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A review article on impact of drug food interactions and its prevention

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Abstract
A drug food interaction is a condition in which a substance effects the activity of a drug and the effects are increased or decreased or they produce a new effect that neither produces on its own. This may occur out of accidental or due to lack of knowledge about the interactions. The main aim of the review is to access a potential impact of drug food interaction. Moreover common use of medications continues to grow drug food interaction. In this review, we have mentioned about the basic information and its importance with common specific examples of both food and drug. It is well acknowledged and identified that drug food interaction occurs. Many medicines have a potent ingredients that interacts with food within a human body in different ways. Diet and lifestyle sometimes have a significant impact on drugs. At present, natural foods and vegetal supplements have recently become gradually popular of their roles. The consumption of foods and vegetal supplements has increased spectacularly over the last few decades raising concerns over the potential interaction between foods products and drugs in patient undergoing therapy. Some commonly used herbs, fruits as well as alcohol may cause therapy failure thus causes changes in the bioavailability of drugs. In addition, some people have a greater risk of food and drug interaction who have poor diet, serious health problem, elderly patients, children and pregnant women. Sometimes interaction may takes to the benefits of patients, but most commonly it results in adverse drug events. Therefore it is advisable to patients and caregiver to get instruction from the physicians and clinical pharmacists to obtain maximum benefits with least drug food interaction. This review gives common information to doctors, clinical pharmacists and other health-care providers about various interactions between drugs and foods. This will help to prescribe drug cautiously with time intervals between the drugs and foods or suitable supplements to get maximum benefits for the patients.

Keywords: drug food, substance effects, prevention

Introduction
In this era people think that all herbs and foods are natural and safe. This is not so. Most habitually, medications get interacted with herbs and foods which are taken intentionally but result in serious adverse effects. "Natural" does not always mean it is completely "Safe" experts say. Same ways medication travels through the digestive system as food and herbs do which are taken orally. Thus there is interaction when drugs and certain foods are taken concomitantly, which decreases the efficiency of the consumed drug or diminishes the absorption of food nutrients [1]. Moreover, there is antagonist's reaction when vitamin and herbal supplements are taken with prescribed medication when food affects the ingredients in a medicine causes food-drug interaction, thus altering the effectiveness of medicine being administered. Many health problems are treated and cured with medicines. Though they must be taken properly to ensure that they are safe and effective. Medication should be extremely definitive in their side effects, having the same expectable effect for all patients, never getting affected by concomitant food or other medication, exhibiting linear potency, be totally nontoxic in any dosage and sometimes, requiring only a single dose to affect a permanent cure. However, this ideal drug is still to be discovered. A drug food interaction is a situation in which a substance affects the activity of a drug, i.e. the effects are increased or decreased, or they produce a new effect that neither produces on its own. Typically, interactions between drugs come to mind (drug-drug interaction). However, interactions may also exist between drugs and foods (drug-food interactions), as well as drugs and herbs (drug-herb interactions) [2]. Thousands of drugs are commercially available and most probably at least one pharmacological active agent is taken by a great percentage of people on regular basis. Given this magnitude of use and variability in

individual nutritional status, dietary habits and food composition, there is a high potential for drug-nutrient interactions. However, there is a relatively short list of documented drug food interaction and extensive clinical evaluation. Health-care providers, such as physicians, pharmacists, nurses, and dietitian, have to be aware of important drug food interactions in order to optimize the therapeutic efficacy of prescribed and over-the-counter drugs. Here, we review some of the most widely consumed fruits and vegetables to inform health-care providers of possible nutrient-drug interactions and their potential clinical significance [3].

The Drug Reaction in the Body

Drugs interact with molecular targets to exert its effect by both therapeutic and adverse. The drug passes signal to this molecular targets, receptor or enzymes which propagates through effector trails which shows the noticed drug effect at the level of altered organ or whole body function. By protein target the drug mediates its therapeutic effect. Frequently, this target is located in the same tissue where a disease or pathological process occurs. In disease process these drugs are designed to interfere or suppress the symptoms of disease. Drug side effects are additional, usually undesirable, effects of medications. They can arise through the same mechanism of action as the therapeutic effect or through a distinct mechanism. They can be categorized based upon the relationship of Drug side effects and adverse events to the desired therapeutic action of the drug [4].

Drug effects are mediated by a drug or metabolite binding a protein target and affecting the function of the target in the context of a cellular network. The response of the cellular network can cause changes in gene expression, enzymatic activation, and ultimately tissue or organ physiology. These give rise to the observed effects of drugs. Measurements or information about any step in the information flow from drug to effects can be informative about any of the preceding steps. Systems pharmacology studies can integrate various forms of data about drug responses to identify off-targets of drugs and predict potential adverse drug effect [5].

Impact of Food Drug Interaction in Patient

It is essential to be responsible for information about the medications in relation to patient food intake. Delayed, decreased or enhanced absorption of the drug are the consequences of major drug food interaction. For example, the absorption of the medicine may get affected when the patient consume the some medicine at a same time. The food may delay or decrease the absorption of the drug. This is why some medicines should be taken on an empty stomach. On the other hand, with food some medicines are easier to tolerate. It is always recommended to ask the doctor or pharmacist about the medicine when to take or the medicine to be taken with food or empty stomach. Other factors like bioavailability, metabolism and excretion of certain medications also interacts. The impact of drug food interaction in patient may experience an adverse side effect or toxicity or may not obtain the full therapeutic outcomes of the medication. Moreover Elderly patients receives more medication because of their chronic condition such people are at a high risk of food drug interaction. Medicine not only affected by food consumed but also by the food being consumed and the time in which it is being consumed [6].

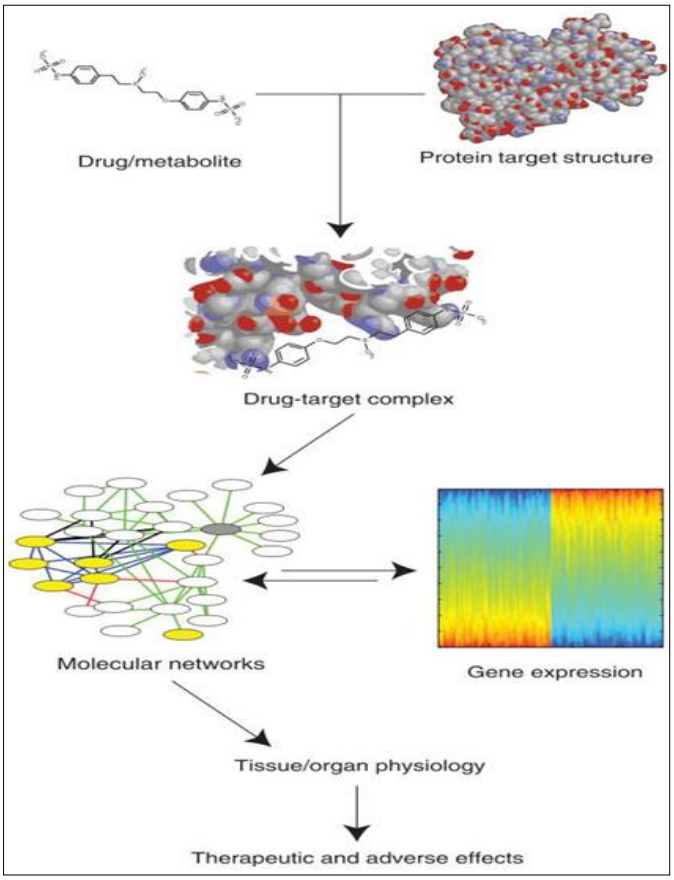

Fig 1

List of Some Common Food Drug Interactions [7]

Table 1

Drug	Food interacting	Effects	What To Do
Analgesics/antipyretics Acetaminophen	Alcohol	Increases Liver Damage	Strictly Avoid Alcohol
Antibiotics Doxycycline, Minocycline, Tetracycline, Amoxicillin, Penicillin	Dairy products, iron Supplements	Decreases Drug Absorption	Donot Take With Milk, Curd, Dairy Products, Iron Supplements
Azithromycin, Nitrofurantoin	Food	Slows Down Drug Absorption	take before 1 to 2 hr of any Foods.
Linezolid	Food Containing Tyramin	risk for hypertensive crisis	Try To Avoid Tyramin containing food or take after 6hr of drug administration
Anticoagulants Warfarin, Clopidogrel, Heparin, Rivaroxaban, Dabigatran, Enoxaparin	Food contain Vitamin K Vitamin E	Vitamin K Decreases & Vit E Increases Absorption Of Drug	Limit foods high in vit k- liver, Cabbage, spinach, broccoli,cauliflower Inform your doctor if you take Vit e supplements

Narcotic Analgesics Codeine + acetaminophen, Hydrocodone + acetaminophen, morphine	Alcohol	Alcohol Can Increase The Chance Of Dangerous Side Effects, Coma, Or Death.	Don't drink alcohol while using narcotics. (if in home medication)
Anti hyperlipidemias (statins) Rosuvastatin Atorvastatin	Grapefruit juice Alcohol	Can raise the levels of those statins in body and increase the chance of side effects Chance of liver damage	Don't drink grapefruit juce Totally avoid
Vitamin b 12	Meat, milk, eggs	Vit b 12 absorption decreases	Do not eat these foods with the drug
Metronidazole, (antibiotic) Procarbazine (antineoplastic) Chlorpropamide (antidiabetic)	Alcohol (major interaction)	Resulting in increased heart rate, increased b.p can take place due to drug interaction	Never take alcohol if on these drugs
Anti-inflammatory (nsaids) Aspirin Diclofenac Ibuprofen Ketoprofen Naproxen	Food or milk Alcohol	Decreases g.i irritation Risk of gi bleed & liver damage	Take with food or milk Avoid
Antidepressants (mao inhibitors) Isocarboxazid Tranylcypromine Rasagiline Selegiline	Tyramine	Risk for hypertensive crisis. Very serious drug food interaction	Avoid cheese, wine, chocolate, cocoa,coffee, yeast. Try to avoid tyramin containing foods.
Immunosuppressant Methotrexate	Folic acid	Folic acid Depletion	Take plenty of green leafy vegetables salads
Antiosteoporotics (calcium metabolism modifier) Alendronate	Caffeine Vitamin c	Reduction in absorption	Take with a gap of 2-3 hrs with food,juices & beverages
Calcium supplements	Dairy products	Inhibition due to chelation	Take on an empty stomach with a gap of 1-2 hours between meals/ dairy products
Iron supplements	Tea, coffee, fiber Vitamin c	Inhibits iron absorption Promotes iron absorption	Do not take with tea, coffee, salads, whole grains Take with fruits, juice add lime, tomatoes, green chilies to food
Antihistamines Cetirizine, Chlorpheniramine, Diphenhydramine, Fexofenadine, Levocetirizine	Alcohol	Increases drowsiness	Abstain from taking alcohol

Prevention of Drug Food Interaction

The following information can be given to the patients while dispensing the medicine:

- Read the label on the medicine container. And try to get more information about the medicine from the physician or pharmacist.
- Avoid over-the-counter medications without proper knowledge about it. Read the precaution mention on the labels.
- Vitamins and minerals can get interact with some drugs. So avoid taking vitamin pills concomitantly along with other medicines. And contact with physician or clinical pharmacist.
- Avoid taking medicine with hot drinks because the heat can destroy the effectiveness of the drug.
- Avoid taking any medicine with alcoholic drinks, also not with any other beverages or juices without instruction of physician.
- Relate with clinical pharmacist to know about the food which affect with the medicines you have been prescribed (8).
- Consult with clinical pharmacist to modify the administration timing and dosage intervals to avoid any kind of suspected interactions
- Patient counseling and patient education by clinical pharmacists/Pharmacologists and community pharmacists can reduce the drug food interaction.

Conclusion

Most often drug interactions are ignored and not considered it as seriously. Drug food interaction can be a very important influential factor for the occurrence of adverse drug events. As large number of drugs have been introduced each year, we can increase the safety and efficacy of the drugs if the particular known drug food interaction are avoided. In case of unavoidable, the patient experiencing the interaction should be monitored because this food drug interaction can produce negative effects in drugs and also in the nutritional status of patient. A proper thoroughly review should be carried about about the patient conditions and medications considering the food drug interaction before prescribing a newer drug to their existing drug regimen. Like food, drugs taken by mouth must be absorbed through the lining of the stomach or the small intestine. Consequently, the presence of food in the digestive tract may reduce absorption. The presence of food changes gastric motility, changes the gastrointestinal pH, and provides substances for drug and nutrient chelation and adsorption. Typically, when food is present in the stomach, drugs are absorbed more slowly; often, such interactions can be avoided by taking the drug 1 hour before or 2 hours after eating. However, a clear distinction must be made between decreased rate of absorption and decreased amount of drug absorbed. A decreased absorption rate allows for increased nutrient interactions and possible delays in therapeutic efficacy without changing the overall bioavailability of the drug. As the patient are unaware about the food drug interaction while hospitalized, the practionier must provide the proper knowledge to caretaker so that patient can get better treatment and moreover it can reduce the number of days in hospital. Discharge patient education programs become more vital. Research shows that dietitian assume responsibility for identifying and Counseling patients on food–drug interactions more frequently than pharmacists. This is likely because patient education and counseling on diet and nutrition is within the normal services provided to patients upon discharge and while hospitalized. Pharmacists, however, were more likely to be involved in providing reference material on potential interactions. Careful attention must be given to

lifestyle factors, unique nutrient, disease specific needs, poly-pharmacy, and over-the-counter medications. Generally speaking, drug food interaction must be avoided, due to the possibility of poor and unexpected outcomes.

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