

## Drug Interaction

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**Received:** February 25, 2019; **Published:** April 25, 2019

### Abstract

Drug interaction includes drug-drug, drug-food and drug-alcohol interactions. Drug – drug interaction may induce synergism, antagonism or alteration of bioavailability and pharmacokinetics of different drugs. The effect of food, alcohol and dietary supplements on absorption and consequently the response to different classes of drugs has been discussed. The role of doctors, pharmacists and patients to avoid and minimize drug interactions is also indicated.

### Drug interaction includes

Drug-drug interaction, Drug-nutrient interaction and Drug-disease interaction.

Drug-drug interaction where the effect of a drug has on a person may be different than expected because the drug interact with another drug. This effect is usually unwanted and sometimes harmful. This interaction may increase or decrease the action of one or more drugs resulting in side effects or failed treatment.

Drug-drug interaction may be Synergistic where two drugs with the same effect are taken. Their side effects may be intensified.

Synergism may occur when people inadvertently take two drugs that have same active ingredients. Often at least one is an over-the-counter drug.

People may take a cold remedy and a sleep aid, both of which contain diphenhydramine.

People may take a cold remedy and a pain reliever, both of which contain acetaminophen. This kind of duplication is likely to happen with drugs that contain multiple ingredients. Or that sold under brand names thus appearing to be different but actually containing the same ingredients.

This synergism can also arise when people see several physicians and obtain prescriptions at more than one pharmacy. One physician prescribes a sleep aid and one prescribes antianxiety drug. Both drugs have similar sedative effects leading to excessive sedation and dizziness.

Drug –Drug interaction may result in antagonism: when two drugs with opposing actions can interact, thereby reducing the effectiveness of one another.

NSAID e.g. ibuprofen cause the body to retain salt and fluids. Where, diuretics e.g. hydrochlorothiazide and furosemide help rid the body of excess salt and fluids. So, if person takes both types of drugs, the NSAID may reduce diuretics effectiveness.

Beta blockers e.g. propranolol taken to control high blood pressure and heart disease. It acts by blocking beta-2 receptors. Where, Beta adrenergic stimulants e.g. albuterol taken to control asthma. It acts by stimulating beta-2 receptors. So, both drugs counteract each other as they target the same cell receptors but one type blocks them and the other stimulates them.

Drug –Drug interaction may result in alteration: when one drug may alter how the body absorbs, distributes, metabolizes or excretes another drug.

Acid blocking drugs e.g. histamine-2 (H2) blockers and proton pump inhibitors, raise pH of the stomach. This decrease absorption of some drugs e.g. ketoconazole, a drug for fungal infection.

Barbiturates e.g. phenobarbital increases activity of liver enzymes. This causes the anticoagulant warfarin to be inactivated more quickly and be less effective when taken during same time period.

Conversely, erythromycin and ciprofloxacin decrease activity of liver enzymes, so increase activity of warfarin, risking bleeding.

Chemicals in cigarette smoke can increase activity of liver enzymes. So, smoking can decrease the effectiveness of some drugs e.g. propoxyphene (analgesic) and theophylline (bronchodilator).

Grapefruit juice inhibits enzymes involved in drug metabolism and thereby intensifies the effect of many drugs e.g. Ca channel blockers, estrogen and oral contraceptives and statins.

Some drugs may affect rate at which kidneys excrete another drug. Vitamin C increases urine acidity. So it decreases the rate of excretion of acidic drugs such as aspirin. But it increases the rate of excretion of basic drugs such as pseudoephedrine.

Salicylates, sulfonamides, phenytoin and tetracyclin displace methotrexate from its binding sites, so increase its toxicity.

### Food and drug interaction

A drug – food interaction happens when the food you eat affects the ingredients in a medicine you are taking so the medicine cannot work the way it should.

Prescription and over the counter medicines including antacids, vitamins and iron pills.

Not all medicines are affected by food, but many medicines can be affected by when you eat it.

Like food, drugs taken by mouth must be absorbed through the lining of the stomach or the small intestine. The presence of food in the digestive tract may reduce absorption of a drug. Such interactions can be avoided by taking the drug one hour before or two hours after eating.

Dietary supplements including medicinal herbs are products that contain a vitamin, mineral, herb or amino acids are regulated as food. They may interact with prescription or over the counter drugs.

People who take dietary supplements should tell their doctors and pharmacists, so that interactions can be avoided.

Changes in a medicine's effect due to an interaction with food, alcohol or caffeine can be significant.

There are many individual factors that influence the potential for such variations, like dose, age, weight, sex, and overall health.

Possible interactions with antihistamines which are used to relieve or prevent the symptoms of colds, hay fever, and allergies. They limit or block histamine, which is released by the body when we are exposed to substances that cause allergic reactions.

Antihistamines are available with and without a prescription (over the-counter).

Antihistamines are used to relieve or prevent the symptoms of colds, hay fever, and allergies. They limit or block histamine, which is released by the body when we are exposed to substances that cause allergic reactions.

Over the Counter antihistamines e.g. brompheniramine/dimetane, bromphen, chlorpheniramine/chlor-trimeton, diphenhydramine/benadryl, clemastine/tavist.

Prescription antihistamines e. g. fexofenadine/allegria, loratadine/claritin, cetirizine/zyrtec, astemizole/Hismanal.

### Interaction of antihistamines

- **Food:** It is best to take prescription antihistamines on an empty stomach to increase their effectiveness.
- **Alcohol:** Some antihistamines may increase drowsiness and slow mental and motor performance. Use caution when operating machinery or driving.

### Analgesic/Antipyretic

- Interaction: They treat mild to moderate pain and fever e. g. acetaminophen/tylenol, tempra.

## Interactions

- **Food:** For rapid relief, take on an empty stomach because food may slow the body's absorption of acetaminophen.
- **Alcohol:** Avoid or limit the use of alcohol because chronic alcohol use can increase your risk of liver damage or stomach bleeding.

### Non-steroidal anti-inflammatory drugs (NSAIDs)

NSAIDs: reduce pain, fever, and inflammation. examples are: aspirin/bayer, ecotrin, ibuprofen/motrin, advil, naproxen/anaprox, aleve, naprosyn, ketoprofen/orudis, nabumetone/relafen.

### Interaction

- **Food:** Because these medications can irritate the stomach, it is best to take them with food or milk.
- **Alcohol:** Avoid or limit the use of alcohol because chronic alcohol use can increase your risk of liver damage or stomach bleeding.

Buffered aspirin or enteric coated aspirin may be preferable to regular aspirin to decrease stomach bleeding.

## Corticosteroids

They are used to provide relief to inflamed areas of the body. Corticosteroids reduce swelling and itching, and help relieve allergic, rheumatoid and other conditions.

some examples are: methylprednisolone/medrol, prednisone/deltasone, prednisolone/pediapred, prelone, cortisone acetate/cortef.

### Interaction

- **Food:** Take with food or milk to decrease stomach upset.

## Narcotic analgesic

Narcotic analgesics are available only with a prescription. They provide relief for moderate to severe pain. Some of these medications can be found in combination with non-narcotic drugs, such as acetaminophen, aspirin, or cough syrups.

Some examples are: codeine combined with acetaminophen/tylenol, oxycodone combined with acetaminophen/percocet, roxicet, hydrocodone with acetaminophen/vicodin, lorcet.

### Interaction:

Avoid alcohol because it increases the sedative effects of the medications.

## Bronchodilators

Bronchodilators are used to treat the symptoms of bronchial asthma, chronic bronchitis and emphysema. These medicines open air passages to the lungs to relieve wheezing, shortness of breath and troubled breathing.

Some examples are: theophylline/SLO-BID, THEO-DUR, THEO-DUR 24, UNIPHYL, albuterol/VENTOLIN, PROVENTIL, COMBIVENT, epinephrine/PRIMATENE MIST.

### Interactions

Food: High-fat meals increase the amount of theophylline in the body.

High-carbohydrate meals may decrease it.

Food can have different effects depending on the dosage form (e.g., regular release, sustained release or sprinkles).

Caffeine: should be avoided by not eating or drinking large amounts of food and beverages that contain caffeine e.g. chocolate, colas, coffee.

Both oral bronchodilators and caffeine stimulate the central nervous system.

**Alcohol:** should be avoided when taking theophylline as it increases risk of side effects e.g. nausea, vomiting, headache and irritability.

## Cardiovascular-disorders

There are numerous medications used to treat cardiovascular disorders such as high blood pressure, angina, irregular heartbeat, and high cholesterol. These drugs are often used in combination to enhance their effectiveness. Some classes of drugs can treat several conditions.

For example, beta blockers can be used to treat high blood pressure, angina, and irregular heart beats.

### Some of the major cardiovascular drug classes are:

#### Diuretics

Sometimes called “water pills,” diuretics help eliminate water, sodium, and chloride from the body.

there are different types of diuretics: furosemide/lasix, triamterene/hydrochlorothiazide/dyazide, maxzide, hydrochlorothiazide/hydrodiuril, triamterene/dyrenium, bumetamide/bumex, metolazone/zaroxoly

#### Interactions

##### Food

- Diuretics vary in their interactions with food and specific nutrients.
- Some diuretics cause loss of potassium, calcium, and magnesium.
- Triamterene, on the other hand, is known as a “potassium-sparing” diuretic.
- It blocks the kidneys’ excretion of potassium, which can cause hyperkalemia (increased potassium). Excess potassium may result in irregular heart beat and heart palpitations.
- When taking triamterene, avoid eating large amounts of potassium-rich foods such as bananas, oranges and green leafy vegetables, or salt substitutes that contain potassium.

#### Beta blockers

- They decrease the nerve impulses to the heart and blood vessels. This decreases the heart rate and the work load of the heart.
- some examples are: atenolol/tenormin, metoprolol/lopressor, propranolol/inderal, nadolol/corgard.

#### Interactions

Alcohol: Should be avoided with propranolol/INDERAL because the combination lowers blood pressure too much.

#### Nitrates

- Nitrates relax blood vessels and lower the demand for oxygen by the heart.

- Some examples are: Isosorbide dinitrate/isordil, sorbitrate, nitroglycerin/nitro, nitro-dur, transderm-nitro.

#### Interaction

- Alcohol: Should be avoided because it may add to the blood vessel-relaxing effect of nitrates and result in dangerously low blood pressure.

#### Angiotensin converting enzyme (ACE) inhibitors

- ACE inhibitors: relax blood vessels by preventing angiotensin II, a vasoconstrictor, from being formed.
- Some examples are: Captopril/CAPOTEN, enalapril/VASOTEK, lisinopril/PRINIVIL, ZESTRIL, quinapril/ACCUPRIL, moexipril/UNIVASC

#### Interactions

- Food: can decrease the absorption of captopril and moexipril. So take captopril and moexipril one hour before or two hours after meals.
- ACE inhibitors may increase the amount of potassium in your body. Too much potassium can be harmful. So tell your doctor if you are taking potassium supplements or diuretics (water pills) that may increase the amount of potassium in your body.
- Avoid eating large amounts of foods high in potassium such as bananas, green-leafy vegetables, and oranges.

#### HMG-COA reductase inhibitors (hydroxy-3methyl-glutaryl – COA-3)

- Also known as “statins”. These medications are used to lower cholesterol.
- They work to reduce the rate of production of LDL (bad cholesterol).
- Some of these drugs also lower triglycerides.
- Recent studies have shown that pravastatin can reduce the risk of heart attack, stroke, or miniature stroke in certain patient populations.

#### Statins

some examples are: atorvastatin/lipitor, cerivastatin/baycol, fluvastatin/lescol, lovastatin/mevacor, pravastatin/pravachol, simvastatin/zocor.

### Interaction

- Food: Lovastatin (Mevacor) should be taken with the evening meal to enhance absorption.

### Anticoagulants

- Anticoagulants help to prevent the formation of blood clots.
- An example is: warfarin/COUMADIN

### Interactions

Food: Vitamin K produces blood-clotting substances and may reduce the effectiveness of anticoagulants. So limit the amount of foods high in vitamin K (such as broccoli, spinach, turnip greens, cauliflower, and brussel sprouts).

High doses of vitamin E (400 IU or more) may prolong clotting time and increase the risk of bleeding. So, talk to your doctor before taking vitamin E supplements.

### Antibiotics and antifungals

Drugs that are used to treat infections caused by bacteria and fungi.

#### Antibacterial

##### Penicillin

Some examples are: penicillin v/veetids, amoxicillin/trimox, amoxil, ampicillin/principen, omnipen.

##### Cephalosporins

Some example are: Cefaclor/ceclor, ceclor cd, cefadroxil/duricef, cefixime/suprax, cefprozil/cefzil, cephalixin/keflex, keftab.

##### Macrolides

some examples are: azithromycin/zithromax, clarithromycin/biaxin, erythromycin/e-mycin, ery-tab, eryc, erythromycin + sulfisoxazole/pediazole.

##### Sulfonamides

- An example is: sulfamethoxazole + trimethoprim/bactrim, sepra
- Interaction: for penicillin, cephalosporins, macrolides and sulfonamides

- Food: Take on an empty stomach one hour before or two hours after meals, but if it upsets your stomach, take it with food.

### Quinolones

Some examples are: ciprofloxacin/cipro, levofloxacin/levaquin, ofloxacin/floxin, trovafloxacin/trovan

### Tetracyclines

Some Examples are: Tetracycline/achromycin, sumycin, doxycycline/vibramycin, minocycline/minocin.

Interaction for tetracyclins and quinolones.

Food: Take on an empty stomach one hour before or two hours after meals. If your stomach gets upset, take with food.

However, it is important to avoid taking tetracyclines and quinolones with calcium containing products (dairy products), antacids and vitamins or minerals containing iron because these can interfere with the medication's effectiveness.

### Antifungals

Some examples are: fluconazole/diflucan, griseofulvin/grifulvin, ketoconazole/nizoral, itraconazole/sporanox.

### Interaction

Food: It is important to avoid taking these medications with dairy products (milk, cheeses, yogurt, ice cream), or antacids. Better take after a fatty meal.

### Monoamine oxidase (MAO) inhibitors

MAO inhibitors are used for treatment of depression, anxiety. Can also use for Parkinson's disease and migraine prophylaxis.

Some examples are: Phenelzine/nardil, tranylcypromine/parnate

### Interactions

- Food: MAO Inhibitors have many dietary restrictions, and people taking them need to follow the dietary guidelines and physician's instructions.

- A rapid, potentially fatal increase in blood pressure can occur if food or alcoholic beverages containing tyramine are consumed while taking MAO Inhibitors.

Food high in tyramine should be avoided while taking MAO Inhibitors

American processed, cheddar, blue, brie, mozzarella and Parmesan cheese; yogurt, sour cream. Beef or chicken liver; cured meats such as sausage and salami; caviar; dried fish. Avocados, bananas, yeast extracts, raisins, soy sauce. Broad (fava) beans, ginseng, caffeine-containing products (colas, chocolate, coffee and tea).

### Potential prescribing problems

1. Inappropriate combination of drugs.
2. Failure to account for patient characteristics in making drug therapy decision.
3. Allergies to ordered medications.
4. Pharmacists fill more than 15 prescriptions/hour.

### Recommendations for reducing pharmacists errors

1. Encourage patients to have and use smart card.
2. Computerized physician order entry.
3. Doctors and pharmacists can use a database which can be downloaded from the internet to a hand held computer.
4. Develop preprinted order forms that improve standardization and give guidance for calculating doses.

### What patient can do

1. Ask question about his care.
2. If he thinks there may be a problem, ask before it is a problem.
3. Have his complete medical history in hand.
4. Tell the pharmacist about any medications, over the counter drugs, dietary supplements or medicinal herbs he is using.
5. Know his options.

### Communicate before medicate

#### Role of pharmacist

1. Closely reviewing drug interactions, patient age, weight and organ function, medication record and provision of patient education.
2. Record all medication errors as they discovered and file appropriate medication error report.
3. Identify and monitoring patients receiving high risk medications.
4. Screening for drug-drug interaction.
5. Evaluating the appropriateness of each dose on basis of patient specific values.
6. All medication orders are reviewed by staff pharmacists and entered into pharmacy computer.
7. Pharmacy computer system has standard automatic dose range checking, allergy checking, drug interaction checking.
8. Talk to the patients and be sure they have written information that explains dosage schedule.
9. Pharmacists should encourage feedback to ensure that patients understand the dosage schedule and the medication should not be used as needed for symptoms control.
10. Electronic alerts in prescriber order entry system and pharmacy computer systems can signal clinicians to check for potential errors [1-13].

### Conclusion

1. If several drugs are taken, refer to the drug interactions of each.
2. Remember that nutrition implications for some drug combinations differ from the implications for an individual drug.
3. Involve the client in finding solutions that address side effects and drug interactions.
4. Give special consideration to traditional medicines.
5. Do consider using one pharmacy for all your prescriptions.
6. Do not combine prescription medicines and over the counter medicines unless the doctor says it's ok.

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**Volume 3 Issue 5 May 2019**

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