



Survey of adherence to time standards to prevent food and drug interaction in the hospitalized patients

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Journal of Research & Health
Social Development & Health Promotion
Research Center

Vol. 8, No. 1, Jan & Feb 2018

Pages: 85-92

DOI: 10.29252/acadpub.jrh.8.1.85

Original Article

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Received: 29 Oct 2013

Accepted: 24 Nov 2013

How to cite this article: Abdollahi M, Salehi Sh, Taherzadeh Zh, Eslami S. Survey of adherence to time standards to prevent food and drug interaction in the hospitalized patients. *J Research & Health* 2018; 8(1): 85-92.

Abstract

Nowadays, food and medicine are two key elements in treatment and prevention of diseases. It is necessary to pay attention to food and drug interactions in order to create ideal conditions for drug effects and provide normal nutritional status to prevent unwanted interactions between food and drug. This study aimed to investigate the range of observing standards of food and drug interactions in hospitalized patients. This study was conducted on 400 hospitalized patients. Data gathering tool included a checklist comprising two sections one of which was used to list demographic data and the other one to record food and drug interaction of 19 commonly prescribed medications using inquiries. According to data from participants who had to take medicine with full stomach, the following interactions were observed: Among the 19 widely consumed medicine in the internal hospital ward, only 2 (10%) were used completely according to the instructions for use of the medication on given meal (magnesium hydroxide and salicylic acid) and in relation to other medications, a maximum of 72.1% matching was observed (omeprazole). Based on the findings of this study, following the guidelines for timely medication administration was not met in the hospitalized patients. To strengthen adherence to food-drug interactions guidelines and make alliance between health care providers and the establishment of regular team, ongoing education of health professionals is recommended.

Keywords: Guideline Adherence, Food-Drug Interactions, Hospitalization, Patients

Introduction

One of the types of drug interaction is interaction with food. Food and drug interactions occur when a food, or one of its components, interacts and interferes with the drug in the body and therefore, affects the absorption, effect, and metabolism of the drug in the body [1].

Studies have shown that medication errors may occur at any stage during the pharmacotherapy

process, such as drug distribution, prescription, and administration. According to the research, most errors occur during medication consumption [2].

When taken simultaneously, some foods and drugs can seriously alter the ability of the body to consume certain foods/drugs and can lead to serious complications and side effects

[3].

Food and drug are both essential to maintain health, but in some cases, their simultaneous consumption can be accompanied by a series of side effects. Hence, the interactions should be well investigated and be specified [4].

Many pathological processes require the consumption of proper food and nutrients along with the administration of effective and safe drugs. However, the association between drugs and food can lead to undesirable interactions, resulting in an increase or decrease in the efficacy of the drug and food [5].

Many people mistakenly believe that there is always no problem with simultaneous consumption of drugs and foods and they consider it safe; however, the interactions between foods and medications can have a profound effect on the success of the treatment and the side effects of many medications. The clinical significance of interactions between drugs and foods can be varied. Due to several reasons, including the patient's preference and/or convenience, compliance with food and drug interaction standards is mainly unfulfilled [6]. Many patients take more than one drug. This is especially true for older people. When the patients take several medications, food and drug interactions are more likely to occur [1]. Physicians, pharmacists, and nurses are the three groups of health care professionals involved in training patients and reducing the adverse side effects of drugs. Their knowledge and role in different fields are also of great importance. Nurses are the last round of the treatment chain in hospitals [7]. Patient care is a key component of nursing practice and drug orders are an important part of the patient's treatment and care process. Failure to pay sufficient attention to the correct principles of prescribing medication can lead to multiple ethical and professional problems [8]. Medications are usually ordered by the doctor, distributed by the pharmacist, and administered by the nurse. The nurse is responsible for the proper administration of medications, which can include preparing, controlling, and administering the medications, updating their

knowledge of medications, monitoring the effectiveness of treatment, reporting the side effects, and training patients about their medications [9]. The results of Jarosz and Wolnicka's study showed that 62.4% of the patients consumed medications incorrectly related to the meal [5]. Similarly, in the study by Abbasi Nazari et al., several mistakes were found in medication consumption, especially in wards with high rate of medication consumption [7]. Moreover, Lopes et al. conducted a study to assess the relationship between food and drug interactions in Brazil, and their results showed that a high rate of interaction between food and drug is possible [5]. Aman et al., conducted studies on "Food and Drug Interactions in Pakistan in 2010" and their results indicated that accurate compliance with medication consumption standards was required [11]. In their study in the United States, Couris Rebecca et al. found that the nurses' knowledge of food and drug interactions was not sufficient [12].

In a study entitled "knowledge and awareness of food and drug interactions among health care professionals", Benni et al. showed that health care providers (novice physicians and interns) had lower awareness of food and drug interactions [13]. Leibovitch et al. showed in their study that older patients are at a higher risk of food and drug interactions [14].

Also, Jones and Treiber claimed in their study that the most common causes of nurses' medication error included non-observance of the five right rule (right patient, right medication, right dose, right route, and right time), distraction, and nursing interruptions [15].

Cheraghi et al. also reported that the most influential factor in medication errors was the nurses' insufficient medical information [16]. Considering the above-mentioned studies and regarding the fact that observance of the food and drug interactions standards has not been studied so far in Iran and due to the importance of compliance with such standards especially by nurses, the researcher decided to conduct a study in this regard in Iran. Hence, the

present study has been carried out with respect to the significance of potential food and drug interactions in order to determine the frequency of such interactions in the internal ward of the hospital in Mashhad.

Method

This study was conducted on 400 eligible patients hospitalized in the internal ward of the hospital in Mashhad, the north east of Iran. After obtaining the required permissions from the Research and Technology Assistance of Khorasgan Branch of Islamic Azad University of Isfahan, the researchers referred to the hospital and Educational Center in Mashhad, and after introducing themselves and expressing the research objectives and procedure, they invited the inpatients of the internal ward of the Hospital to participate in the study. Sampling was done using census method for 400 hospitalized patients who were eligible for the study.

The data gathering tools included a researcher-made two-part questionnaire based on scientific resources, the first part containing demographic information, and the second part containing information about potential food and drug interactions and 19 commonly prescribed medications.

Administration of oral medications to hospitalized patients was carried out by the nurses in accordance with the related doctor's prescriptions in the patient's medical kardex.

The relevant checklist for adherence to the standards by the patients was evaluated through direct observation and inquiry about the timing of medication consumption, and information about the potential food and drug interactions was obtained by the researcher and recorded in the checklist at the time of administration. In order to determine the potential food and drug interactions, drugs were first divided into two general categories:

1) Drugs to be taken with food: Magnesium Hydroxide, Acetylsalicylic Acid (Aspirin), Diclofenac, Metronidazole, Carvedilol, Amiodarone, Metoral, Propranolol, Spironolactone, Triamterene, Lovastatin.

2) Drugs to be taken on an empty stomach: Captopril, Omeprazole, Ranitidine, Clidinium C, Cotrimoxazole, Ferrous Sulfate, Isosorbide, Nitrocontin.

In order to measure the potential food and drug interactions, the ratio of the number of correct cases to the total number of drugs was utilized. For example, if a person took 10 drugs and did not comply with the criteria for potential food and drug interactions for 5 drugs, it can be said that there is 50% of potential food and drug interactions. In this study, the potential food and drug interaction level ranging 0-30% was considered as a low potential interaction, 31-50% as an intermediate potential interaction, 51-70% as a high potential interaction, and 71-100% as a very high potential interaction. The collected data were analyzed using descriptive statistics (mean, standard deviation) by SPSS-18. Meanwhile, anonymous questionnaire was used in order to observe ethical and confidential considerations. The informed consent was obtained from the study units and the principle of integrity was observed in using the resources.

Patients who received at least one of the 19 studied oral medications and patients who had been hospitalized for more than 48 hours had the inclusion area. Patients who were unable to communicate verbally and to take oral medication were excluded from the study. At the end, the patients who wrongly took the drugs were given the necessary training on the correct use of the drug.

Results

Of the 400 patients, 178 (44.5%) were male and 222 (55.5%) were female, and the mean age of participants was 47.8 years. About half of the participants (49.2%) had less than high school diploma education. Most of the hospitalized patients were suffering from cardiovascular and gastrointestinal diseases. In 100% of cases, magnesium hydroxide and acetylsalicylic acid were taken correctly on a full stomach. About 60% of the patients took triamterene and 50% took carvedilol correctly

on a full stomach. The lowest rate of correct drug administration was seen for metronidazole

(0%), lovastatin (22.2%), metoral (28.6%), and Diclofenac (31.6%), in sequence (Table 1).

Table 1 Frequency of drug administration in the study units based on the use of drugs on a full stomach

Drugs	The cases with correct administration (full stomach) Frequency (%)	The cases with mistakenly administration (empty stomach) Frequency (%)	All cases
Magnesium Hydroxide	298(100%)	0	298
Aspirin (Acetylsalicylic Acid)	298(100%)	0	298
Metoprolol	56(28.6%)	140(71.4%)	196
Lovastatin	14(22.2%)	49(77.8%)	63
Spiroinolactone	21(37.5%)	35(62.5%)	56
Carvedilol	21(50%)	21(50%)	42
Propranolol	14(33.3%)	28(66.7%)	42
Triamterene-H	21(60%)	14(40%)	35
Metronidazole	0	26(100%)	26
Amiodarone	7(33.3%)	14(66.7%)	21
Diclofenac	6(31.6%)	13(68.4%)	19
Total	756(69%)	340(31%)	1096

Regarding the correct use of drugs (on an empty stomach), Omeprazole and Clidinium C had the highest frequency (72.1% and 56.6%,

respectively), and Nitrocontin, Captopril, and Ferrous sulfate had the lowest frequency (0%, 13.3%, and 16.2%, respectively).

Table 2 Frequency of drug administration in the study units based on the use of drugs on an empty stomach

Drugs	The cases with correct administration (empty stomach) Frequency(%)	The cases with mistakenly administration (full stomach) Frequency(%)	All cases
Isosorbide dinitrate	53(29.8%)	125(70.2%)	178
Captopril	21(13.3%)	137(86.7%)	158
Omeprazole	88(72.1%)	34(27.9%)	122
Ranitidine	38(39.6%)	58(60.4%)	96
Nitrocontin	0	77(100%)	77
Clidinium – c	43(56.6%)	33(43.4%)	76
Ferrous sulfate	12(16.2%)	62(83.8%)	74
Co-trimoxazole	8(26.7%)	22(72.3%)	30
Total	259(32.1%)	548(67.9%)	807

As reported in Table 3, the highest frequency (34%) was observed in the very high level of potential food and drug interactions, and in 54.8% of the subjects, more than 50% potential food and drug interactions was reported (Table 3).

The highest frequency of drug categories that were correctly administered in relation to

potential food and drug interactions belonged to anti-inflammatory drugs (95.9%) and gastrointestinal drugs (78.9%). Meanwhile, the highest frequency of drug categories that were mistakenly administered in relation to potential food and drug interactions belonged to antibiotics (85.7%), lovastatin (85.7%), and ferrous sulfate (83.8%) (Table 4).

Table 3 Relative frequency of the study units based on the degree of potential food and drug interactions

level of potential food and drug interactions	Frequency	Percentage
Highest Frequency	136	34%
Middle Frequency	122	30.4%
High Frequency	83	20.8%
Low Frequency	59	14.8%
Total	400	100%

Table 4 Comparison of potential food and drug interactions based on drug category

Drug Category	Correctly Administered N(%)	Mistakenly Administered N(%)	Total
Cardiovascular drugs	210(26.2%)	591(73.8%)	801
Gastrointestinal drugs	467(78.9%)	125(21.1%)	592
Anti-inflammatory	304(95.9%)	13(4.1%)	317
Ferrous sulfate	12(16.2%)	62(83.8%)	74
Lovastatin	14(14.3%)	49(85.7%)	63
Antibiotics	8(14.3%)	48(85.7%)	56

Discussion

The results of this study revealed that the rate of adherence to the standards of prevention from potential food-drug interactions in hospitalized patients was not high. In a study entitled "Food-Drug Interactions: Do They Really Matter?" Vella showed that drug interactions really matter [17].

In their study of food and drug interactions, Lopes et al. asserted that 13% of the reported food and drug interactions were related to aspirin (acetyl salicylic acid (anti-inflammatory drug)), 10 cases (17%) to captopril (cardiovascular drug), and 18 cases (30%) to spironolactone, which had the highest number of interactions among the other studied drug categories. Their results on interactions of captopril are consistent with the present study findings [5].

In their study of food and drug interactions, Leibovitch et al. reported interactions among cardiovascular, psychoactive, antibiotic, endocrine, gastrointestinal, and respiratory medications. Health care providers can prevent food and drug interactions and complications by careful drug selection and counseling for older patients [14].

The results of the study by Lopes on the evaluation of food and drug interactions were consistent with those of the present study

and revealed that from the total food and drug interaction cases, 53% were related to cardiovascular drugs, 22% to anti-inflammatory drugs, 18% to diuretic drugs, and 7% to gastrointestinal drugs [5].

Abbasi Nazari et al. reported frequent incorrect use of hydrochlorothiazide, captopril, and gemfibrozil, and 44% of drug administration was incorrect in relation to meals in their study. The surgery ward had the highest rate of wrong use of drugs followed by the gastrointestinal, hepatology, endocrinology, and nephrology wards [7].

High-risk patients, such as the elderly, patients who consume three or more drugs for their chronic conditions, and patients who suffer from diabetes, high blood pressure, depression, high cholesterol, or congestive heart failure should especially be controlled for such food and drug interactions [6].

Since cardiovascular and other medications are critical to improving patients' health, it is essential to have prior knowledge of such interactions to prevent interruptions in treatment, longer admission times, or damage to the nutritional status in these patients [5].

Food and drug interactions may lead to long-term hospitalization, re-admission to the

hospital, or deterioration of the patient's health condition [10].

Al-Shara et al. asserted in their study that medications are usually ordered by the doctor, distributed by the pharmacist, and administered by the nurse. The nurse is responsible for the proper administration of medications, which can include preparing, controlling, and administering the medications, updating their knowledge of medications, monitoring the effectiveness of treatment, reporting the side effects, and training patients about their medications [9].

Farzi et al. reported that crowded environments and heavy workload can lead to distraction and interruption in nursing activities and, as a result, altering pharmacotherapy, and food and drug interactions. Since the nature of health care services is collaborative and teamwork and the pharmacotherapy process is an interdisciplinary process, many people can contribute to the occurrence of such mistakes [18].

Otles et al. also found that pharmacists should be aware of the need to monitor food and drug interactions and provide counseling to patients on the consumption of food and beverages along with the prescribed drugs [4].

The potential clinical relevance of food and drug interactions should be recognized for each patient by the physician, nurse, pharmacist, and nutritionist who are members of the treatment team in order to establish an appropriate treatment regimen. It is important, therefore, that both pharmaceutical companies and health personnel recognize the importance of preventing food and drug interactions [19].

Otles et al. showed in their study that the effects of some drugs can change when they are used on a full or an empty stomach. If the medication has no guiding label, the patients must ask their physician whether to take the drug on a full or an empty stomach [4].

The following causes were found in the present study to be influential in the occurrence of food and drug interactions: the lack of knowledge of health care personnel, high number of inpatients, and lack of enough time, which will all lead to less patients training on food and drug interactions by the doctors and nurses. Other

reasons include: lack of patients' questioning about drug consumption directions, lack of pharmacists in the wards, lack of nutritionists in the wards, and not paying sufficient attention to patients training on food and drug interactions, which is a responsibility of the physicians, pharmacists, nurses, and nutritionists.

The factors affecting poor nursing performance regarding compliance with the standards for preventing food and drug interactions include type of the ward, average bed occupancy rate per week, number of nurses and paramedics in each shift, education level, and satisfaction with the ward of service. Factors such as exhaustion due to extra workload, shortage of nurses relative to the number of patients in the ward, mental and psychological problems of the nurses, lack of sufficient time, and supervision methods in the ward are some of the most important factors contributing to the occurrence of food and drug interactions.

One of the reasons why aspirin is taken properly by patients is that it is one of the most widely used medications in the study units. The use of this drug has severe gastrointestinal complications, and the patients themselves use this drug properly based on their own experience and the trainings provided by the medical staff. Similarly, magnesium hydroxide, which is used to treat constipation, was taken properly by most patients in accordance with the advice of the healthcare team.

Most strategies put forward by contributors included prevention from so many drug prescriptions and high workload. Regarding prevention and reduction of the interactions, it is necessary to pay more attention to continuous monitoring of nurses in terms of compliance with the five right rule, preparation and administration of drugs by a nurse, ongoing training of nurses about drugs, and improving the communications between members of the healthcare team.

The first limitation of this study involved the various social and psychological conditions of the patients that affected the results. The second limitation was that the actual effects of pharmacotherapy were not investigated

due to food and drug interactions. The third limitation was that this study was conducted in a training hospital and the results of studies conducted at this center may be different from those of other centers.

Conclusion

In general, it can be concluded from the findings of the present study that there has been relatively high compliance with the standards of prevention of potential food and drug interactions in hospitalized patients. Therefore, it can be asserted that multiple factors directly and indirectly affect the standards of prevention of potential food and drug interactions in hospitalized patients and as a result, consideration of these influential factors in compliance with the standards of prevention of potential food and drug interactions is of great importance.

According to the findings of this study, it is concluded that the main reason for the increased rate of non-compliance with the standards of food and drug interactions in the study units is the lack of proper and principled education based on the special needs of the inpatients of the ward that have to be done by physicians, pharmacists, nutritionists, and nurses.

Furthermore, the other reasons for this issue include the lack of sufficient awareness and knowledge of the above-mentioned personnel regarding special food and drug interactions, lack of a resident physician in the ward, lack of a pharmacist in the ward, lack of a nutritionist in the ward, lack of sufficient knowledge of the patients on how to take drugs, and lack of sufficient knowledge of the therapeutic personnel and patients about the importance of food and drug interactions. Hence, conducting periodic training programs on food and drug interactions is recommended for pharmacists, physicians, nutritionists, and nurses. Due to the limited size of the population of this study, conducting such research in larger populations is recommended.

Acknowledgments

This paper is derived from a masters thesis which was approved by the Assistance of Research and Technology of Khorasgan

Branch of Islamic Azad University of Isfahan under No.23810403911006. Hereby, the authors would like to express their gratitude and appreciation to all those patients and their families and the personnel of the educational hospital who contributed to this research.

Contribution

Study design: AM, SSh, ES

Data collection and analysis: AM

Manuscript preparation: AM, TZh, SSh, ES

Conflict of Interest

The authors declare that they have no competing interests."

Funding

The author (s) received no financial support for the research, authorship, and/or publication of this article.

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