "Monoamine oxidase inhibitors (MAOI) cause a hypertension crisis, if taken with high tyramine-containing foods such as processed and aged cheese, fermented salami, fermented sausage, sausage, chicken, and calf liver"	45.5 (60)	71.6 (48)	18.5 (12)	37.634	**<0.001**
21. "Antidiabetic drugs with metformin active substance negatively affect the absorption of vitamin B12"	62.9 (83)	82.1 (55)	43.1 (28)	21.513	**<0.001**

%: Percentage, n: Number, * The correct answer to the marked questions is "False," the correct answer to the other questions is "True."

Table 4: Food–drug interaction scale score and classifications according to pharmacy employee groups

	Pharmacist (n=67)	Pharmacy technicians/foremen (n=65)	Test value	p
Scale score (mean±SD)	13.4±3.96	7.9±5.46	−6.676	**<0.001**
Classification (%, n)				
Low	3.0 (2)	43.1 (28)	35.691	**<0.001**
Intermediate	17.9 (12)	23.1 (15)		
Good	52.2 (35)	21.5 (14)		
Very good	26.9 (18)	12.3 (8)		

SD: Standard deviation, %: Percentage, n: Number

Table 5: Determinants of individuals' food–drug interaction scale score

Dependent variable	Factors	Beta	t	p
Food–drug interaction scale scores	Age (year)	−0.032	−0.227	0.821
	Sex	−0.105	−1.321	0.189
	Profession	−0.443	−5.308	**<0.001**
	Work experience (year)	0.028	0.187	0.852
	Additional education on herbal products	−0.184	−2.377	**0.019**

Beta: Regression coefficient

Herbal product usages, attitudes toward herbal products, and opinions on food–drug interactions according to occupational groups are shown in Table 2. Pharmacists and pharmacy technicians/foremen mentioned that herbal products are sold in pharmacies at a high rate, with 88.1% by pharmacists and 69.2% by pharmacy technicians/foremen (p=0.008). Pharmacy technicians/foremen believed that herbal products exert fewer side effects than those believed by pharmacists (p<0.001). Pharmacists agreed more with the statement that herbal products interact with drugs (p=0.003).

Almost all participants (90.2%) believed that an individual's hunger state changed the effectiveness of the medication taken. Most participants could not provide correct answers to questions on food–drug interactions in items 5 and 11 of the scale (Table 3). In most items of the scale, pharmacists had a higher rate of correct answers than pharmacy technicians/foremen.

The mean scale score of pharmacists was 13.4±3.96, whereas that of pharmacy technicians/foremen was 7.9±5.46 (p<0.001) (Table 4). Regarding the knowledge level, 3.0%, 17.9%, 52.2%, and 26.9% of pharmacists had low, intermediate, good, and very good knowledge level, respectively, whereas 43.1%, 23.1%, 21.5%, and 12.3% of pharmacy technicians/foremen had low, intermediate, good, and very good knowledge level, respectively. Most pharmacists had good and very good knowledge level, and most pharmacy technicians/foremen had low and intermediate knowledge level (p<0.001) (Table 4).

According to the linear regression analysis (Table 5), being a pharmacist or pharmacy technician/foreman and having additional education on herbal products significantly affected the scale scores (β=−0.443, p<0.001, β=−0.184, p=0.019, respectively). Age, gender, and work experience exerted no significant impact on scale scores (p>0.05).

DISCUSSION

This study investigated the current attitudes toward herbal products and knowledge on food–drug interactions of pharmacy employees. To the best of our knowledge, this is the first study to compare knowledge regarding herbal products and food–drug interactions between pharmacists and pharmacy technicians/foremen in Türkiye. Pharmacists have crucial responsibilities in ensuring the safe and appropriate use of medicines (19). Hence, considering the globally increasing demand on T&CM practices, it is essential to understand their attitudes toward herbal products (9).

In our study, the majority of pharmacists sold and received questions concerning herbal products from patients and informed patients about food–drug interactions as anticipated. These findings can be supported by several previous studies (20-22). Nevertheless, we also observed high response rates from pharmacy technicians/foremen for the same questions. In most of the community pharmacies in Türkiye, pharmacy technicians/foremen, although not primarily authorized, assist pharmacists and can counsel customers (23). Unfortunately, we found that only 50.8% of them believed that they had sufficient knowledge regarding the interactions of foods/drinks with medicines. It is well known that interactions between herbal products and drugs can increase or decrease the pharmacological or toxicological effects of product/drug components in the human body. A review study showed that the use of herbal or dietary supplements with warfarin may cause several side effects ranging from bleeding to fatal cerebrocranial hemorrhages (24). Herbal products are commonly used together with medications. A study conducted in the USA reported that 38% of people who used herbal drugs also used prescription drugs and 42% of them used over-the-counter drugs (25). Another study showed

that most pharmacists believed that they need more intensive training in the field of herbal products (26). These data indicate that the importance of education on food–drug interactions.

Most users of herbal products reported that they found these products safe (27). In the present study, the majority of pharmacy technicians/foremen believed that herbal products exert fewer side effects than conventional medicines. Most pharmacists agreed that herbal products have significant interactions with conventional medicines. One study reported that 37.8% of pharmacists were unsure about the safety of using herbal products, and at the same time, the majority of pharmacists believed that the use of herbal products with prescription drugs was not safe (20). Another study found that several physicians believed that phytopharmaceuticals were not safe and effective (26). Based on these studies, it can be concluded that healthcare professionals are skeptical about herbal products. In a parallel study, 54.3% of pharmacists reported that there was a food–drug interaction when herbal products were used with conventional drugs (21). The interaction between herbal products and drugs is a very critical issue in terms of health. Studies have demonstrated that pharmacists and physicians are more aware of this important issue (21, 26). In our study, pharmacy technicians/foremen believed that herbal products did not have significant interactions with traditional medicines, which can be explained by their food–drug interaction scale scores. The lower level of knowledge of pharmacy technicians/foremen on the subject may have caused them to provide less counseling to patients regarding food–drug interactions and to leave this responsibility primarily to pharmacists or physicians.

Furthermore, most pharmacists in our study agreed that herbal products were inadequately regulated. A previous study investigated the ingredients of herbal supplements and found that approximately 50% of the tested products were contaminated, and some products had unreported presence of stimulants (such as caffeine, synephrine, and ephedrine). The same study also found the presence of allergens, toxins, or animal ingredients in some products (28). Therefore, to prevent the abuse of people's attitudes toward herbal products, healthcare professionals should be involved in product inspection to ensure that herbal products are provided with clean ingredients.

In our study, the majority of pharmacists had good food–drug interaction scale scores, whereas pharmacy technicians/foremen had low scale scores. In the original scale development study, the food–drug interaction scale scores were different among health professional groups (18). The overall food–drug interaction scale scores of pharmacists were reported as inadequate in studies from Palestine and Jordan (29, 30). However, in another study, having a master's degree increased the awareness of herb–drug interactions (31). In the present study also, pharmacists with a master's degree had the highest food–drug interaction scale score (data not shown). Being a pharmacist or assistant and having additional education on herbal products were the determinants of individuals' food–drug interaction scale scores. Therefore, these results demonstrated that professional specialization is valuable in terms of updating basic knowledge and acquiring novel knowledge.

Fasting and satiety states of individuals affect the gastrointestinal transit time of drugs and cause changes in the absorption and bioavailability of drugs. In satiety, gastric emptying slows down and the absorption time of drugs increases (32). Furthermore, the physiological response of the body to food intake, especially gastric acid secretion, may increase or decrease the bioavailability of some drugs (33). Protein intake causes a more significant difference in the clearance of drugs than carbohydrate and fat intake (18). In general, the correct response rate to the scale questions was higher among pharmacists than among technicians/foremen. Nonetheless, the correct answer rate to some questions was low among both pharmacists and technicians. In our study, for the question regarding the intake of drugs used for Parkinson's disease such as levodopa and methyldopa with protein-rich foods, 36.4% of pharmacy employees could answer correctly. Moreover, 22% of them could answer correctly to the question whether the antihypertensive drug propranolol increases bioavailability when taken with a high-carbohydrate meal. For another question concerning drug interaction with grapefruit juice, the correct answer rate was 35.6%. Grapefruit juice acts by inhibiting presystemic drug metabolism mediated by CYP3A isoforms in the small intestine. This interaction may cause at least doubling of the plasma drug concentration (34). High intake of foods rich in vitamin K (e.g., broccoli, cabbage, and spinach) stimulates the excretion of warfarin, which consequently decreases the anticoagulant effect reduces the efficacy of the drug (35,36). In our study, the rate of finding this information correct was low (23.5%). Pharmacists provided a higher rate of correct answers than pharmacy technicians (34.3% vs 12.3%, respectively, p=0.003).

CONCLUSION

Pharmacists are important healthcare professionals who counsel and guide patients regarding herbal products and food–drug interactions. The attitudes and knowledge of pharmacy technicians/foremen in this field may be inadequate compared with those of pharmacists. Although pharmacists have better knowledge about food–drug interactions, they may need to improve themselves on knowledge regarding some food–drug interactions as well. Therefore, this study clearly indicates that both pharmacists and pharmacy technicians/foremen should update their knowledge regarding food–drug interactions to provide adequate counseling to their patients.

Ethics Committee Approval: This study was planned following the Helsinki Principles, and ethical approval was obtained from the Ondokuz Mayıs University Clinical Research Ethics Committee (Date 30.04.2021, Decision number: 2021/249).

Informed Consent: Informed consent was obtained from each participants.

Author Contributions: Concept – Y.E.Ö., O.Y., B.B., S.K.; Data Collection – Y.E.Ö., O.Y., B.B., S.K.; Analysis and/or Interpretation – Y.E.Ö., O.Y., B.B., S.K.; Writing – O.Y., B.B., S.K.; Critical review – Y.E.Ö.; Supervision – Y.E.Ö.

Acknowledgement: Authors would like to thank to Dyt. Hatice ÇİMEN for her help on data collection. This study has presented as oral presentation on December 24-25, 2022 at 11th International Medicine and Health Sciences Researches Congress.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: This study supported by Scientific Research Projects Coordination Unit, Kocaeli University (0742018).

REFERENCES

1. Kemppainen LM, Kemppainen TT, Reippainen JA, Salmenniemi ST, Vuolanto PH. Use of complementary and alternative medicine in Europe: health-related and sociodemographic determinants. Scand J Public Health 2018;46(4):448-55.
2. Molassiotis A, Fernandez-Ortega P, Pud D, Ozden G, Scott JA, Panteli V, et al. Use of complementary and alternative medicine in cancer patients: a European survey. Ann Oncol 2005;16(4):655-63.
3. Kav S, Hanoğlu Z, Algier L. Use of complementary and alternative medicine by cancer patients in Turkey: a literature review. UHOD 2008;18(1):32-8.
4. Kes D, Gökdoğan F, Tuna D. Use of complementary and alternative medicine by hypertensive patients: a literature review. Turk J Card Nur 2016;7(12):40-55.
5. Çetin O.The use of complementary and alternative medicine in Eskisehir. Sosyoekonomi 2007;6(6):90-106.
6. Smith N, Shin DB, Brauer JA, Mao J, Gelfand JM. Use of complementary and alternative medicine among adults with skin disease: results from a national survey. J Am Acad Dermatol 2009;60(3):419-25.
7. Eardley S, Bishop FL, Prescott P, Cardini F, Brinkhaus B, Santos-Rey K, et al. A systematic literature review of complementary and alternative medicine prevalence in EU. Forschende Komplementmed 2012;19(2):18-28.
8. Orhan MF, Elmas B, Altındiş S, Karagöz R, Altındiş M. Aile hekimi ve pediatristlerin geleneksel ve tamamlayıcı tıbba (GETAT) bakışı. J Biotechnol and Strategic Health Res 2019;3(Özel Sayı):161-7.
9. Onbaşlı D, Çelik Yuvalı G, Ceylan A, Dal A. Herbal medicines found in pharmacies in Turkey. ERÜ Sağlık Bilim Fakültesi Derg 2019;6(1):18-31.
10. Süzgeç-Selçuk S, Eyisan S. Herbal medicines availabile in pharmacies in Turkey. Marmara Pharm J 2012;16(3):164-80.
11. Chan LN. Drug-nutrient interactions. J Parenter Enter Nutr 2013;37(4):450-9.
12. Bayraktar Ekincioğlu A, Demirkan K. Nutrient and drug interactions. Beslenme ve Diyet Derg 2014;42(2):154-9.
13. Genser D. Food and drug interaction: consequences for the nutrition/health status. Ann Nutr Metab 2008;52:29-32.
14. Nazer LH, Tuffaha H. Health care and pharmacy practice in Jordan. Can J Hosp Pharm 2017;70(2):150-5.
15. Atavwoda A, Gabriel A. Assessment of pharmacists knowledge, attitude and practices regarding herbal drug information services. J Basic Clin Pharm 2012;3(3):317-22.
16. İstanbulluoğlu S, Celiker A. The role of pharmacist in prevention of drug-herbal product interactions. FABAD J Pharm Sci 2018;43(3):201-16.
17. Yükseköğretim Kurumu. Ulusal çekirdek eğitimi programları: Mezuniyet Öncesi Eczacılık Eğitimi – Ulusal Çekirdek Eğitim Programı 2019 (cited 2023 December 11). https://www.yok.gov.tr/kurumsal/idari-birimler/egitim-ogretim-dairesi/ulusal-cekirdek-egitimi-programlari
18. Karagöz MF, Gezmen Karadağ M, Yıldıran H, Akçil Ok M. Developing a food and drug interaction knowledge scale for health care professionals: a validity and reliability study. SDÜ Sağlık Bilim Derg 2022;13(1):48-59.
19. Harnett JE, Ung COL. Towards defining and supporting pharmacists' professional role associated with traditional and complementary medicines–A systematic literature review. Res Social Adm Pharm 2023;19(3):356-413.
20. San San Tan C, Wen Huey Lee S, Lagoon Selatan J, Sunway B. Warfarin and food, herbal or dietary supplement interactions: a systematic review. Br J Clin Pharmacol 2021;87(2):352-74.
21. Rashrash M, Schommer JC, Brown LM. Prevalence and Predictors of Herbal Medicine Use Among Adults in the United States. J Patient Exp 2017;4(3):108-13.
22. Fakeye TO, Onyemadu O. Evaluation of knowledge base of hospital pharmacists and physicians on herbal medicines in Southwestern Nigeria. Pharm Pract 2008;6(2):88-92.
23. Apikoglu-Rabus S, Sancar M, Okuyan B, Izzettin FV. Turkish pharmacy technicians' counseling practices and attitudes regarding emergency contraceptive pills. African Journal of Pharmacy and Pharmacology 2011;5(1):60-6.
24. Baypınar MŞ. The evaluation of the awareness of pharmacists on the ınteraction between widely used herbal products and drugs (Master Thesis). Ankara: Hacettepe Univ. 2019.
25. Carr A, Santanello C. Pharmacists' knowledge, perceptions, and practices regarding herbal medicine. Inov Pharm 2019;10(3):15.
26. Oshikoya KA, Oreagba IA, Ogunleye OO, Oluwa R, Senbanjo IO, Olayemi SO. Herbal medicines supplied by community pharmacies in Lagos, Nigeria: pharmacists' knowledge. Pharm Pract 2013;11(4):219-27.
27. Bardak F. Pharmacists' self drug application cases. J Curr Nurs Res 2021;1(1):20-31.
28. Klepser TB, Doucette WR, Horton MR, Buys LM, Ernst ME, Ford JK, et al. Assessment of patients' perceptions and beliefs regarding herbal therapies. Pharmacotherapy 2000;20(1):83-7.
29. Radwan A, Sweileh A, Shraim WA, Hroub A, Elaraj J, Shraim N. Evaluation of community pharmacists' knowledge and awareness of food–drug interactions in Palestine. Int J Clin Pharm 2018;40(3):668-75.
30. Zawiah M, Yousef A-M, Khan AH, ALAshwal FY, Matar A, ALKhawaldeh B, et al. Food-drug interactions: Knowledge among pharmacists in Jordan. PLoS ONE 2020;15(6):e0234779
31. Crighton E, Coghlan ML, Farrington R, Hoban CL, Power MWP, Nash C, et al. Toxicological screening and DNA sequencing detects contamination and adulteration in regulated herbal medicines and supplements for diet, weight loss and cardiovascular health.

J Pharm Biomed Anal 2019;30:112834.

32. Corum D, Üney K. Nutrient-drug interactions. Dicle Üniversitesi Veteriner Fakültesi Dergisi 2017;10(1):38-55.
33. Bushra R, Aslam N, Khan AY. Food-drug interactions. Oman Med J 2011;26(2):77-83.
34. Bailey DG, Malcolm J, Arnold O, Spence JD. Grapefruit juice–drug interactions. Br J Clin Pharmacol 1998;46(2):101-10.
35. Ovesen L, Lyduch S, Idorn ML. The effect of a diet rich in brussels sprouts on warfarin pharmacokinetics. Eur J Clin Pharmacol 1988;34(5):521-3.
36. Karlson B, Leijd B, Hellström K. On the influence of vitamin K rich vegetables and wine on the effectiveness of warfarin treatment. Acta Med Scand 1986;220(4):347-50.