Asian Journal of Medicine and Health

5(2): 1-9, 2017; Article no.AJMAH.33682

A Questionnaire Study of Food – Drug Interactions to Assess Knowledge of People from Diverse Backgrounds

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Authors' contributions

This work was carried out in collaboration between all authors. Author MSA designed the study, performed the statistical analysis wrote the protocol and the first draft of the manuscript. Authors SAS and RS managed the analyses of the study. Author MM managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJMAH/2017/33682
Editor(s):
(1) Ana Rita Ramalho Figueiras, Pharmacy, University of Coimbra, Azinhaga de Santa Comba, Portugal.
Reviewers:
(1) Tauqeer Hussain Mallhi, University Sains Malaysia, Malaysia.
(2) Maria Cristina Soares Rodrigues, University of Brasilia, Brazil.
(3) Stefano Bianchi, Marche Nord Hospitals, Italy.
(4) Uttara Singh, Panjab University, India.
Complete Peer review History: http://www.sciencedomain.org/review-history/19666

Original Research Article

Received 25th April 2017
Accepted 19th June 2017
Published 23rd June 2017

ABSTRACT

Background: Food drug interactions contribute a major reason for drug interactions but they are neglected due to less knowledge and awareness on it.
Objective: To assess the awareness about food drug interactions among various individuals from diverse backgrounds.
Methodology: This is the prospective questionnaire study comprising of 12 questions, each question have both right and wrong options, where as the last question is opinion based. The questionnaire was formatted in a simple and easy manner for the understanding of individuals from non-medical field. These forms were circulated online and the responses were collected.

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Results: Thirty nine out of forty five responses from doctors were valid in which 65.55% were correct, 23.46% were wrong and 9.66% were unaware, similarly out of thirty three, twenty four responses from nurses were valid in which 44.07% were correct, 49.72% were wrong and 5.65% were unaware. From a total of 102 responses from clinical pharmacologists 81 were valid in which 72.27% were correct, 24.75% were wrong and 0.99% was unaware.
Discussion: Geriatric population is highly susceptible to food drug interactions due to polypharmacy and altered levels in absorption, distribution, metabolism and elimination. The study was successful in assessing the knowledge about food drug interactions in individuals from diverse backgrounds.
Conclusion: The clinical pharmacologists had more awareness on food drug interaction than doctors and nurses. The study findings support the need for nurses and doctors to update their practice through additional training and integration of knowledge and expertise about food drug interactions to improve the therapeutic efficacy, drug compliance and safety of patients.

Keywords: Alcohol; awareness; food drug interactions; knowledge; questionnaire.

1. INTRODUCTION

Medications, both prescribed and over-the-counter, are used every day to treat acute and chronic illness. Clinical Research and technology constantly upgrades the drugs we have available and introduce new ones. Medications can help people live healthy life for a prolonged period. Although medicines are prescribed often, it is important to realize that they must still be used with caution. Food becomes harmful to the body when it reacts with medications administered concomitantly in a diseased patient.

Precisely a food drug interaction is the result of a reaction between food and drugs [1]. According to FDA a food and drug interaction is “a situation where a food affects the activity of a drug; for instance, the effects are increased or decreased, or a new effect of that drug is produced that would not be produced without consumption of that food” [2].

Food and drug interactions play a significantly important role in the pharmaceutical field as they greatly impact the compliance and success of drug therapy. Food has the ability to affect one or all areas of pharmacokinetics, including absorption, distribution, metabolism, and elimination [2]. The ability of a natural product to interact with a drug is based on the same pharmacokinetic and pharmacodynamic principles as drug-drug interactions [3]. Presence of additional drug, food, herbs, beverages or environmental chemicals alters the pharmacologic activity of a drug, leading to DI [3]. The other methods for food - drug interaction include binding or chelation, altering gastric pH, altering gastrointestinal motility, or affecting transport proteins such as P-glycoprotein [4]. The limits of food - drug interactions are unknown [4].

Several studies had shown the drug interactions incidence ranges from 3% to 30% [5]. In 1999, the Institute of Medicine reported that as many as 98,000 deaths occur annually in US from medical errors [6,7].

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has created standards for health care professionals to improve in omission of food drug interactions. JCAHO aims to ensure that, “Patients are educated about potential drug food interactions and provided counselling on nutrition and modified diets” [8,9].

A food-drug interaction can: Reduce therapeutic activity of a drug, cause a side effect from a medicine to get worse or better, cause a new side effect [10]. Defined by the Dietary Supplement Health and Education Act (DSHEA) of 1994, dietary supplements include a wide array of non-food, non-drug substances intended to supplement the diet, but are not intended to treat diseases or disorders of the human body [11].These dietary supplements may also react in the body and produces food – drug interactions.

Risk for food – drug interactions can be affected by many factors such as: Age, gender, medical co-morbidities, body composition, nutritional status, polypharmacy [12].

This questionnaire study includes some of the basic questions on interaction of herbal and allopathic drugs, food and drug interaction and which age groups is highly susceptible to food drug interaction.

Table 1. Examples of food – drug interactions

Food	Active constituent	Drug / Class	Effect
Milk products	Calcium	Tetracycline	tooth discoloration
Cranberry	Vitamin K	Warfarin and other anticoagulants	It increases the INR in patients on warfarin [6].
Coffee	Caffeine	Bronchodilators	Increases excitability and nervousness
Chocolate	Caffeine	Antidepressants	Decreases antidepressants activity
Banana	Potassium	ACE inhibitors	Increases potassium levels
Grapefruit	Furanocoumarins	Pshycotropics	Increases oral bioavailability [6].
Alcoholic beverages	Ethanol	Antiretrovirals	Toxic Epidermal Necrolysis, Hypersensitivity Syndrome Reaction And Liver Failure [7].

** INR- International Normalized Ratio*

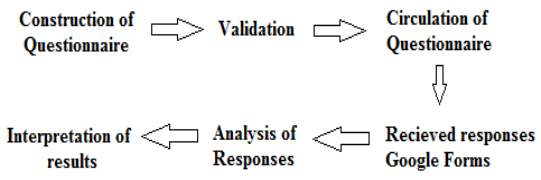
Table 2. Allopathic-Ayurverdic interactions [10-12]

Herbs	Active Constituent	Drugs	Interactions
Aloe vera	Anthraquinone glycosides	Digoxin and Thiazide	Increases cardiac toxicity
Capsicum annum	Capsascin	Theophylin	May increase absorption
Garlic *(Allium sativum)*	Allicin	Antihypertensive drugs	Herb may decrease BP
Ginko biloba	Ginkgolides	Anticonvulsants	Increases seizures
St. Johns wort	Hypericin and hyperforin	Oral contraceptives	Breakthrough bleeding, follicle growth and ovulation [13].

Food- drug interactions are equally important as drug- drug interactions, but are neglected due to less awareness and knowledge on it. The survey was carried out to determine the degree of awareness on food drug interactions among various hospital staff members.

2. METHODOLOGY

This questionnaire study comprising of twelve questions was carried out using online Google forms. These forms were circulated using a social media among various individuals from diverse backgrounds. Two weeks online survey was carried out in the month of feb and march. Various articles on knowledge assessment of health care professionals on food- drug interactions were taken into consideration for designing the present questionnaire.



Respondents were categorised into various groups to assess their knowledge and awareness on food – drug interactions. A total of 345 respondents were enrolled in the study. The data was analysed and the results were expressed in percentages. Groups classified are given in Table 3. Non medicos include individuals with non medical qualification like engineering, commerce, MBA etc. Question no 2 and 8 where alike but represented in a different way to know how genuine the respondents were, and on that basis only they were categorised as valid and invalid. The valid responded correctly to question 2 and 8 that is they were firm on opinion that both OTC and prescription drugs do interact with herbal drugs, where as invalid respondents were not sure on their opinion. Questions included in the study are given below in the Table 4.

Table 3. Respondents classified into groups

Group I	Doctors
Group II	Nurses
Group III	Clinical pharmacologists
Group IV	Dieticians
Group V	Pharmacy students
Group VI	Non-medicos

Table 4. Sample of questionnaire

A Questionnaire Study of Drug – Food Interactions to Assess Knowledge of People from Diverse Backgrounds

Name:		Group:
Age:	Gender:	Qualification:

1. Do you have knowledge about food – drug interaction:
   (a) □ Yes (b) □ No
2. OTC and prescription medicines do not interact with herbal remedies and supplements:
   (a) □ True (b) □ False
3. Use the same pharmacy for all your medications to make drug interactions less likely
   (a) □ True (b) □ False
4. Which of the following beverages do health experts recommend you to avoid when taking medicines:
   (a) □ Green tea (b) □ Alcohol (c) □ Coconut water
5. This fruit interacts with around 45 different medicines and produces lethal side effects:
   (a) □ Mango (b) □ Grape fruit (c) □ Banana
6. Excessive amount of this common craving may make you happy but can interfere with treatment of depression:
   (a) □ Ice cream (b) □ Apple pie (c) □ Chocolate
7. If you are using Tetracycline, you should avoid:
   (a) □ Milk (b) □ Apple (c) □ Meat
8. Allopathic and Ayurvedic medicines interact with each other:
   (a) □ True (b) □ False
9. Avoid using this flavor of juice while taking Warfarin:
   (a) □ Pineapple (b) □ Cranberry (c) □ Tomato
10. Asthma medicines should not be taken with:
    (a) □ Coffee (b) □ Orange juice (c) □ Milk
11. When taking an ACE inhibitor such as Captopril avoid excessive amount of potassium found in:
    (a) □ Oranges (b) □ Bananas
    (c) □ Green leafy vegetables (d) □ All of the above
12. Which age group of patients do you think are at a greater risk of developing drug – food interaction:
    (a) □ Neonates (b) □ Pediatrics
    (c) □ Adults (d) □ Geriatrics

Sign

3. RESULTS

The results were obtained after two weeks of online survey. A total of 345 responses were collected from the Google forms and the data was analysed.

Out of 345 responses 73.04% were valid and 26.95% were invalid. They were differentiated into valid and invalid depending upon their response to questions 2 & 8. From a total of 345 respondents 32.17% were male and 67.82% were female.

Out of 252 respondents which are valid 85.68% believed that they were aware of food drug interactions while 14.28% were unaware, 83.3% respondents knew that alcohol should be avoided during drug treatment and 8.33% respondents were unaware that both over the counter (OTC) and prescribed drugs do interact with herbal medicines. Remaining responses are shown in Fig. 1.

Out of 93 respondents which are invalid 80.5% responded that they were aware of food drug interactions and 19.32% were unaware, 83.72% respondents respond that alcohol should be avoided during drug treatment and the rest of the responses as shown in Fig. 2

The Figs. 3, 4, 5 and 6 represent valid male, female and invalid male, female respondents respectively.

Thirty nine out of 45 responses from doctors were valid in which 65.55% were correct, 23.46% were wrong and 9.66% were unaware, similarly out of 33, 24 nurses were valid in which 44.07% were correct, 49.72% were wrong and 5.65% were unaware. In total of 102 clinical pharmacologists 81 were valid in which 72.27% were correct, 24.75% were wrong and 0.99% was unaware. Remaining group's data is shown in the Fig. 7.

A total of 2,772 responses were collected from 252 valid respondents (11 responses per person) out of which the correct respondents were 62.53% and 47.17% from medical and non-medical staff respectively, wrong respondents were 30.29% and 42.93% respectively and similarly the percentage of unawareness were 2.99% and 9.01% as shown in Fig. 8.

In Figs. 9 out of 1,023 invalid responses the correct responses were 59.04% and 45.3% from medical and non-medicos respectively, 38.52% and 51.34% of medical and non medicos responded to wrong answer and 1.44% and 3.02% of unawareness among medical and non medicos respectively.

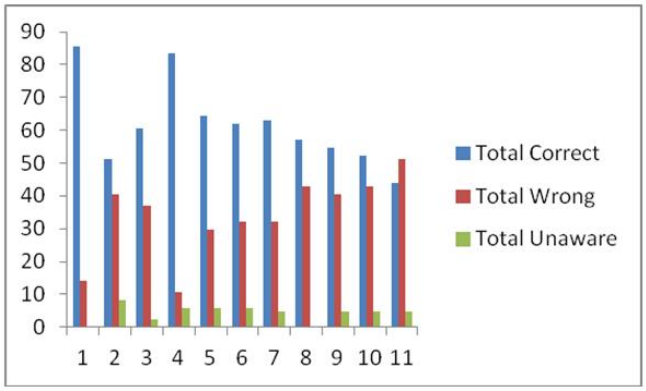


Fig. 1. Knowledge and awareness of valid responses

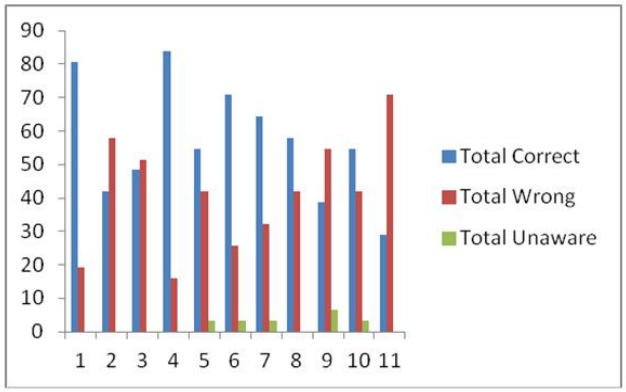


Fig. 2. Knowledge and awareness of invalid responses

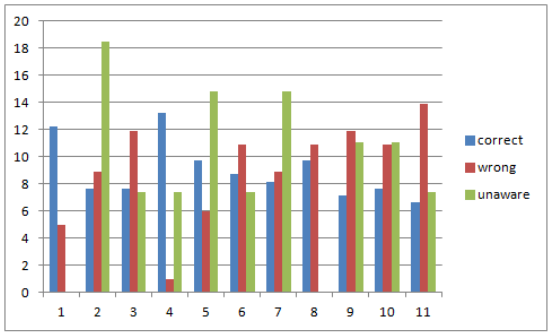


Fig. 3. Valid male responses

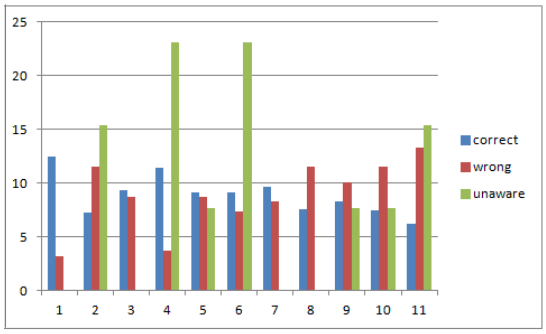


Fig. 4. Valid female responses

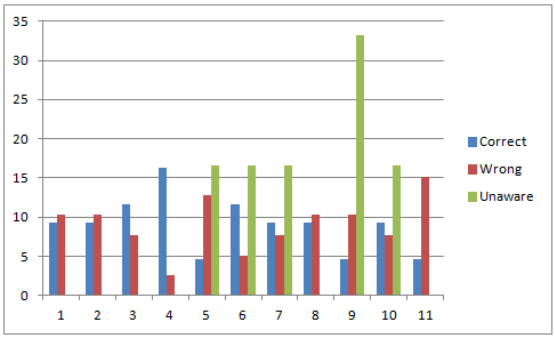


Fig. 5. Invalid male responses

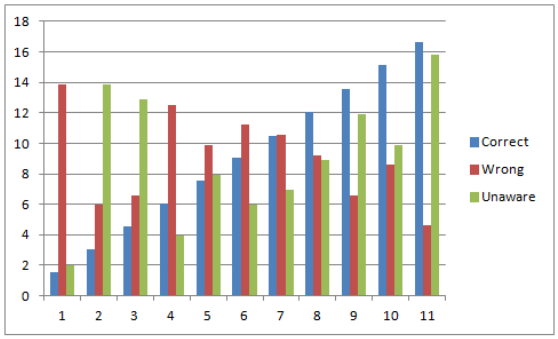


Fig. 6. Invalid female responses

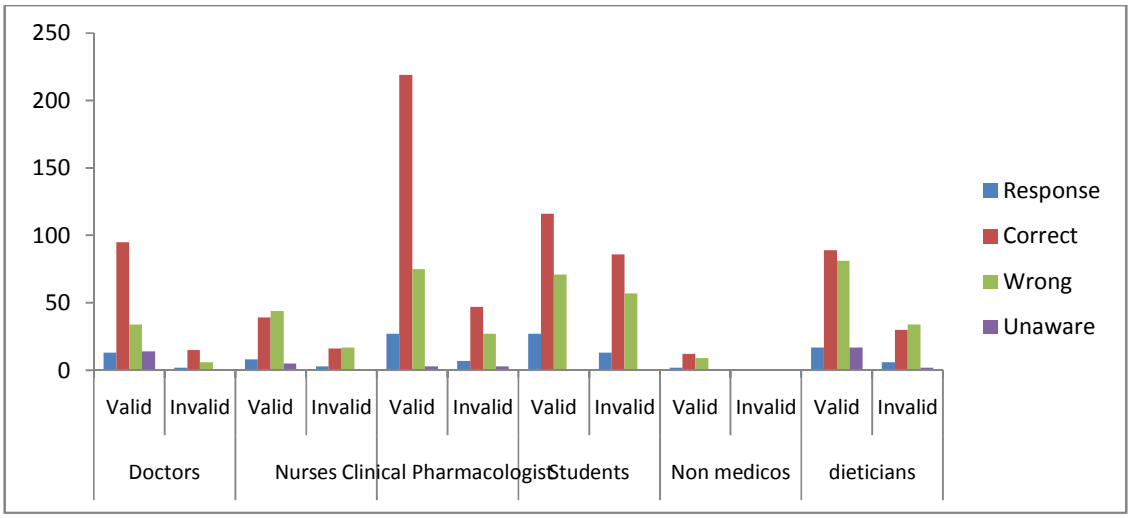


Fig. 7. Responses of different groups

The question 12 was opinion based in which valid responses to the options A,B,C,D and BD were 8.33%, 19.04%, 27.97%, 41.65% and 3.57% respectively, similarly the invalid respondents to the options A, B, C, D, AB, AD, and BC were 12.88%, 22.54%, 32.2%, 3.22%, 3.22%, 3.22% which is shown in Fig. 10.

Valid doctors responded 15.38%, 30.76%, 23.07% and 30.76% to options A, B, C, and D respectively and invalid doctors responded 50% to C and D option each. The valid nurses responded 25%, 25% and 50% to A, C and D options respectively and invalid nurse's responds 33.3% equally to the options A, B and D. Among

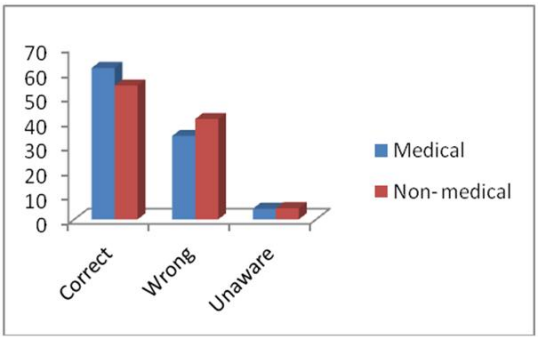


Fig. 8. Valid responses (Medical v/s Non medicos)

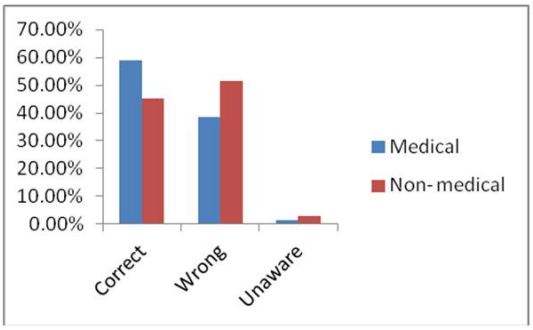


Fig. 9. Invalid responses (Medical v/s Non medicos)

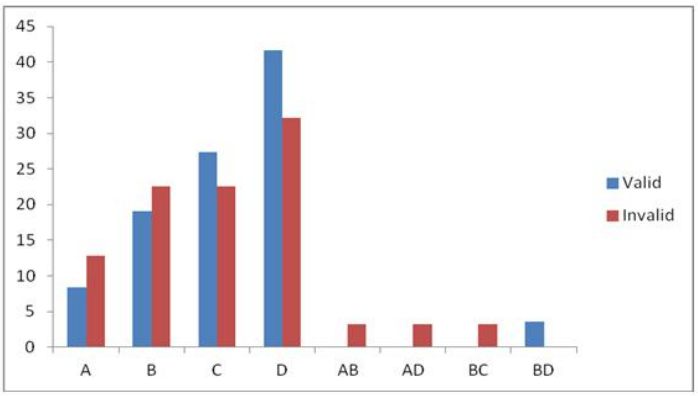


Fig. 10. Opinion based graph

valid clinical pharmacologists 3.7%, 22.2%, 25.9% and 48.1% thinks that food drug interaction mainly affects neonates, paediatrics, adults and geriatrics respectively. Among invalid clinical pharmacologists 28.56%, 14.28%, 42.84% and 14.28% thinks that food drug interaction mainly occurs in neonates, adults, geriatrics and paediatrics and adults respectively.

4. DISCUSSION

Present study was successful in evaluating of knowledge and awareness. A 2002 National Health Interview Survey indicated that nearly 1 in 5 adults report using an herb for treatment of health conditions and/or health promotion [14].

A recent studied showed that the risk of interactions with 6-10 drugs may just be 7% but with 16-20 drugs, the risk may increase up to 40% [15]. Geriatric population is highly susceptible to food drug interactions due to polypharmacy and altered levels in absorption, distribution, metabolism and elimination. The study was successful in assessing the knowledge about food drug interactions in individuals from diverse backgrounds. 86.5% were aware that food drug interactions do exist. The results of survey also showed that 38% think geriatrics and 25% think adults are more susceptible to food drug interactions. Nurses with higher education do better in recognizing food drug interactions. In the IOM report [16], it is recommended that there will be an increase in the proportion of nurses with a baccalaureate degree to 80% by the year 2020. Nurses with higher education do better in recognising food drug interactions.

Specific foods greatly affect drug therapy, resulting in serious side effects, or reduced absorption of a drug i.e. therapeutic failure [17] or increase bioavailability [18].

5. LIMITATIONS

Very few dieticians were enrolled in the study as this study was conducted in a single centered hospital. Higher number of responses from dieticians would have been helpful in

understanding their knowledge towards FDI's as they are mainly concerned with diet selection. Sample size was small to conduct the study.

6. CONCLUSION

Females actively participated in this survey than males. Knowledge of Clinical Pharmacologists on food drug interactions was better than doctors, nurses and pharmacy students. The other outcome of this survey showed that individuals from non medical field had a limited awareness on food drug interactions. This survey also found that people from non-medical field use herbal supplements concomitantly with prescription and OTC medication. The study findings support the need for nurses and doctors to update their practice through additional training and integration of knowledge and expertise about Food drug interactions to improve the therapeutic efficacy, drug compliance and safety of patients.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/19666