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Research Article

Knowledge and Awareness toward Food Drug Interaction among Pharmacists in Erbil City

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ABSTRACT

In the evolving landscape of healthcare, understanding the potential interactions between pharmaceutical drugs and food is imperative yet often overlooked. This study aimed to assess pharmacists' knowledge of food-drug interactions (FDI) in Erbil city, focusing on comprehension, risk factors, counseling practices, and familiarity with drug databases. Conducted through a survey-based approach, the research involved 100 pharmacists from varying educational backgrounds, sampled purposively from Doctors Street in Erbil. Data collection occurred over 2 months through a self-administered questionnaire comprising 34 questions covering basic FDI awareness and advanced topics. Results indicate a correlation between higher education levels and a deeper understanding of FDI, particularly in recognizing specific drug-nutrient interactions. Nonetheless, knowledge gaps persist, underscoring the complexity of FDI comprehension. Intriguingly, pharmacists with institute certificates exhibited nuanced understanding in certain scenarios, challenging assumptions about the linear relationship between education and awareness. The study emphasizes the necessity for targeted interventions in pharmaceutical education to address these nuances effectively. These findings contribute to the growing body of knowledge on FDI awareness among pharmacists, highlighting the importance of continuous education to ensure optimal patient care, treatment efficacy, and safety.

Keywords: Erbil, Food-drug interactions, Knowledge assessment, Patient care, Pharmaceutical education

INTRODUCTION

In today's fast-paced world, the use of pharmaceutical drugs has become increasingly common. As individuals seek medical assistance for various ailments, it is crucial to consider the potential interactions between medications and food, which can significantly impact treatment outcomes and patient safety.[1] The complex interactions between the substances we consume and the drugs we take can significantly impact the therapeutic outcomes and potentially lead to adverse reactions or reduced efficacy of treatments.[2-7] Food and drug interactions (FDI) arise due to either pharmacokinetic or pharmacodynamics mechanisms. Pharmacokinetic mechanisms refer to how the body processes a drug, while pharmacodynamics mechanisms pertain to the effects of drugs on the body.[8] Various types of food have been demonstrated to impact drug metabolism and absorption.[9]

Numerous factors contribute to FDI, including the chemical composition of foods, the mechanisms of drug absorption and metabolism, and individual variations in metabolism and genetic predispositions.[4-13] Some foods can interfere with drug absorption by binding to or altering the pH of the gastrointestinal tract, thus affecting the drug's bioavailability. In addition, certain foods may interact with drugs at the metabolic level, either by inhibiting or inducing enzymes responsible for drug breakdown, leading to changes in drug concentration and effects. Understanding these interactions is crucial for healthcare professionals and patients to optimize medication regimens and ensure patient safety.[14-17] The intricate relationship between food and drugs, known as FDI, has gained recognition as a critical area of study in healthcare.[18] Pharmacists, as frontline healthcare professionals, play a pivotal role in ensuring patients' well-being by possessing in-depth knowledge and awareness of FDI.[19] It is essential for pharmacists to possess a comprehensive understanding of FDI and its implications. Despite the growing importance of this subject, limited research has focused on

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assessing the knowledge and awareness levels of pharmacists regarding FDI in Erbil city.

This article aimed to bridge this knowledge gap by exploring the current understanding and awareness of pharmacists in Erbil city regarding FDI, which can provide valuable insights into the extent to which pharmacists in this region are equipped to identify and manage potential FDI risks.

Enhancing the knowledge and awareness of pharmacists toward FDI is crucial for promoting patient safety and optimizing therapeutic outcomes. By shedding light on the current scenario in Erbil city, this study aims to contribute to the existing body of knowledge in FDI research and provide actionable insights for healthcare policymakers, regulatory bodies, and pharmaceutical education institutions. Ultimately, it is our hope that this research will foster the development of targeted interventions and initiatives that empower pharmacists to deliver effective pharmaceutical care, ensuring the well-being of the population they serve.

MATERIALS AND METHODS

Study Design

This study employed a survey-based research methodology to assess the knowledge and awareness of FDI among pharmacists in Erbil city. The main aim was to investigate the degree of knowledge and awareness among pharmacists of both genders and varying academic backgrounds and to associate their knowledge and awareness with their education levels.

Study Population

The study population included male and female pharmacists with different education levels, ranging from certificate holders from institutes to those with bachelor's degrees and higher education (postgraduate and Ph.D.). The pharmacists were selected from pharmacies located on Doctors Street in Erbil city.

Sampling Design and Techniques

Purposive sampling was implemented for this study. A total of 100 pharmacists were selected, comprising 47 males and 53 females. Participants were distributed according to their education levels. Only those who accepted to participate voluntarily and provided their consent were included in the study.

Survey Structure

The survey covered various aspects of FDI, including:

- Understanding of common drug-nutrient interactions
- Identification of risk factors
- Counseling practices
- Familiarity with relevant drug databases and resources.

Data Collection and Analysis

Data were collected through the administered survey, which was designed to gauge the overall level of knowledge and awareness among pharmacists. The collected data were then analyzed to identify potential areas for improvement in knowledge and awareness regarding FDI.

Method of Data Collection

The required information obtained using a suitable questionnaire.

Study pattern: In this study, the required data collected from the pharmacists using a self-administered Questionnaire.[20] The data were collected within 2 months (December to February 2022) from the pharmacies in Doctors Street of Erbil City.

Questionnaire was included 34 questions which could be divided into two different domains: (1) Basic and general awareness about FDI and (2) advanced questions about the interaction of different foods with certain drugs.

Scoring guideline: The overall level of knowledge and awareness about FDI is calculated by summing up all the correct answers. Each correct answer scored 1 and each incorrect answer scored 0. The sum of total scores considered as overall FDI knowledge value. The possible range of scores was 0–34 scores. However, the minimum score in our results was 11, and the maximum score was 33. To make comparison between the three groups in terms of the level of knowledge regarding FDI, a range defined: (1) 11–18: Low knowledge, (2) 19–25: Medium knowledge, (3) 26–34: High knowledge.

Statistical Analysis

After data cleaning, data were entered to Microsoft Excel and then SPSS (V.16) was implemented for further statistical analysis. The Chi-square test and ANOVA test were used for making comparison between the percentage of participants, and the mean of scores, respectively. A $p \leq 0.05$ was considered as statistically significant.

RESULTS AND DISCUSSION

Drug interactions (DI) are the main cause for many issues in pharmacotherapy. Changes which occur in these interactions can lead to altered drug effectiveness, increased or decreased drug potency, changes in the way a drug is metabolized or absorbed, or the occurrence of unexpected side effects in effects of a drug or simultaneous administration of another drug may cause DI.[21] FDI, herb DI, laboratory DI, etc. are concepts emerged from the DI.[22]

The more complicated nature of food with different components increases the risk of food-drug interaction. Even FDI might reveal more difficulties than a drug-drug interaction.[23] Food-induced changes in drug bioavailability determine the patient's safety is the first and foremost critical issue in health care system.[24,25] Lack of knowledge, or report about FDI, and ignorance may cause irrecoverable health complications.[26]

Table 1 presents the general information of the participants. Required demographic information of the participants including the age, gender, and education level of the participants has been presented in Table 1. The study population comprised 45% male, and 51% female pharmacists from different pharmacies from Erbil city. A higher percentage

Table 1: General information of the participants n (%)

Variables	Gender		Total
	Male	Female	
	n-47	*n*-53	100
Education			
Institute	18 (38.3)	22 (41.5)	40 (40.0)
Bachelor	21 (44.7)	21 (39.6)	42 (42.0)
Postgraduate	6 (12.8)	8 (15.1)	14 (14.0)
Ph.D.	2 (4.3)	2 (3.8)	4 (4.0)
Age			
20–30	41 (87.2)	49 (92.5)	90 (90.0)
31–40	6 (12.8)	4 (7.5)	10 (10.0)

of the participants both male and females, belonged to the age range of 20–30 years old (Males-87.2%; Females-92.5%). The higher percentage of the male participants (44.7%) had a bachelor degree, while a higher percentage of females (41.5%) had only an institute certification in pharmacy.

The overall knowledge of the pharmacists with different academic background (institute certificate holders, Bachelor, Higher education) toward FDI is presented in Table 2. The total correct responses to the questionnaire were used as a determinant of overall knowledge of participants regarding food-drug interaction. Table 2, displays the knowledge and comparison of FDI among pharmacists with different level of education in Erbil city. The percentage of total correct answers to each question among participants is representative of the level of knowledge of the participants in each education group.

The differences between the levels of knowledge regarding each question were significant only in Q4, Q9c, Q10f, and Q17. It is obvious from Table 2 that the higher percentage of pharmacist with higher level of education was aware of the possibility of interaction between MAO Inhibitors with cheese, processed meats, legumes, wine & beer, fava beans, and fermented products.

It is surprising that in certain questions (Q9e, Q9f, Q9g, Q10j, Q12, Q14, and Q15) the percentage of total scores of pharmacists with higher level of education were lower than even their institute certificate holder counterparts. Conversely, in other questions, the percentage of total correct answers showed an ascending trend in favor of higher-educated pharmacists. However, the differences between the percentages of total scores were not statistically significant.

The comparison between the mean of total scores among the pharmacists with different education level has been presented in Table 3. It is evident from the table that the mean of total scores was higher for pharmacist with a higher level of education (Higher education-20.56±6.206; Bachelor-20.48±4.139) compared to their institute certificate holder counterparts (17.97±3.765); this shows that knowledge and awareness of pharmacists with higher education level regarding FDI was higher in comparison with pharmacist with a certificate from institutes. It is interesting that the differences in the mean of total scores were highly significant (Pv=0.024).

Table 2: Comparison of the knowledge of food-drug interactions of pharmacists with different academic level in %

Q No.	Level of education among pharmacists			Chi-square	
	Institute	Bachelor	Higher education		
n	*n*=40	*n*=42	*n*=18	X^2	Pv
Q1	80.0	76.2	83.3	0.428	0.807
Q2	77.5	95.2	83.3	5.484	0.064
Q3	80.0	92.9	88.9	3.064	0.216
Q4	62.5	72.2	92.9	10.944	0.004
Q5	37.5	35.7	44.4	0.415	0.813
Q6	55.0	61.9	72.2	1.573	0.456
Q7	72.5	90.5	88.9	5.232	0.073
Q8	40.0	19.0	27.8	4.384	0.112
Q9a	65.0	71.4	66.7	0.4.07	0.816
Q9b	60.0	69.0	66.7	0.764	0.682
Q9c	60.0	83.3	94.4	10.210	0.006
Q9d	70.0	66.7	66.7	0.123	0.941
Q9e	57.5	61.9	44.4	1.574	0.455
Q9f	50.0	52.4	44.4	0.317	0.853
Q9g	60.0	59.5	55.6	0.110	0.947
Q10a	87.5	97.6	100.0	5.121	0.077
Q10b	32.6	40.5	44.4	0.940	0.625
Q10c	45.0	54.0	66.7	2.430	0.297
Q10d	40.0	47.6	66.7	3.541	0.170
Q10e	0.0	2.4	11.1	5.362	0.068
Q10f	22.5	52.4	38.9	7.772	0.021
Q10g	20.0	35.7	44.4	4.220	0.121
Q10h	60.0	64.3	72.2	0.807	0.668
Q10i	62.5	52.4	66.7	1.401	0.496
Q10j	70.0	66.7	66.7	0.123	0.941
Q11	32.5	50.0	44.4	2.630	0.269
Q12	47.5	66.7	44.4	4.029	0.133
Q13	37.5	35.7	61.1	3.697	0.157
Q14	70.0	71.4	50.0	2.888	0.236
Q15	57.5	64.3	55.6	0.574	0.751
Q16	82.5	83.3	83.3	0.012	0.994
Q17	50.0	81.0	72.2	9.148	0.010
Q18	52.5	52.4	66.7	1.207	0.547

The level of awareness and knowledge of the participants with different age groups is presented in Table 4. In general, degree of awareness and knowledge is associated with age. Here, in the present study, we investigated the association between degrees of knowledge of participants toward FDI with different age ranges. The mean of total scores compared between participants with age group 20–30, and 31–40. It was surprising that the majority of the participants were belonged to the age group 20–30 years old, and only 10 participants belonged to the age group of 31–40.

Table 3: Comparison of the overall knowledge of the participants: Based on Mean±SD total scores

Q No.	Level of education among Pharmacists			ANOVA	
	Institute	Bachelor	Higher education		
n	*n*=40	*n*=42	*n*=18	F	Sig.
Mean±SD	17.97±3.765	20.48±4.139	20.56±6.205	3.888	0.024

Table 4: Knowledge and awareness of the participants with different age ranges: presented as (Mean±SD)

Variable	Age range (years)		ANOVA	
	20–30	31–40	F	Sig.
n	*n*=90	*n*=10		
Mean±SD	19.42±4.695	20.10±3.281	0.197	0.658

Although the mean of total knowledge scores was slightly higher (20.10±3.281) among elder participants (age group 31–40), however, the differences between the mean of scores statistically were not significant. That could be due to having un-homogenized groups in terms of a number of participants in each group.

It could be even more favorable to do the comparison between the level of knowledge and awareness of male and female participants with different age groups, however, due to the lack of a homogenized population groups (uneven number of participant) in each group it is impossible.

The degree of awareness and attitude toward FDI has been presented in Table 5. It is obvious from Table 5 that the higher percentage of pharmacists with different level of education were aware about food-drug interaction but the differences between the three groups in both males and females were not statistically significant. The majority of the participants both males and females stated the importance of knowledge about FDI, hence, it was obvious from Table 3 that a higher percentage of pharmacists with bachelor and higher degree emphasized in the importance of knowledge regarding FDI. However, the differences between a number of positive responds to the importance of knowledge regarding FDI in both males and females with different degree certificates were not statistically significant.

The level of awareness of the participants with different academic background (Institute, bachelor, and higher education) regarding the importance of FDI for elderly people is presented in Table 6. Higher percentage of pharmacist with master or Ph.D degree (Higher education level) was aware of the importance of food and drug interaction among the senior citizens due to increasing the likelihood of occurrence of food and drug interaction. In the contrary, the higher percentage of individuals with only institute certificate in pharmacy had a higher level of awareness toward the necessity of FDI for older individuals followed by pharmacist with higher level of education and bachelors. However, the results do not support any relationship between the degree of awareness regarding the importance of FDI for the elderly and the level of education of the participants.

The degree of knowledge and understanding of the participants with different academic background about the concept of food-drug interaction has been presented in Table 7. It is apparent from Table 7 that, a higher percentage of the pharmacists with a bachelor degree and higher (Males: bachelor-52.4%, Higher education-75.0%; Females: Bachelor-71.4%, Higher education-70.0%) had a better understanding about food and drug interaction compared to their institute certificate holder counterparts. However, the comparisons were not statistically significant.

The level of awareness of the participants regarding the factors affecting FDI has been presented in Table 8. Age of the individuals, drug dosage, and health status are the main factors affecting FDI. It is interesting that a higher number of pharmacists with higher degree (bachelor and above) both males and females were more knowledgeable about factors affecting food and drug interaction compared to their counterparts.

Level of knowledge of the participants toward Food-drug interaction among male and female pharmacist with different education levels is presented in Table 9. The knowledge here represents the total correct answers regarding the food and drug interaction. It is obvious from Table 9 that a higher number of pharmacists both males and females (Male-55.6%; Females-63.6%) with a lower education level (institute) had lower knowledge about food and drug interaction. Among the participants, pharmacists with the bachelor degree, both males (61.9%) and females (57.1%) had a medium level of knowledge regarding FDI.

The level of knowledge of the participants regarding the importance of avoidance of consumption of drugs with certain food items has been presented in Table 10. It is evident from Table 10 that among males, a higher percentage of pharmacists with a bachelor degree and above (bachelor-66.7%, Higher education-75%) compared to their institute certificate holder counterparts were more aware about the importance of not consuming theophylline/NSAID with tea, chocolate, and coffee. However, females with bachelor's degree were more knowledgeable about the interaction occurs between theophylline and chocolate, tea, and coffee in the body, still the degree of difference in their responses is not statistically significant.

Likewise, a higher percentage of female participants with a higher degree in pharmacy (bachelor and above) (Bachelor-66.7%; Higher education-80.0%) revealed to be more aware about the significance of avoidance of ingestion of dairy products with tetracycline and fluroquinolones. However, this pattern was not observed among male counterparts. It was interesting that the majority of participants both male and females with higher degree in pharmacy (bachelor and above) were highly familiar with the importance of prevention of the intake of MAO inhibitors and cheese, possessed meats, legumes, wine and beer, fava beans compared to their institute certificate holder counterparts. Similarly, the higher percentage

Table 5: Awareness and attitude toward food-drug interactions

Variables	Male			Female		
	Institute	Bachelor	Higher education	Institute	Bachelor	Higher education
n	***n*=18**	***n*=21**	***n*=8**	***n*=22**	***n*=21**	***n*=10**
Awareness about FDI (being familiar with FDI)						
Yes	15 (83.3)	15 (83.3)	7 (87.5)	17 (77.3)	17 (81.0)	8 (80.0)
Chi-square		χ^2=1.263, Pv=0.532			χ^2=0.093, Pv=0.955	
Importance of knowledge about FDI						
Yes	13 (72.2)	18 (85.7)	7 (87.5)	19 (86.4)	21 (100.0)	9 (90.0)
Chi-square		=1.415, Pv=0.493			=2.970, Pv=0.227	
Importance of report about FDI						
Yes	12 (66.7)	20 (95.2)	5 (62.5)	13 (59.1)	19 (90.5)	8 (80.0)
Chi-square		6.239, Pv=0.044			=5.854, Pv=0.054	

Table 6: Knowledge regarding the importance of food-drug interactions for elderly

Variable	Male			Female		
>60 years	**Institute**	**Bachelor**	**Higher Education**	**Institute**	**Bachelor**	**Higher education**
Yes	4 (22.2)	7 (33.3)	4 (50.0)	11 (50.0)	8 (38.1)	4 (40.0)
Chi-square		χ^2=2.002, Pv=0.368			χ^2=0.678, Pv=0.713	
			χ^2=1.394, Pv=0.238			

Table 7: Knowledge and understanding the concept of food-drug interactions

Gender	Male			Female		
Variable	**Institute**	**Bachelor**	**Higher education**	**Institute**	**Bachelor**	**Higher education**
Concept of FDI						
Chi-square	9 (50.0)	11 (52.4)	6 (75.0)	13 (59.1)	15 (71.4)	7 (70.0)
		χ^2=1.533, Pv=0.465			χ^2=0.815, Pv=0.665	

Table 8: Knowledge regarding factors affecting food-drug interactions

Variable	Male			Female		
	Institute	Bachelor	Higher education	Institute	Bachelor	Higher education
Awareness regarding factors affecting FDI						
Chi-Square	16 (72.7)	20 (95.2)	9 (90.0)	13 (72.2)	18 (85.7)	7 (87.5)
		χ^2=1.415, Pv=0.493			χ^2=4.498, Pv=0.106	

Table 9: Level of knowledge toward food-drug interactions (FDI) among male and female pharmacist with different level of education

Gender	Male			Female		
Variables	**Institute**	**Bachelor**	**Higher education**	**Institute**	**Bachelor**	**Higher education**
	***n*=18**	***n*=21**	***n*=8**	***n*=22**	***n*=21**	***n*=10**
Low knowledge 11–18	10 (55.6)	8 (38.1)	3 (37.5)	14 (63.6)	5 (23.8)	4 (40.0)
Medium knowledge 19–25	8 (44.4)	13 (61.9)	3 (37.5)	8 (36.4)	12 (57.1)	5 (50.0)
High knowledge≥26	0 (0.0)	0 (0.0)	2 (25.0)	0 (0.0)	4 (19.0)	1 (10.0)
Chi-square		χ^2=11.449, Pv=0.022			χ^2=9.100, Pv=0.059	

of pharmacists with a higher level of education (bachelor and above) had a better level of understanding about the significance of stopping the consumption of acidic foods with antibiotics. Interns showed poor performance in overall FDI, which could be due to a lack of knowledge, awareness, and clinical exposure.

Table 10: Importance of prevention of consumption of drug with foods

Gender	Male			Female		
Variables	**Institute**	**Bachelor**	**Higher education**	**Institute**	**Bachelor**	**Higher education**
n	***n*=18**	***n*=21**	***n*=8**	***n*=22**	***n*=21**	***n*=10**
Consumption of theophylline/NSAIDs with tea, chocolate, and coffee						
Yes	11 (61.1)	14 (66.7)	6 (75.0)	15 (68.2)	16 (76.2)	6 (60.0)
Chi-Square		=0.890, Pv=0.641			=0.484, Pv=0.785	
Milk and dairy products iron-rich food and supplements with tetracycline and fluro-quinolones						
Yes	14 (77.8)	15 (71.4)	4 (50.0)	10 (45.5)	14 (66.7)	8 (80.0)
Chi-square		=4.005, Pv=0.135			=2.070, Pv=0.355	
MAO inhibitors and cheese, possessed meats, legumes, wine & beer, fava beans						
Yes	10 (55.6)	16 (76.2)	8 (100.0)	14 (63.6)	19 (90.5)	9 (90.0)
Chi-square		=5.749, Pv=0.056			=5.573, Pv=0.062	
Caffeine consumption with quinidine, diazepam, pseudoephedrine & theophylline						
Yes	14 (77.8)	12 (57.1)	5 (62.5)	14 (63.6)	16 (76.2)	7 (70.0)
Chi-square		=1.889, Pv=0.389			=0.804, Pv=0.669	
Garlic/ginger with coumarins						
Yes	14 (77.8)	12 (57.1)	3 (37.5)	9 (40.9)	14 (66.7)	5 (50.0)
Chi-square		=4.136, Pv=0.126			=2.900, Pv=0.235	
Acidic foods and beverages, and antibiotics						
Yes	7 (38.9)	11 (52.4)	5 (62.5)	13 (59.1)	11 (52.4)	3 (30.0)
Chi-square		=1.416, Pv=0.493			=2.357, Pv=0.308	

Table 11: Degree of knowledge about the likelihood of interaction of different food with certain drugs (Mean±SD)

Gender	Male			Female		
Variables	**Institute**	**Bachelor**	**Higher education**	**Institute**	**Bachelor**	**Higher education**
Mean of scores (Range of scores 0–7)						
Mean±SD	4.44±1.338	4.48±1.340	4.39±1.614	4.05±1.290	4.81±1.537	4.30±1.418
ANOVA			F=0.067, Pv=0.796^{NS}			

Our results were not in line with the results of Benni *et al*. (2012) in terms of awareness regarding cheese reaction[20] which occurs in depressive disorder patients on monoamine oxidase inhibitors as the majority of our population study were aware about this type of interaction. However, it could be due to the population in their study was not comprised of pharmacists but medical doctors and surgeons.

It is obvious from Table 10 that the majority of female pharmacists with a higher level of education were well-informed about the importance of avoiding the intake of caffeine consumption with quinidine, diazepam, pseudoephedrine and theophylline due increasing the risk of drug toxicity with symptoms such as nervousness, tremor, and insomnia. However, surprisingly pharmacists with only institute certificate were more educated about the risk of consumption of quinidine, diazepam, pseudoephedrine and theophylline along with caffeine. It is interesting from the result that among the males, a higher percentage of the institute certificate holders were more aware about the increasing the risk of bleeding by increasing the potential of these drugs in terms of stimulating and anticoagulation in multiple ways in the body. Conversely, female pharmacist with higher degree had better knowledge regarding the interaction between garlic and ginger with coumarin.

The level of knowledge regarding the interaction of different drugs with certain foods has been presented in Table 11. The level of knowledge of the participants regarding the possibility of interaction of certain foods with specific drugs has been presented as Mean±SD of scores. It is obvious from Table 8 that the mean of scores for knowledge regarding the possibility of food and drug interaction did not show significant differences among male and female participants with different education level.

CONCLUSION

Our results indicate that pharmacists with higher academic backgrounds generally possess a better understanding of FDI. This study highlights the necessity to increase knowledge and awareness among pharmacists, as inadequate information about FDIs can lead to improper patient counseling and adverse side effects.

The findings reveal a positive association between higher education levels and a deeper comprehension of FDIs, particularly in recognizing specific drug-nutrient interactions. However, the knowledge gaps identified among pharmacists with lower educational qualifications emphasize the need for continuous professional development and targeted interventions.

Education alone is not sufficient; ongoing professional development and specialized training programs are crucial to address specific FDI scenarios and enhance practical application in pharmaceutical care. Bridging these knowledge gaps is essential for optimizing treatment outcomes, ensuring patient safety, and maintaining healthcare standards.

This research underscores the dynamic nature of healthcare and the importance of continuous learning in the field of pharmacotherapy. It provides a foundation for improving pharmaceutical education strategies to better equip pharmacists in managing FDIs.

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