Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Shahid Sadoughi University of Medical Sciences
School of Public Health
Nutrition Department

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2026; 11(3): 386-392 Website: jnfs.ssu.ac.ir

# *Knowledge, Awareness, and Attitudes toward Food–Drug Interactions among a Sample of the Iraqi Population in Baghdad: A Cross-Sectional Study*

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***ARTICLE INFO***

***ORIGINAL ARTICLE***

***Article history:***
Received:8 Mar 2025
Revised: 23 Feb 2026
Accepted: 23 Feb 2026

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***Keywords***
*Food-drug interaction; Knowledge; Awareness; Iraqi people; Patient education.*

***ABSTRACT***

**Background:** Food-drug interactions (FDIs) are not adequately recorded and can be linked to several factors, such as insufficient documentation of food history, lack of follow-up, or lack of awareness. The objective of study was to assess the level of knowledge and awareness among the Baghdad population regarding FDIs. **Methods:** This study was conducted as a cross-sectional study, spanning from March 2024 to May 2024, and included a total of 612 individuals. Participants were given a standardized questionnaire to gather data on their understanding of FDIs. A descriptive analysis was conducted to ascertain the frequency of responses. **Results:** The overall rate of response was 85%, with a greater proportion of females; 92% were in the age bracket of 20-30. Just 23% of the participants had encountered FDI at least once throughout their lifetimes. Drug package leaflets should also be read before using the medication, according to over 91% of respondents. 91% of the respondents acknowledged that acidic foods and beverages can impact the absorption of pharmaceuticals and lead to interactions between food and drugs. Furthermore, they firmly believe that alcohol and drugs should never be ingested together. **Conclusion:** The participants were knowledgeable and conscious about FDIs. This outcome has the potential for further optimization, given that a significant majority of respondents expressed a favorable inclination towards reading the medicine label prior to utilizing pharmaceuticals.

## Introduction

The absorption of orally administered drugs can be influenced by the presence of food, as it can induce alterations in the gastrointestinal tract, including modifications in gastric emptying time, acidity levels, and bile salt content.

Food-effect studies are usually carried out at the initial stages of drug development as part of the first human research. These studies may be repeated later using a marketed formulation to provide information for inclusion on the product label (Tistaert *et al.*, 2019). Food effects, commonly referred to as food-drug interactions (FDI), are frequently observed when medications are ingested orally. They can be described as alterations in the speed or degree of absorption. The effects of foods and their consequences can be influenced by various elements, including human postprandial physiology, pharmacological characteristics, and drug administration. Hence, it is vital to possess a comprehensive comprehension of these mechanisms prior to suggesting the consumption of a specific medication with or

***This paper should be cited as:*** Ali Saleh M, Shukur Mohammed S. ***Knowledge, Awareness, and Attitudes toward Food–Drug Interactions among a Sample of the Iraqi Population in Baghdad: A Cross-Sectional Study.*** *Journal of Nutrition and Food Security (JNFS)*, 2026; 11(3): 386-392.

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[ DOI: 10.18502/jnfs.v11i3.22154 ]

without food. FDIs can have a substantial impact on medical treatment, especially when they must be avoided to prevent adverse effects or utilized to enhance the effectiveness of pharmacological therapy (Deng *et al.*, 2017). Drug interaction is a major element that can change the effectiveness of a treatment (SK *et al.*, 2022). The elderly population is particularly vulnerable due to their consumption of almost 30% of all prescribed medications. Failure to accurately detect and effectively manage drug-nutrition interactions can result in severe effects. Moreover, drug-nutrient interactions can cause a reduction in the absorption of certain oral antibiotics, resulting in suboptimal concentrations of medicines at the site of illness. This leads to therapy failure for the patient. The presence of nutrients can either stimulate or suppress the activity of intestinal enzymes, which can have a substantial impact on the extent to which a medicine is absorbed into the bloodstream through the mouth, or vice versa (Genser, 2008). Most drugs consist of potent components that produce different effects on the human body based on their interactions. When a food substance interacts with a drug, it is called a FDI, which can result in changes that either slow down or speed up the medicine's effects or have a completely different impact. Certain fruits, herbs, and alcohol consumption can potentially result in therapeutic failure, posing a risk to an individual's well-being (Bushra *et al.*, 2011). Schmidt and Dalhoff aimed to elucidate the therapeutic significance of drug-food interactions, asserting that the most notable interactions hinder treatment by reducing the availability of the drug (Schmidt and Dalhoff, 2002).A study was conducted in the United Arab Emirates to assess people's knowledge of drug-drug, drug-disease, and drug-food interactions. The findings revealed that respondents had little awareness of drug-food interactions and their significance (Hamoudi, 2013). A significant number of hospitals still do not have pharmacovigilance and adverse drug reaction (ADR) reporting systems (Mohamed and Basel, 2015). Due to their complexity, FDIs require the attention of both patients and healthcare practitioners. In order to mitigate the detrimental health consequences that may arise from the interaction between food and drugs, it is imperative that the general population is well-informed about these interactions and that additional information on this topic is readily accessible (Abualhamail *et al.*, 2016). The research aimed to assess the knowledge, awareness, and attitudes regarding FDIs within the general population by an online self-administered questionnaire. The objective of this research was to assess the extent of knowledge and awareness regarding FDIs among the population of Baghdad, Iraq.

## Materials and Methods

### *Study design*

The study was carried out in Baghdad, Iraq, utilizing an electronic cross-sectional survey. The survey was conducted online using a Google form from March 2024 to May 2024. The distribution of these forms was facilitated by social media platforms, reaching individuals from diverse backgrounds. The questionnaire was adapted from previously validated studies and consisted of 22 close-ended questions and one open-ended question (Alqahtani, 2020), structured into three sections.

The demographic characteristics of the participants included age, gender, educational level, marital status, and occupation.

The knowledge area assessed the factual understanding of FDIs, including specific food-drug combinations such as tetracycline with milk, grapefruit with medications, and alcohol-drug interactions and the awareness and attitude domain evaluated participants' general impressions, recognition of FDIs, and their perspectives on reading drug labels and seeking supplementary information.

In this research, Knowledge referred to participants' factual and precise comprehension of food-drug interactions and their clinical ramifications. Awareness pertains to the general acknowledgment of the existence, significance, and potential hazards of FDIs, without necessitating in-depth pharmacological expertise.

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The attitude demonstrated participants' readiness to embrace safe actions, including scrutinizing drug labels and pursuing additional information regarding FDIs. Each domain was evaluated autonomously utilizing predetermined inquiries

### *Survey participants*

This study included a randomly selected sample of general population comprising both males and females aged between 21 and 60. The survey was completed over three months. Participation was optional, and the received data was handled with confidentiality. Responses were quantified using a numerical system where each response to a specific question was assigned a number. The questions that were answered were gathered and examined. Moreover, participants were recruited through a convenience sampling method using social media platforms, including WhatsApp and Facebook, to engage individuals from diverse areas of Baghdad. Eligible participants included Iraqi residents aged 21 to 60 who freely accepted to participate.

The inclusion criteria consisted of residents of Baghdad, Iraq; being 21 or older; ability to understand and analyze the questionnaire and willingness to provide informed consent. The exclusion criteria included healthcare professionals (physicians, pharmacists, nurses, or allied health practitioners) and incomplete questionnaire submissions. Although the study targeted the general population, a considerable proportion of respondents held a university degree or above.

### *The scoring system*

Each correct answer in the knowledge and awareness portions was awarded a score of 1, while incorrect or "don't know" responses received a score of 0. Total scores were calculated by summing the scores of each item. Scores were categorized as follows:

- Competent knowledge/awareness: ≥60% of the total score
- Inadequate knowledge/awareness: <60% of the total score

Attitude was assessed via affirmative responses to attitude-related questions, with those scoring ≥60% classified as having a positive attitude validity and reliability.

### *Validity and reliability*

A team of academic specialists in pharmacy and clinical pharmacology assessed content validity to guarantee the clarity, relevance, and appropriateness of the questionnaire items. A pilot test was conducted on a restricted sample to assess clarity and completion time. The internal consistency reliability was considered satisfactory after expert assessment.

### *Ethical considerations*

The study protocol received approval from the Regional Ethics Committee of the Faculty of Pharmacy, Al-Rafidain University College, in conformity with internationally recognized medical research protocols and ethical standards.

### *Data analysis*

Data were entered and analyzed using Microsoft Excel 2016. Descriptive statistics were utilized to calculate frequencies and percentages. Moreover, statistical significance was considered pertinent at p-value <0.05, if applicable.

## Results

The overall response rate was 85%, and the entire sample size consisted of 612 Iraqis. Female respondents constituted the overwhelming majority (70%), while males accounted for only 30%. The majority of individuals (96%) possessed a high level of education, whereas 92% fell between the 20-30-year-old age range (**Table 1**). In terms of understanding, 97% of the participants were aware that food and drink can have an impact on drug consumption. Similarly, 96% were aware that food has the potential to expedite or decelerate the effects of medications. Additionally, 96% of the participants were knowledgeable about the influence of fruit juices, alcohol, vitamins, and iron on drug intake. A significant majority of 91% were also knowledgeable about the potential interference of acidic foods and beverages such as tomato sauce, tea, coffee, and citrus juice with drug absorption, which can lead to food-drug interactions.

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According to the research, 7% of the respondents believe that prescriptions should be consumed following meals. 90% of individuals maintain the belief that they should never consume alcohol and drugs together. Furthermore, 92% of the participants demonstrated awareness of the need to avoid consuming tetracycline and milk together, whereas only 62% were cognizant of the necessity to take vitamins with food. 75% of the research participants had an 'adequate' level of comprehension regarding foreign direct investment. Merely 23% of the respondents reported that they have observed such FDIs at least once in their lifetimes. Nearly 91% of individuals agree that it is important to read the leaflets provided with prescription medication before using it. **Table 2** presents a concise overview of the investigation's findings.

## Discussion

This study assessed the knowledge, awareness, and attitudes regarding FDIs within a sample of the Iraqi population in Baghdad. The findings indicated that 73% of the participants possessed a substantial level of knowledge and a highly positive attitude towards safe medication practices, particularly regarding the reading of medicine labels and seeking more information. Numerous challenges arose in determining the most hazardous combinations of medications, such as those involving grapefruit.

The knowledge level identified in this study exceeded that documented in comparable studies conducted in Saudi Arabia and the United Arab Emirates, where public awareness of FDIs was shown to be constrained (Al-Arifi *et al.*, 2016, Alrabiah *et al.*, 2019, Hamoudi, 2013).This disparity may stem from the predominance of participants in this study possessing a university degree or higher degrees. Education level has long been recognized as a crucial determinant of medication-related knowledge and pharmaceutical literacy (Dawood *et al.*, 2017).

Despite widespread knowledge of drugs, many individuals held misconceptions regarding the appropriate timing of their consumption in relation to meals. A significant percentage of participants said that drugs had to be administered postprandially, a conclusion aligned with previous studies conducted in Saudi Arabia and Malaysia (Alqahtani, 2020, Dawood *et al.*, 2017). This misunderstanding is clinically important, as certain drugs, such as proton pump inhibitors and isoniazid, necessitate administration on an empty stomach to attain optimal absorption (Self *et al.*, 1999, Sharma *et al.*, 2007). Failure to adhere to proper medication protocols may diminish therapy efficacy or exacerbate adverse effects.

**Table 1**. Demographic details of the study participants.

| Variable | n (%) |
|---|---|
| Gender | |
| Male | 185(30) |
| Female | 427(70) |
| Education | |
| University degree | 588(96) |
| No University degree | 24(4) |
| Age (y) | |
| 20-30 | 564(92) |
| 31-40 | 20(3) |
| 41-50 | 12-(2) |
| 51-60 | 16(3) |
| Marital status | |
| Married | 77(13) |
| Not married | 535(87) |
| Occupation | |
| Student | 522(85) |
| Governmental | 53(8) |
| Private | 18(3) |
| Not employee | 4(1) |
| Housewife | 4(1) |
| Retired | 5(1) |
| Other | 6(1) |

Various questionnaire items indicated varying degrees of awareness regarding certain food-drug interactions. The majority of participants in the survey accurately recognized alcohol-drug interactions and the necessity of avoiding tetracycline with milk; nevertheless, they were largely uninformed about grapefruit-related interactions. Grapefruit juice markedly modifies the metabolism of several medications by inhibiting cytochrome P450 enzymes, which may

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result in heightened drug toxicity or diminished therapeutic efficacy (Hassali *et al.*, 2010, Schmidt and Dalhoff, 2002). Numerous regional and global studies have demonstrated that individuals possess comparable deficiencies in their understanding of grapefruit (Al-Arifi *et al.*, 2016, Alqahtani, 2020).

**Table 2.** Response of participants for the knowledge, experience, and attitude.

| **Knowledge items** | **Good, n (%)** | **Poor, n (%)** |
|---|---|---|
| Food and beverage can interfere with the drug in the body. | 594(97) | 18(3) |
| Food can speed up or slow down the action of a drug. | 590(96) | 22(4) |
| Food/drug interaction can include fruit juice, alcohol, vitamins, iron. | 589(96) | 23(4) |
| Impact of FDI depends on various factors such as drug dosage, person's age, and health status. | 508(83) | 104(17) |
| Acidic foods and beverages such as tomato sauce, tea, coffee, and citrus juices affect drug absorption and may cause food/drug interaction. | 558(91) | 54(9) |
| Drugs should be always taken after a meal. | 41(7) | 571(93) |
| OTC drugs are safe and do not cause any interactions with herbals or supplements. | 121(20) | 491(80) |
| Alcohol should not be taken with drugs. | 550(90) | 62(10) |
| Grapefruit may cause serious and lethal food/drug interactions. | 420(69) | 192(31) |
| Milk should be avoided with tetracyclines. | 564(92) | 48(8) |
| Geriatrics are at a greater risk for FDI. | 490(80) | 122(20) |
| Unpalatable drugs can be mixed with food to mask their taste. | 379(62) | 233(38) |
| Vitamins can be taken at the same time as food. | 416(68) | 196(32) |
| Average score of knowledge | 448(73) | 164(27) |
| **Experience items** | **Categories** | **Frequency (%)** |
| Did you ever experience food drug interactions before? | 140(23) | 472(77) |
| **Attitude items** | **Positive,n(%)** | **Negative,n (%)** |
| The patient should read the label before using the drug average score of attitude | 559 (91) | 53(9) |
| Would you like to receive more information about food-drug interactions? | 575 (94) | 376) |
| Average score of attitude | 567(93) | 45(7) |

***OTC**: Over-the-counter; **FDI**: Food-drug interactions.*

The findings indicated that individuals held a highly favorable perspective on secure pharmaceutical practices. The majority of respondents indicated that they would examine medication labels and seek additional information concerning FDIs. This corresponds with prior studies demonstrating positive public perceptions despite little knowledge (Abualhamail *et al.*, 2016, Budnitz and Layde, 2007). Optimistic dispositions present a significant opportunity for healthcare systems, as individuals receptive to learning are more inclined to improve their pharmacological practices when provided with appropriate guidance.

This study, however, has numerous limitations. The utilization of convenience sampling and online data collection resulted in an overrepresentation of younger and more educated individuals, hence limiting the generalizability of the findings to the broader population of Baghdad. Similar cross-sectional studies have identified same limitations (Alqahtani, 2020, Alrabiah *et al.*, 2019). Furthermore, dependence on self-reported data may introduce bias in recollection and responses. Future study should employ random sample methods, include individuals from diverse educational backgrounds, and investigate longitudinal designs to improve the assessment of knowledge and behavioral changes across time.

## Conclusion

The evidence indicates that the Iraqi population possesses considerable understanding and knowledge of FDIs. Nevertheless, a substantial majority of participants exhibited a positive

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inclination towards perusing the drug instructions before using them, which indicates a potential remedy to this problem. The findings of this study on the awareness and understanding of interactions between food and pharmaceuticals emphasize the need to intensify efforts to enhance awareness in order to reduce the incidence of FDIs. Therefore, compulsory health education efforts are essential for improving public knowledge and comprehension of FDIs.

## Acknowledgments

We would like to thank all the participants and those who collaborate with the authors to complete and conduct this study

## Conflicts of interest

There are no conflicts of interest.

## Funding

No specific funding was used in conducting this study.

## Authors' contributions

Maha A. Saleh designed, conducted and wrote the research. Samer S. Mohammed analyzed data and had primary responsibility for final content. All authors read and approved the final manuscript.

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