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National assessment of public awareness and attitudes toward food-drug interactions: A study in the Kingdom of Saudi Arabia

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Abstract

Food-drug interactions are an under-recognized risk factor that can significantly alter the efficacy and safety of medications. Understanding public awareness and attitudes towards these interactions is essential for effective healthcare delivery, especially in regions with unique dietary habits and cultural practices. This study aims to assess the current state of knowledge, beliefs, and practices related to food-drug interactions among the Saudi population, thereby identifying the gaps in public awareness and the implications for health education and policy. A cross-sectional survey was conducted across various regions of the Kingdom of Saudi Arabia (KSA), encompassing diverse demographics. The survey included questions related to the knowledge of food-drug interactions, personal beliefs, and reported practices when combining medications with certain foods or dietary patterns. Preliminary findings indicate a notable deficiency in the public understanding of food-drug interactions within the KSA. Many participants were unaware of common interactions, such as those involving grapefruit juice and certain medications. Healthcare professionals also reported a need for more training and resources to counsel patients on this topic effectively. The lack of awareness in the KSA population and among healthcare providers suggests a pressing need for targeted educational interventions. Cultural factors and the prevalent use of herbal medicines underscore the necessity for tailored communication strategies. This study highlights the urgency for enhanced public health initiatives and healthcare professional training to mitigate the risks associated with food-drug interactions in the KSA.

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Introduction

The interplay between food and medications poses a complex challenge in the public health domain, particularly within the distinct cultural and healthcare milieu of the Kingdom of Saudi Arabia (KSA). This research aims to delve into the Saudi public's level of awareness, attitudes, and practices pertaining to food-drug interactions, contextualized within the nation's unique dietary patterns and a healthcare landscape undergoing rapid modernization.

Globally, the literature reveals a pervasive lack of awareness regarding the potential hazards of food-drug interactions. This gap in knowledge is not confined to the general populace but is also prevalent among healthcare professionals, as evidenced by the study conducted by Enwerem and Okunji (2015). Such interactions, especially those involving grapefruit juice and various medications, pose substantial risks to patient safety. These risks are often underestimated or misunderstood, as Bailey *et al.* have documented (2020). The importance of maintaining a consistent diet to ensure the stable metabolism and efficacy of medications has been underscored, highlighting the complexity of managing food-drug interactions (Bailey *et al.*, 2013).

In the context of the KSA, the imperative for educational interventions is particularly pronounced. The existing literature, including the work of Al-Arifi *et al.*, points to a significant knowledge deficit among the population regarding the implications of combining certain foods with medications (Al-Arifi *et al.*, 2014). The widespread use of herbal medicines, as detailed by Alsanad *et al.*, further complicates the interaction between diet and pharmacology, indicating a pressing need for healthcare professionals to have a thorough understanding of these complexities to provide effective patient education (Alsanad *et al.*, 2018).

This study sets out with a primary goal: to propose and advocate for targeted educational interventions and policy reforms tailored to enhance public awareness and optimize healthcare practices concerning food-drug interactions within the KSA. By contributing to the global dialogue on medication safety and public health education and by taking into account the cultural particularities of the Saudi population, this research seeks to forge a path towards informed medication use and prevent adverse drug events through improved public and professional knowledge.

Materials and methods

This study employed a quantitative research design to assess public awareness and attitudes toward food-drug interactions in the Kingdom of Saudi Arabia (KSA). The methodology was structured to address the research objectives and provide a comprehensive overview of the current state of knowledge, beliefs, and practices related to food-drug interactions among the Saudi population.

Study design: A cross-sectional survey was conducted to gather data from a diverse sample of the Saudi population. The survey was designed to assess the public's awareness, attitudes, and beliefs regarding food-drug interactions, as well as to identify common misconceptions or knowledge gaps prevalent among different demographic groups within the Kingdom.

Sample: The sample consisted of individuals aged 18 and above residing in various regions of the KSA. Participants were selected using a stratified random sampling technique to ensure representation from all major demographic groups, including different ages, genders, educational levels, and regions of residence.

Inclusion and exclusion criteria

The study targeted Saudi nationals or residents aged 18 and above who had used prescription or over-the-counter medication within the past year, ensuring the study's relevance to their experiences with food-drug interactions. We excluded individuals below the age of 18, as their medication intake is usually managed by guardians, and their understanding of food-drug interactions might not reflect independent behavior. Non-residents and tourists were also excluded to

maintain a focus on the resident population's interactions with the local healthcare system and cultural practices. Additionally, individuals with cognitive impairments that could impact their comprehension or ability to provide informed consent were not included in the study.

Data collection: Data was collected through a self-administered questionnaire distributed online. The questionnaire was divided into six sections, each addressing a specific aspect of public awareness and attitudes toward food-drug interactions. The questions were structured using a Likert scale, with responses ranging from "Strongly Agree" to "Strongly Disagree" or similar scales relevant to the question. The questionnaire was pre-tested on a small sample to ensure the clarity and validity of the questions.

Data analysis: The data collected from the survey was analyzed using statistical software (SPSS). Descriptive statistics were used to summarize the demographic characteristics of the sample and the overall level of awareness and attitudes toward food-drug interactions.

Quality control and data processing

Quality control measures were strictly enforced to ensure the validity of the data collected. Responses were screened for duplicates, and any anomalies, such as patterned responses, were carefully reviewed to determine their validity. A subset of participants was also re-surveyed to validate the consistency of the data. Before analysis, data cleaning procedures were rigorously applied. This included the verification of incomplete surveys, standardization of open-ended responses, and conversion of Likert scale answers into numerical data for statistical evaluation.

Ethical considerations and sampling strategy

Ethical approval for the study was approved by the Ethical Approval Committee from the Research Department at Hail Health Cluster No H-2023-393. All participants provided informed consent that explained the study's purpose, the voluntary nature of participation, confidentiality assurances, and the right to withdraw at any time. To address potential sampling biases, the stratified random sampling approach was complemented with quota sampling to ensure representation from demographics typically underrepresented in surveys, such as women, the elderly, and residents of rural communities.

Results

Regarding the participation aspect, the vast majority of the sample, 97.6% (n=1015), agreed to participate in the study, with a mean agreement score of 1.011685 and a standard deviation of 0.107514, indicating high consensus. A small minority, 1.2% (n=12), disagreed with participating. The total number of responses for participation was 1027, accounting for 98.8% of the sample. There were 13 instances (1.3%) where participation data was missing.

The demographic data collected provides a comprehensive overview of the study's participants, reflecting a diverse sample in terms of gender, age, education, occupation, and regional distribution within the Kingdom of Saudi Arabia (Table 1).

The study sample comprised 1040 participants, with a near-complete demographic data set (99.1% response rate). The gender distribution was skewed towards females, who constituted 63.1% (n=656) of the participants, while males represented 36.1% (n=375).

Age distribution indicated a youthful cohort, with the majority of participants falling within the 18 – 24 age range (59.1%, n=615). The subsequent age groups, 25 – 34, 35 – 44, 45 – 54, and above 54 years, accounted for 23.4% (n=243), 9.4% (n=98), 6.5% (n=68), and 1.0% (n=10) of the population, respectively.

Educational attainment among participants varied, with the largest group holding a Bachelor's degree (59.2%, n=616). High school graduates made up 24.3% (n=253), while 7.1% (n=74) had education below high school level. A smaller fraction of the sample had attained a Master's degree or higher (8.9%, n=93).

Table 1. Consolidated demographic information of participants

SL	Question	Category	Frequency	Percent (%)
1	What is your gender?	Male	375	36.1
		Female	656	63.1
		Total	1015	99.2
2	In which region of the Kingdom of Saudi Arabia do you reside?	Northern region	58	5.6
		Southern region	334	32.1
		Eastern region	96	9.2
		Western region	296	28.5
		Central region	189	18.2
		Total	1033	100
3	What is the highest level of education you have completed?	Below high school	74	7.1
		High school graduate	253	24.3
		Bachelor's degree	616	59.2
		Master's degree or higher	93	8.9
		Total	1015	100
4	What is your age group?	18 – 24	615	59.1
		25 – 34	243	23.4
		35 – 44	98	9.4
		45 – 54	68	6.5
		Above 54	10	1
		Total	1015	99.4
5	What is your current employment status?	Employed	338	32.5
		Unemployed	691	66.4
		Total	1029	100

Table 2. Awareness and understanding

SL	Question	Response	Frequency	Percent (%)	Mean ± SD
6	Have you ever heard of food-drug interactions?	Yes	792	76.2	1.232558 ± 0.422668
		No	240	23.1	
		Total	1039	100	
7	How would you rate your understanding of food-drug interactions?	Excellent	168	16.2	2.871745 ± 1.186288
		Good	202	19.4	
		Fair	360	34.6	
		Poor	209	20.1	
		Very Poor	98	9.4	
		Total	1039	100	
8	Have you ever experienced or known someone who has experienced a food-drug interaction?	Yes	326	31.3	1.684414 ± 0.464974
		No	707	68	
		Total	1039	100	

Occupational data revealed that the majority of participants were classified as unemployed (66.4%, n=691), with the remaining under-employed (32.5%, n=338).

Regional distribution of participants' residence within the Kingdom of Saudi Arabia showed that the Southern Region was the most represented (32.1%, n=334), followed by the Western Region (28.5%, n=296), Central Region (18.2%, n=189), Eastern Region (9.2%, n=96), and Northern Region (5.6%, n=58).

The Awareness and Understanding" section of the study presents important insights into public knowledge about food-drug interactions, as indicated in (Table 2). A considerable majority of the respondents, accounting for 76.2% (792 individuals), indicated awareness of food-drug interactions, as reflected by a mean score of 1.232558 and a standard deviation of 0.422668. However, 23.1% (240 individuals) were not aware, highlighting a gap in public knowledge. Regarding the self-assessment of understanding these interactions, the responses varied significantly. While 16.2% (168 individuals) rated their understanding as 'Excellent', and 19.4% (202 individuals) as 'Good', the most common response was 'Fair', noted by 34.6% (360 individuals). The concern, however, lies in the 20.1% (209 individuals) who perceived their understanding as 'Poor' and the

9.4% (98 individuals) as 'Very Poor'. This distribution suggests a varied but often limited comprehension among the public. In terms of personal experiences with food-drug interactions, only 31.3% (326 individuals) reported either experiencing or knowing someone who had experienced such an interaction, with a mean score of 1.684414 and a standard deviation of 0.464974. The majority, 68% (707 individuals), had no personal experience or knowledge of such interactions, indicating a potential lack of practical awareness in this area.

The "Attitudes and Beliefs" section of the study reveals a strong public consensus on the importance of awareness and understanding of food-drug interactions, as well as the role of healthcare professionals in providing relevant information, as demonstrated in (Table 3). A majority of the respondents, 58.3% (606 individuals), consider it extremely important to be aware of these interactions, emphasizing the significance of this issue with a mean score of 1.593449 and a standard deviation of 0.712497. This sentiment is further echoed by 26.8% (279 individuals) who also rate the importance highly. On the topic of the impact of food-drug interactions on health and treatment efficacy, a substantial 52.9% (550 individuals) strongly agree with this notion, supported by a mean score of 1.390927 and a standard deviation of 0.65103. This strong belief is also shared by another 35.5% (369 individuals) who agree with the statement. Additionally, the data reflects a significant expectation from healthcare professionals, with 68.1% (708 individuals) strongly agreeing that they should provide more information about these interactions, underlined by a high mean score of 3.184971 and a standard deviation of 1.236103. This indicates a clear public demand for more educational initiatives and information dissemination from healthcare providers on the subject of food-drug interactions.

Table 3. Attitudes and beliefs

SL	Question	Response	Frequency	Percent (%)	Mean ± SD
9	How important do you think it is to be aware of food-drug interactions?	1	606	58.3	1.593449 ± 0.712497
		2	279	26.8	
		3	124	11.9	
		4	20	1.9	
		5	6	0.6	
		Total	1039	100	
10	Do you believe that food-drug interactions can have a significant impact on health and treatment efficacy?	Strongly agree	550	52.9	1.390927 ± 0.65103
		Agree	369	35.5	
		Neutral	111	10.7	
		Disagree	7	0.7	
		Strongly disagree	1	0.1	
		Total	1039	100	
11	Do you think that healthcare professionals should provide more information about food-drug interactions?	Strongly agree	708	68.1	3.184971 ± 1.236103
		Agree	267	25.7	
		Neutral	48	4.6	
		Disagree	10	1	
		Strongly disagree	3	0.3	
		Total	1039	100	

The "Sources of Information" section of the survey reveals intriguing insights into how frequently people seek information about medications, their interactions with food, and their trust in the information provided by healthcare professionals, as shown in (Table 4). A minority of respondents, 11.8% (123 individuals), reported that they always seek such information, with an overall mean response score of 2.052936 and a standard deviation of 0.921844. Additionally, 16.3% (170 individuals) often seek this information, while the most common response was 'Sometimes', reported by 30% (312 individuals). However, a notable 24.8% (258 individuals) rarely seek this information, and 16.8% (175 individuals) never do, reflecting varied levels of proactive information-seeking behavior among the population.

Table 4. Sources of information

SL	Question	Response	Frequency	Percent (%)	Mean ± SD
12	How often do you seek information about medications and their interactions with food?	Always	123	11.8	2.052936 ± 0.921844
		Often	170	16.3	
		Sometimes	312	30	
		Rarely	258	24.8	
		Never	175	16.8	
		Total	1039	100	
13	How much do you trust the information about food-drug interactions provided by healthcare professionals?	Completely trust	320	30.8	2.859768 ± 1.070897
		Mostly trust	428	41.2	
		Somewhat trust	218	21	
		Slightly trust	62	6	
		Do not trust at all	11	1	
		Total	1039	100	

Regarding trust in the information about food-drug interactions provided by healthcare professionals, 30.8% (320 individuals) completely trust this information, as indicated by a mean score of 2.859768 and a standard deviation of 1.070897. A larger segment, 41.2% (428 individuals), mostly trusts the information, while 21% (218 individuals) somewhat trust it. A smaller group, 6% (62 individuals), only slightly trusts this information, and a minimal 1% (11 individuals) do not trust it at all. This data suggests a generally high level of trust in healthcare professionals regarding this matter, though there remains a segment of the population with reservations.

The "Cultural and Dietary Practices" section of the survey provides valuable insights into how respondents perceive the influence of cultural and dietary practices in Saudi Arabia (KSA) on food-drug interactions, as well as their opinions on how well healthcare professionals consider these factors when prescribing medications as indicated in (Table 5).

Table 5. Cultural and dietary practices

SL	Question	Response	Frequency	Percent (%)	Mean ± SD
15	How much do you think cultural or dietary practices in KSA affect food-drug interactions?	A great deal	243	23.4	2.495644 ± 1.141293
		A lot	336	32.3	
		A moderate amount	326	31.3	
		A little	116	11.2	
		Not at all	9	0.9	
		Total	1039	100	
16	How well do you think healthcare professionals consider cultural or dietary practices when prescribing medications?	Very well	238	22.9	1.56644 ± 0.830954
		Well	301	28.9	
		Neutral	287	27.6	
		Poorly	158	15.2	
		Very poorly	49	4.7	
		Total	1039	100	

In response to the question about the impact of cultural or dietary practices in KSA on food-drug interactions, the data reveals that a substantial portion of respondents acknowledge their significance. Specifically, 23.4% (243 individuals) believe that these practices affect food-drug interactions "A Great Deal," while 32.3% (336 individuals) think they affect it "A Lot." Additionally, 31.3% (326 individuals) perceive a "Moderate Amount" of influence, highlighting the recognition of cultural and dietary practices as relevant factors in this context. However, it's important to note that 11.2% (116 individuals) see these practices as having only "A Little" impact, and a small minority of 0.9% (9 individuals) believe they have "Not At All" impact. This variation in perceptions is reflected in the mean score of 2.495644 with a standard deviation of 1.141293.

Concerning the consideration of cultural and dietary practices by healthcare professionals when prescribing medications, respondents provide diverse opinions.

While 22.9% (238 individuals) believe that healthcare professionals consider these factors "Very Well," 28.9% (301 individuals) think they do so "Well." A significant number of respondents, 27.6% (287 individuals), maintain a "Neutral" stance, indicating a lack of consensus on this matter. However, a substantial portion, 15.2% (158 individuals), feel that healthcare professionals consider these practices "Poorly," and 4.7% (49 individuals) even believe they do so "Very Poorly." The mean score of 1.56644 with a standard deviation of 0.830954 signifies the varied perceptions of how well healthcare professionals address cultural and dietary practices when prescribing medications.

In (Table 6), which focuses on "Recommendation," the majority of respondents, accounting for 59.6% (620 individuals), consider it "Very Important" to enhance public education and awareness in this regard. Additionally, 26.9% (280 individuals) find it "Important." However, there is a notable portion of respondents with a more neutral stance, as 9.9% (103 individuals) express a "Neutral" opinion. A very small fraction, 1.3% (14 individuals), regard it as "Unimportant" and "Very Unimportant." While the Mean and SD are indicated as 2.352936 ± 0.821844, the data reflects a general consensus among respondents on the importance of improving education and awareness about food-drug interactions, with a predominant focus on its significance.

A full list of the survey questions referenced in the study can be found in Appendix A, providing a context for the responses analyzed.

Table 6. Recommendation

SL	Question	Response	Frequency	Percent (%)	Mean ± SD
17	How important do you think it is for healthcare professionals, educators, and policymakers to improve public education and awareness about food-drug interactions?	Very important	620	59.6	2.352936 ± 0.821844
		Important	280	26.9	
		Neutral	103	9.9	
		Unimportant	14	1.3	
		Very unimportant	14	1.3	
		Total	1039	100	

Discussion

The findings of this research illuminate the extensive utilization of herbal medicines. The extensive use of herbal medicines among the Saudi Arabian populace, as revealed in our study, is emblematic of a broader global trend towards complementary and alternative medicine (CAM). This trend, as Ahern (2015) has noted, brings with it a spectrum of potential herb-drug interactions that can significantly affect the efficacy and safety of conventional medications due to variability in product compositions and a lack of regulatory oversight in the self-administration (Ahern, 2015). Our findings resonate with those of Abdelmola *et al.* (2021), who documented a profound inclination towards herbal medicine within various demographics in Jazan, Saudi Arabia (Abdelmola *et al.*, 2021). These practices, deeply rooted in the culture and traditions of the region, warrant a healthcare system that is both receptive and knowledgeable. Such a system should not only integrate but also critically evaluate the use of traditional herbal medicines, as illustrated by the work of Elmaghraby *et al.* (2023), who discuss the patterns of use and knowledge of safety among the Eastern Region Saudi population (Elmaghraby *et al.*, 2023). Furthermore, Patel (2016) champions the collaboration between pharmacists and physicians to enhance patient care and medication adherence, a synergy that is indispensable in the context of KSA, where cultural and dietary practices significantly affect food-drug interactions (Patel, 2016).

The cultural proclivity towards herbal remedies in KSA, often viewed as an adjunct to prophetic medicine, is influenced by traditional beliefs, as demonstrated by Alghadir *et al.* (2022) and Aldwihi *et al.* (2021). These beliefs shape the behaviors of patients, particularly in the context of chronic diseases and during public health crises such as the

COVID-19 pandemic (Alghadir *et al.*, 2022), (Aldwihi *et al.*, 2021). The concomitant use of prescription drugs and herbal medicinal products (HMPs) among older adults, as highlighted by Agbabiaka *et al.* (2017), underlines the prevalence and potential for significant interactions, necessitating vigilant patient education and monitoring (Agbabiaka *et al.*, 2017).

The imperative for healthcare providers to be well-versed in public perceptions, attitudes, and practices toward herbal medicine is further underscored by Zaidi *et al.* (2022). Their study emphasizes that educational interventions should be culturally sensitive and tailored to the diverse Saudi demographic, which includes a significant youthful population with varying levels of education (Zaidi *et al.*, 2022). This nuanced understanding of patient care, which necessitates consideration of cultural or dietary practices when prescribing medications, is crucial for healthcare professionals to deliver personalized and effective treatment plans.

The influence of the pharmaceutical industry on the drug approval process and the information provided to healthcare providers has been a growing concern. Pagano (2010) critiques the potential for conflict of interest, bias, and manipulation in prescriber education, urging healthcare professionals to critically evaluate the information they receive and disseminate to patients(Pagano, 2010). This call for critical evaluation is echoed in the work of Al Akeel *et al.* (2018), who explored the knowledge, attitude, and practice regarding herbal medicines among the Saudi population, revealing a need for improved healthcare provider awareness (Al Akeel *et al.*, 2018).

In light of these insights, our study advocates for an educational overhaul that enhances the proficiency of healthcare professionals regarding herbal medicine use and its interactions with food and drugs. This initiative should be culturally sensitive and collaborative and involve both pharmacists and physicians to ensure the safe and effective use of medications within the Saudi population.

Conclusion

The current study's exploration into the awareness and attitudes toward food-drug interactions among the Saudi Arabian population reveals a landscape where herbal medicine is not only prevalent but also deeply intertwined with cultural practices. The demographic data indicates a young, educated populace that is engaged yet variably informed on the complexities of food-drug interactions. This underscores an urgent need for healthcare professionals to bridge the knowledge gap and ensure safe medication practices.

The evidence points to a dual imperative: first, to enhance the education of healthcare professionals regarding the potential interactions between prescribed medications and herbal supplements, and second, to ensure that such education is culturally attuned and responsive to the practices prevalent in the Kingdom of Saudi Arabia. The study aligns with the broader literature that emphasizes the risks associated with unsupervised use of herbal medicines and the critical role of healthcare providers in mitigating these risks through education and collaboration.

In light of the findings, it is recommended that healthcare professionals in Saudi Arabia receive continuous and comprehensive training on the implications of herbal medicine use and its interactions with conventional drugs. This training should be culturally sensitive and incorporate the diverse healthcare needs and practices of the Saudi population. Additionally, there should be a concerted effort to foster collaboration between pharmacists and physicians to optimize patient outcomes and medication adherence.

Ultimately, the goal is to create a healthcare environment where patients are well-informed and supported in their use of both prescription medications and herbal remedies, ensuring both efficacy and safety in their treatment plans. The study's insights contribute to a growing body of evidence that will inform policy, practice, and patient education in Saudi Arabia and beyond.

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