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Food-Drug Interactions: To Be Considered Solemnly for Rational Therapy

			
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ABSTRACT

The effect of the drug on a person may be different than expected as the drug may interact with another drug (drug-drug interaction), food, beverages, dietary supplements the person is consuming (drug-nutrient/food interaction) or another disease the person has (drug-disease interaction). A drug interaction is a situation in which a substance affects the activity of a drug where the effects are increased or decreased or they produce a new effect that neither produces on its own. These interactions may occur out of accidental misuse or due to lack of knowledge about the active ingredients involved in the relevant substances. Regarding food-drug interactions, physicians and pharmacists recognize that some foods and drugs, when taken simultaneously, can alter the body's ability to utilize a particular food or drug, or cause serious side effects. Clinically significant drug interactions, which pose potential harm to the patient, may result from changes in pharmaceutical, pharmacokinetic, or pharmacodynamic properties. Some may be taken advantage of, to the benefit of patients, but more common drug interactions result in adverse drug events. Therefore, it is advisable for patients to follow the physician and doctors instructions to obtain maximum benefits with least food-drug interactions. This review gives information about various interactions between different foods and drugs and will help patients to take medication cautiously with only suitable food supplement to get the maximum benefit.

INTRODUCTION

Drug-drug interactions are widely recognized and evaluated as part of the drug-approval process, whether pharmaceutical, pharmacokinetic, or pharmacodynamics in nature. Equal attention must be paid to food-drug interactions. Drug metabolizing enzymes and drug transporters play important roles in modulating drug absorption, distribution, metabolism, and elimination. Acting alone or in concert with each other, they can affect the pharmacokinetics and pharmacodynamics of a drug. The interplay between drug metabolizing enzymes and transporters is one of the confounding factors that have been recently shown to contribute to potential complex drug interactions. Drugs with anticholinergic properties (eg, traditional antihistamines; diphenoxylate HCl with atropine sulfate) slow gastric emptying and can delay drug absorption and the onset of action. Antacids, H₂-blockers, and proton pump inhibitors also alter gastric pH, which affects the rate of dissolution of many drugs ^[1].

MECHANISMS OF DRUG INTERACTIONS

The three major mechanisms can cause interactions develop are:^[2]

1. Pharmacokinetic interactions.
2. Pharmacodynamic interactions.
3. Pharmaceutical interactions.

Pharmacodynamic Interactions

Pharmacodynamic interactions are those in which the activity of the object drug at its site of action is altered by the precipitant. These interactions may be direct & indirect.

Direct Pharmacodynamics Interactions

It is one in which drugs having similar or opposing pharmacologic effects are used concurrently. The following are the three consequences of direct interactions.

Antagonism

The condition of the interacting drugs having opposing actions is called Antagonism. This can be seen Acetylcholine with Noradrenaline have opposite effects on Heart rate. Another

example is Antiparkinsonian drug Levodopa action can be antagonized by dopamine antagonist, haloperidol & chlorpropamide.

Additive effect (or) Summation

The condition in which the interacting drugs have similar actions and the resultant effect is the sum of individual drug responses is called Additive effect. This is happening Hydrocortisone with Hydrochlorothiazide together can produce additive side effects of hyperglycemia or hypokalaemia. Another example co-administration of salicylates & anticoagulants results in the increased risk of bleeding.

Synergism

The condition of enhancement of action of one drug by another drug. This can be seen Alcohol enhances the analgesic effect of aspirin. Another example estrogen with Warfarin leads to increased anticoagulation.

Indirect Pharmacodynamic Interactions

Indirect Pharmacodynamic in both the object and the precipitant drugs have unrelated effects but the precipitant. The drug in some way alters the effects of the object drug. This effect can see in salicylates decrease the ability of platelets to aggregate thus impairing the hemostasis of warfarin-induced bleeding occurs. The resultant effect of all Pharmacodynamic interactions is thus altered with drug action change in plasma concentration.

Pharmaceutical Interactions

A physicochemical interaction occurs. When drugs are mixed in intravenous infusion causing precipitation or inactivation of the active principle such interaction are expressed by the term compatibility.

Ex: Ampicillin with dextran in solutions and are broken down (or) form chemical complexes.

Pharmacokinetic Interactions

These are those in which the absorption; distribution; metabolism and or excretion (i.e., ADME) of the object drug are altered by the precipitant. The resultant effect is altered plasma concentration of the object drug. These are most common and often result in

differences in pharmacologic effects. The drug having low therapeutic indices (digoxin) precipitates clinically important effects.

FOOD DRUG INTERACTIONS

Foods can interfere in different stages of drug action in the body. The most common effect is foods interfere with drug absorption. This can make a drug less effective because less amount of drug gets into the blood and to the site of action. Second, nutrients or other chemicals in foods can affect drug action in the body. Third, foods, nutrients, or other substances may affect excretion of drugs from the body. With some drugs, it is important to avoid taking food and medication together because the food can make the drug less effective. For example, vegetables high in vitamin K (eg, asparagus, red leaf lettuce) pharmacodynamically antagonize the anticoagulation effects of warfarin, making it essential to counsel patients to limit any variability in vitamin K intake. Increased dietary sodium can negate the effectiveness of many anti-hypertensive agents such as thiazides, and can alter the renal excretion of lithium. For other drugs, it may be good to take the drug with food to prevent stomach irritation. Risk factors for food/drug and drug/nutrient interactions can be affected by many factors such as age, gender, medical history, and body composition, and nutritional status, the number of medications used^[1].

MECHANISM OF FOOD DRUG INTERACTIONS

Food-drug interactions can be either Pharmacodynamic (relating to the action of the drug) or pharmacokinetic (relating to the drug's absorption, distribution, metabolism, and excretion).both of these pharmacologic properties can be potentiated or antagonized by food. However, pharmacokinetic effects represent the more significant mechanism for food-drug interaction. Aging itself is associated with slowing of gastric emptying, diminished gut wall function, and an increase in gastric pH. Concomitant ingestion of food with many medications can often have additional significant effects on drug absorption due to drug-nutrient binding, alterations in gastric emptying, and/or changes in gastric pH. These actions may reduce, increase, delay, or accelerate drug absorption. Heavy meals, particularly those with high-fat content, slow gastric emptying, just as many medications do.

Milk and milk products can raise the gastric pH and cause enteric-coated tablets to dissolve prematurely. This can result in altered drug absorption as well as gastric irritation. As a rule, drugs are more promptly inhibition of absorption can occur with some drugs when they are

taken with acidic fruit juices, vegetable juices, carbonated beverages, or caffeine. In older patients, where congestive heart failure or urinary incontinence frequently requires fluid restriction, Food can also alter transport mechanisms important in the drug absorption process. Milk and other products containing calcium can produce a complexation with some drugs, such as fluoroquinolones (ciprofloxacin, norfloxacin, and others), impairing their absorption. In addition, nutrients can affect intestinal transit time, splanchnic and hepatic blood flow, and can act as a physical barrier by hindering drug product (tablet, capsule) dissolution, binding to the drug, or preventing the drug from getting to the mucosal surface of the GI tract. In some instances, the mechanism for altering absorption remains unknown.

Occasionally, almost any ingested food or liquid can alter the absorption of certain medications, the most important example of which are the bisphosphonates used for management of osteoporosis (alendronate, risedronate, and tiludronate). Orange juice, coffee, and calcium products effect Bisphosphonate absorption. Geriatrics taking bisphosphonates should avoid these foods whenever possible to increase the activity of the drugs'. Ease of patient use has led to numerous slow-release formulations of many drugs and these formulations are commonly prescribed for geriatric patients. The rate of the release may be influenced by alterations in pH, the content of the diet, and the transit time in the GI tract. For example, some sustained-release verapamil and theophylline products have demonstrated highly variable bioavailabilities when taken with meals compared with the fasting state^[3].

DRUG/NUTRIENT INTERACTIONS

It is also possible for drugs to interfere with a person's nutritional status. Some drugs interfere with the absorption of a nutrient. Other drugs affect the body's use and/or excretion of nutrients, especially vitamins and minerals. If less of a nutrient is available to the body because of these effects, this may lead to a nutrient deficiency. Sometimes drugs affect nutritional status by increasing or decreasing appetite. This affects the amount of food (and nutrients) consumed. According to the World Health Organization (WHO), increased daily fruit and vegetable intake could help prevent major chronic non-communicable diseases. Following are the few examples of widely used nutrient supplements which are having prominent drug interactions^{[4],[5] [6],[7],[8],[9],[12]}.

Orange (*Citrus sinensis*)

Orange having an excellent source of vitamin C and them also the very good source of dietary fiber & vitamin B1, pantothenic acid. Previous studies in humans using fexofenadine as a probe showed that oral coadministration with orange juice decreased the oral bioavailability of fexofenadine. Orange juice and its constituents were shown to interact with members of the OATP transporter family by reducing their activities. Orange juice might reduce the intestinal absorption of substrates of OATP-B (e.g., digoxin, benzylpenicillin, and hormone conjugates), resulting in a decrease in concentration in the blood. It has been previously shown that consumption of a single 240 mL serving of Sevilla orange juice resulted in a 76% increase in felodipine exposure, comparable to what is observed after grapefruit juice consumption.

Grapes (*Vitis vinifera*)

Grapes having the good source of vitamin C, A, K, pyridoxine, riboflavin, thiamine. The grape is considered a source of unique and potentially useful medicinal natural products; they are also used in the manufacturing of various industrial products.). Resveratrol is an electron-rich molecule with two aromatic benzene rings linked by an ethylene bridge. CYP3A-mediated aromatic hydroxylation and epoxidation of resveratrol are possible, resulting in a reactive p-benzo- Quinone methide metabolite which is capable of Binding covalently to CYP3A4, leading to inactivation and potential drug interactions.

Guava (*Psidium guajava* L)

Guava is rich source of vitamin C. There is only one report about the effect of guava extracts on drug transport: guava extract showed a potent inhibitory effect on P-gp mediated efflux in Caco-2 cells. It was also found to inhibit efflux transport from serosal to mucosal surfaces in the rat ileum. This means that guava could interact with P-gp substrates such as digoxin, fexofenadine, indinavir, vincristine, colchicine, topotecan, and paclitaxel in the small intestine. For this reason, this fruit should be consumed with caution by patients taking medicines.

Apple (*Malus domestica*)

Apple is having good potassium content. It has been found that apple juice extract inhibits CYP1A1 at levels of CYP1A1 mRNA, protein, and enzymatic activity. On the other hand, it has also been reported that apple juice and its constituents can interact with members of the OATP transporter family (OATP-1, OATP-3, and NTCP) by reducing their activities *in vitro*. The functional consequence of such an interaction was a significant reduction in the oral bioavailability of fexofenadine in human plasma levels, possibly by preferential direct inhibition of intestinal OATP activity.

Grapefruit (*Citrus paradisi*)

Several findings showed that grapefruit juice had a major effect on the intestinal CYP system with a minor effect at the hepatic level. The predominant mechanism for this interaction is the inhibition of cytochrome *P*- 450 3A4 in the small intestine, which results in a significant reduction of drug pre-systemic metabolism. The interaction of grapefruit with certain drugs was unintentionally discovered two decades ago. Since then, there have been numerous reports on the effects of grapefruit and its components on CYP450 drug oxidation and Transportation^[10].

Pomegranate (*Punica granatum*)

Pomegranate having rich in carbohydrate & fats. It has been having reported that pomegranate juice influenced the pharmacokinetics of carbamazepine in rats by inhibiting enteric CYP3A activity. Such inhibition of the enteric CYP3A activity by a single exposure to pomegranate juice appears to last for approximately 3 days^[11].

FOOD DRUG INTERACTIONS IN VARIOUS DISEASED CONDITIONS:

Cardiovascular disorders

ACE Inhibitors (Angiotensin Converting Enzyme Inhibitors) like Captopril, Enalapril , Lisinopril, Moexipril, Quinapril, Ramipril, Beta Blockers like Carvedilol, Metoprolol, Diuretics like Bumetanide, Furosemide, Hydrochlorothiazide, metolazone, triamterene, triamterene + hydrochlorothiazide, Vasodilators-Nitrates like Isosorbide dinitrate , Vitamin K Agonists/ Anticoagulants like Warfarin are used in the treatment of cardiovascular disorders. Medication should be taken one hour before meals. ACE inhibitors can increase the amount of

potassium in the body. Too much potassium is harmful and can cause an irregular heartbeat and heart palpitations (rapid heartbeats). Avoid eating large amounts of foods high in potassium, such as bananas, oranges, green leafy vegetables, and salt substitutes that contain potassium. They can raise the level of potassium even higher. The doctor should be intimated while taking salt substitutes with potassium, potassium supplements, or diuretics (water pills) because these can add to the amount of potassium in the body.

Taking carvedilol along with the food lowers the blood pressure than the normal. Carvedilol extended-release capsules should be taken in the morning with food without crushing. Chewing, or dividing the capsule into parts. Metoprolol can be taken with meal or right after a meal. Diuretics cause loss of the minerals potassium, calcium, and magnesium from the body. Other diuretics like triamterene (not with hydrochlorothiazide), lower the kidneys' ability to remove potassium, which can cause high levels of potassium in the bloodstream (hyperkalemia).

Diuretics can increase potassium in the body, avoid eating large amounts of foods high in potassium, such as bananas, oranges, and green leafy vegetables, and salt substitutes that contain potassium as They can raise the level of potassium even higher. Too much potassium can be harmful and can cause an irregular or rapid beating of the heart.

Patients using digoxin should maintain time gap one hour before or two hours after eating food. Foods with high fiber content may decrease the digoxin in the body. Caution should be taken when taking digoxin along with Senna and St. John's wort as they may decrease the amount and action of digoxin in the body. Intake of digoxin with black licorice (which contains the glycyrrhizin used in some candies, cakes and other sweets) should be avoided. Digoxin with glycyrrhizin can cause irregular heartbeat and heart attack.

Lipid-Altering Agents (also called Statins) must be taken with a full or empty stomach. Some statins will work better with an evening meal. Drinking more than one quart of grapefruit juice a day should be avoided along with atorvastatin, lovastatin, or simvastatin. Large amounts of grapefruit juice can raise the levels of those statins in the body and increase the chance of side effects. Some statins do not interact with grapefruit juice. Taking alcohol with these medicines can increase liver damage.

In Vasodilators, all forms of nitrates can be administered with the full or empty stomach. Intake of Alcohol may add to the blood vessel-relaxing effect of nitrates and lead to a dangerously low blood pressure.

Anticoagulants can be taken with the full or empty stomach. Vitamin K in food can make the medicine less effective. Foods high in vitamin K include broccoli, cabbage, collard greens, spinach, kale, turnip greens, and Brussel sprouts. Cranberry juice or cranberry products should be avoided while using anticoagulants because they can change the effects of warfarin. Many dietary supplements and vitamins can interact with anticoagulants and can reduce the benefit or increase the risk of warfarin. Garlic, ginger, glucosamine, ginseng, and ginkgo should be avoided because they can increase the chance of bleeding. Alcohol can affect dose of warfarin^{[12],[13],[14]}.

Allergies

Antihistamines like Brompheniramine, cetirizine, chlorpheniramine, clemastine, desloratadine, diphenhydramine, fexofenadine, levocetirizine, triprolidine are used in the treatment of allergies. At the time of medication avoid alcohol because it increases drowsiness caused by these medicines^[14].

Arthritis, Pain, and Fever

Analgesics / Antipyretics like Acetaminophen, Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) like Aspirin, celecoxib, diclofenac, ibuprofen, ketoprofen Naproxen, Narcotic Analgesics like codeine + acetaminophen hydrocodone + acetaminophen meperidine morphine oxycodone + acetaminophen are used for Pain relieving and fever reducing. Drinking three or more alcoholic drinks every day, while using these medicines may result in harmful effects. Acetaminophen can cause liver damage. The chance for severe liver damage is higher with the combination of alcoholic drinks every day resulting in the unwanted synergistic effect. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) when used with milk upsets stomach. Narcotic Analgesics taken with Alcohol can increase the chance of dangerous side effects such as coma or death^[14].

Asthma

Bronchodilators like Albuterol, Theophylline used in this condition taken with Food can have different effects. Directions should be followed sprinkle forms of the medicine. Sprinkled capsules over soft puddings should be swallowed at once followed by a glass of water or juice. Using bronchodilators with foods and drinks that have caffeine can increase the chance of side effects, such as excitability, nervousness, and rapid heartbeat. Avoid alcohol while using theophylline medicines as alcohol can increase the chance of side effects, such as nausea, vomiting, headache, and irritability^[14].

Gastroesophageal reflux disease (GERD) and ulcers

Proton Pump Inhibitors like Dexlansoprazole, Esomeprazole, Lansoprazole, Omeprazole, Pantoprazole, and Rabeprazole are used in these cases. Dexlansoprazole and pantoprazole can be taken on a full or empty stomach. Esomeprazole should be taken at least one hour before a meal. Lansoprazole and omeprazole should be taken before eating^[14].

Hypothyroidism

Levothyroxine used in the treatment of thyroid should be taken once in a day in the morning on an empty stomach or at least one-half hour to one hour before eating any food. Avoid eating soybean flour (also found in soybean infant formula), cottonseed meal, walnuts, and dietary fiber as the dose of the medicine need to be changed^[14].

Infections

Antibacterial like Quinolone Antibacterial like Ciprofloxacin, Levofloxacin, Moxifloxacin Oxazolidinone like Antibacterial Linezolid, Metronidazole Antibacterial like Metronidazole, Antifungals like Fluconazole, Itraconazole, Posaconazole, Voriconazole, Griseofulvin, Terbinafine Itraconazole *capsules*, Antimycobacterials like Ethambutol, Isoniazid, Rifampin, Rifampin + Isoniazid, Rifampin + Isoniazid + Pyrazinamide Ethambutol, Antiprotozoals like Metronidazole, Tinidazole are used in the treatment of infections. Antibacterial like Ciprofloxacin, Levofloxacin, Moxifloxacin. Ciprofloxacin, levofloxacin, and moxifloxacin can be taken with the full or empty stomach. Levofloxacin oral solution should be taken one hour before eating or two hours after eating. Avoid taking of ciprofloxacin with dairy products (like milk and yogurt) or calcium-fortified juices alone, but can be taken with a

meal that has these products in it. Avoid taking ciprofloxacin with caffeine because caffeine may build up in the body. Tetracycline Antibacterial these medicines should be taken one hour before a meal or two hours after a meal, with a full glass of water. Tetracycline can be taken with food, but avoid dairy products (such as milk, cheese, yogurt, ice cream) one hour before or two hours after meals. Minocycline and some forms of doxycycline can be taken with milk if the remaining medicine upsets the stomach. Oxazolidinone should not be taken with large amounts of foods and drinks high in tyramine while using linezolid. High levels of tyramine can cause a sudden, dangerous increase in blood pressure. Tyramine is rich in the foods such as

- Cheeses, especially strong, aged, or processed cheese, such as American processed, cheddar, Colby, blue, brie, mozzarella, and parmesan cheese; yogurt; sour cream (can eat with cream and cottage cheese)
- Beef or chicken liver, dry sausage (including Genoa salami, hard salami, pepperoni, and Lebanon bologna), caviar, dried or pickled herring, anchovies, meat extracts, meat tenderizers and meats prepared with tenderizers
- Avocados, bananas, canned figs, dried fruits (raisins, prunes), raspberries, overripe fruit, sauerkraut, soybeans and soy sauce, yeast extract (including brewer's yeast in large quantities)
- Broad beans (fava)
- excessive amounts of chocolate

Any foods and drinks with caffeine also contain tyramine. Avoid alcohol while using linezolid. Many alcoholic drinks contain tyramine including tap beer, red wine, sherry, and liqueurs. Tyramine can also be in alcohol-free and reduced alcohol beer. Metronidazole Antibacterial with alcohol should be taken at least one full day after finishing the medicine; together alcohol and metronidazole can cause nausea, stomach cramps, vomiting, flushing, and headaches. Antifungals will work better during or right after a full meal. Itraconazole *solution* should be taken with empty stomach. Posaconazole will work better when taken with a meal or within 20 minutes of eating a full meal or with a liquid nutritional supplement. Don't mix voriconazole suspension with any other medicines, water or any other liquid. Griseofulvin works better when taken with fatty food. Avoid alcohol while taking

griseofulvin because griseofulvin can make the side effects of alcohol worse. For example, together they can cause the heart to beat faster and can cause flushing. Antimycobacterials like Ethambutol, Isoniazid, Rifampin, Rifampin + Isoniazid, Rifampin + Isoniazid + Pyrazinamide Ethambutol can be taken with or without food. The rest of these medicines one hour before a meal or two hours after a meal, with a full glass of water. Foods with histamine can cause a headache, sweating, palpitations (rapid heartbeats), flushing, and hypotension (low blood pressure). Drinking alcohol should be avoided while taking metronidazole and for at least one full day after finishing the medicine and for three days after finishing the medicine with tinidazole^[14].

Psychiatric disorders

Anti-Anxiety and Panic Disorder Medicines like Alprazolam, Clonazepam, Diazepam, Lorazepam, Antidepressants like Citalopram, Escitalopram, Fluoxetine, Paroxetine, Sertraline, Antidepressants-Monoamine Oxidase Inhibitors (MAOIs) like Phenelzine, Tranylcypromine Antipsychotics like Aripiprazole, Clozapine, Olanzapine, Quetiapine Risperidone, Ziprasidone, sedatives and Hypnotics (Sleep Medicines) like Eszopiclone, Zolpidem Bipolar Disorder Medicines like Carbamazepine, Divalproex sodium, Lamotrigine, Lithium are used in the treatment of psychiatric disorders. While taking these medicines Alcohol should be avoided as it increases side effects caused by these medicines such as drowsiness. Antidepressants can be taken with the full or empty stomach. Paroxetine should be swallowed as the whole tablet and it should not be chewed or crushed. While administering Antidepressants-Monoamine Oxidase Inhibitors (MAOIs) like Phenelzine, Tranylcypromine, Avoid foods and drinks that contain tyramine. High levels of tyramine can cause a sudden, dangerous increase in your blood pressure^[14].

Osteoporosis

Bisphosphonates (bone calcium-phosphorus metabolism) like Alendronate sodium, Alendronate sodium + cholecalciferol, Ibandronate sodium, Risedronate sodium, Risedronate sodium + calcium carbonate these medicines work only when taken them on an empty stomach. Take the medicine plain water and avoid drinking mineral water and antacids or any other medicine, food, drink, calcium, or any vitamins or other dietary supplements for at least 30 minutes. While using alendronate or risedronate and ibandronate avoid lying down for at least 60 minutes^[14].

DIABETES:

Oral hypoglycemic like glibenclamide or insulin, most of the plants like aloe vera, seeds of fenu Greek, ginseng, gurmar (*Gymnema Sylvestre*) leaves, gum fiber (galactomannans) are used for the hypoglycemic action. The effect of these supplements is unpredictable in individuals and no specific changes in hypoglycemic doses are needed unless the change in blood changes occur. While additive effects are certainly possible when these herbs are combined with the hypoglycemic drugs, appropriate self-monitoring by the patient and clear lines of communication between the patient and healthcare practitioner should avert problems^[14].

Tuberculosis

Isoniazid, Rifampin, Ethambutol, Moxifloxacin/Levofloxacin, Pyrazinamide, Ethionamide, Amikacin, Streptomycin, Capreomycin, Para-Aminosalicylic Acid (PAS), Cycloserine, Linezolid are used in the treatment of tuberculosis. Isoniazid, Rifampin should be taken 1 hour before or 2 hours after meals. It May take with the small snack if needed. Take 1 hour before or 2 hours after antacids. Alcohol should be avoided and Supplement Vitamin B6 is needed (25-50 mg). Ethambutol May be taken with food. Moxifloxacin/Levofloxacin should be Taken 2 hours before or after. These can be taken with aluminum magnesium or calcium-containing antacids, iron, vitamins, sucralfate, milk-containing products and food supplements. Pyrazinamide May be taken with food. Ethionamide may be taken with or after meals and alcohol should be avoided. Amikacin Increases fluid intake. It May is taken on a full or empty stomach. Streptomycin May affect the taste of food & Increase fluid intake. Capreomycin needs increase in intake of foods high in potassium but assures normal renal function. It Increases fluid intake. May be taken on a full or empty stomach. Para-Aminosalicylic Acid (PAS) it may take with or immediately following meals. It Increases fluid intake. Cycloserine with alcohol should be avoided. Linezolid May be taken with food. Food and drinks that contain tyramine should be avoided & drugs that promote the release of serotonin or block its uptake (serotonin syndrome) should not be used. Vitamin B6 supply is needed in most of the cases in tuberculosis treatment^[14].

There are a wide variety of medications on the market today. Almost all medications have the potential to cause side effects. Many people take more than one medication. This is especially true for older people. When people take multiple medications, food and drug

interactions are more likely to occur. The following tips can help avoid problems with medication.

- Always carry a list of all your medications and the dosing instructions.
- When your doctor prescribes a new medication, other drugs which are already taking should be intimated. This includes over-the-counter drugs and supplements that are used regularly. The doctor should be reminded of any drug allergies.
- Know how and when to take all of the medications through doctor or pharmacist.
- If any side effect from a medication is observed, contact doctor or pharmacist immediately.
- It is usually best to take medication with a full glass of water. This may help to prevent stomach irritation and improve absorption. Don't take medications with soft drinks or grapefruit juice.
- Get prescription refilled before it runs out so that there are no missed doses.
- Don't stir medication into food or drink unless doctor or pharmacist tells to do so. Certain foods may break down the drug, or limit its absorption.

Always read the directions and warning labels on your medication bottles and packages.

CONCLUSION

The number of drugs are introducing every year. Food-drug interactions can produce negative effects on safety and efficacy of drug therapy, as well as the nutritional status of the patient. 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 of a drug. Often, such interactions can be avoided by taking the drug 1 hour before or 2 hours after eating. Like drugs, foods are not tested as comprehensively so they may interact with prescription or over-the-counter drugs. Apart from various foods, alcohol is the primary drink to be avoided in all disease conditions to get beneficial effects of drugs. This review concludes suggesting patients to tell doctors and pharmacists about food intake and dietary supplements so that interactions can be avoided.

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