



## ROLES OF HEALTHCARE PROVIDERS IN FOOD-DRUG INTERACTIONS WITH CVD PATIENTS

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### ABSTRACT

Cardiovascular disease is a highly significant disease that tends to impact the whole body functioning. Various pharmaceutical drugs are prescribed to treat the conditions associated with cardiovascular disease (CVD). However, concerning the significance of pharmaceutical drugs, innovation in nursing health practices is crucial to make healthcare providers informed about the common problems associated when drugs' efficacy. The concomitant drug interaction with that of the foods is always a question, as components (nutrients) present in the foods either increase the therapeutic effectiveness of the drugs or bring undesirable and unavoidable side effects. Pharmaceutical interventions can pose unwanted interaction with the organ receptors, which can lead to unwanted impacts on the age, sex, weight, medical history, and health outcomes of the person. Further, the dose, interval, and frequency of medicines, can result in significant side effects that can seriously harm the patient's health. Hence, food-drug interaction provides a crucial approach to improving the metabolic functioning of the person.

**KEYWORDS;** *pharmaceutical interventions, cardiovascular disease, food-drug interaction, and therapeutic effectiveness.*

### INTRODUCTION

Food tends to possess the critical interventions in treating several kinds of pathophysiology which further guarantees the safety and efficacy of the person's metabolic system. There may be certain side effects to the pharmaceutical medications, which may not be recommended for a longer duration. Food interaction with drugs or cardiovascular disease can be further understood through the branch of nutraceuticals, where health-benefit food components tend to improve the physiological and metabolic system of the person, making them healthy and fit<sup>[1]</sup> Foods can generally change the drug interaction, which will either strengthen or weaken the functioning of the drugs within the human body. Furthermore, clinically, most drugs are recommended to produce a significant positive effect, when it is taken with foods, herbs, or fruits. Food-drug interaction tends to change the drugs' bioavailability in the body and exerts a complete influence on the functioning of the metabolic system through the action of mechanisms on the drug-binding receptors.<sup>[2]</sup> However, the functioning of the impact of the drug can be changed according to the main factors including age, the dose of

medication, time of drug consumption followed by or following food components and level of awareness. Depending on the dietary constituents, there may occur subsequent treatment failure leading to serious adverse effects. An improper diet or lack of knowledge of dietary intake through three specialised processes including absorption, metabolism and excretion, can increase the potential risks of the drug-to-drug interaction. Further discussion will provide deep insights into the pharmacodynamic alterations due to the drug-food interaction and interfering with the drug mechanism of the actions. Further, the list of nutrients posing negative impacts as well as a positive influence on the drug-food interaction will be described.

### METHODS

Research methodology is considered as the specific procedures to assist the appropriate information of the research question by identifying, processing, and analyzing the information from the top selected research articles or even by performing the on-site studies.

**Qualitative and quantitative research methods:** Two common types of research methodologies include primary and secondary analysis. Primary analysis is determined by the qualitative or quantitative research approach, which is carried itself by the key performer or researcher. However, secondary analysis is the interpretation of the information which are researched by other researchers.<sup>[3]</sup>

Under this research, secondary methods will be selected, in which data collection is done based on previously researched information. The data will be collected through secondary analysis, including experimental, observational, and surveys. The benefit of collecting qualitative data over quantitative data is that gathering non-numerical information is easier and outcomes or results can be achieved without on-field observation or experimentation.

The methodology will help in interpreting the detailed plan of research through data collection, analysis of results, and development of conclusions.<sup>[3]</sup> However, whilst formulating the research, the main principles of research will be followed including the reduction of risk of information leakage of participants and protection of their confidentiality.

#### Research design

Considering the Research design, the analysis will be based on the interpretation of the key information

through observation and surveys. The outcomes of the studies aid in providing detailed information about the drug efficacy in treating CVD along with the increment of the drug efficacy when it is applied along with the functional foods. This research will allow the researchers to analyze the positive as well as negative impacts of the drugs when mediated through functional food availability. Further, there will not be any harm to the participants as well as to the economy, as there is a great emphasis on comparing the different research articles to make the evidence stronger. Further, the casual relationship will be recognized concerning the adverse impacts of the drug with the non-required functional foods. To collect the data for the qualitative studies under the secondary analysis, peer-reviewed journals will be selected, where the strengths and limitations of the papers will further be discussed along with the future viewpoints of the research aims.

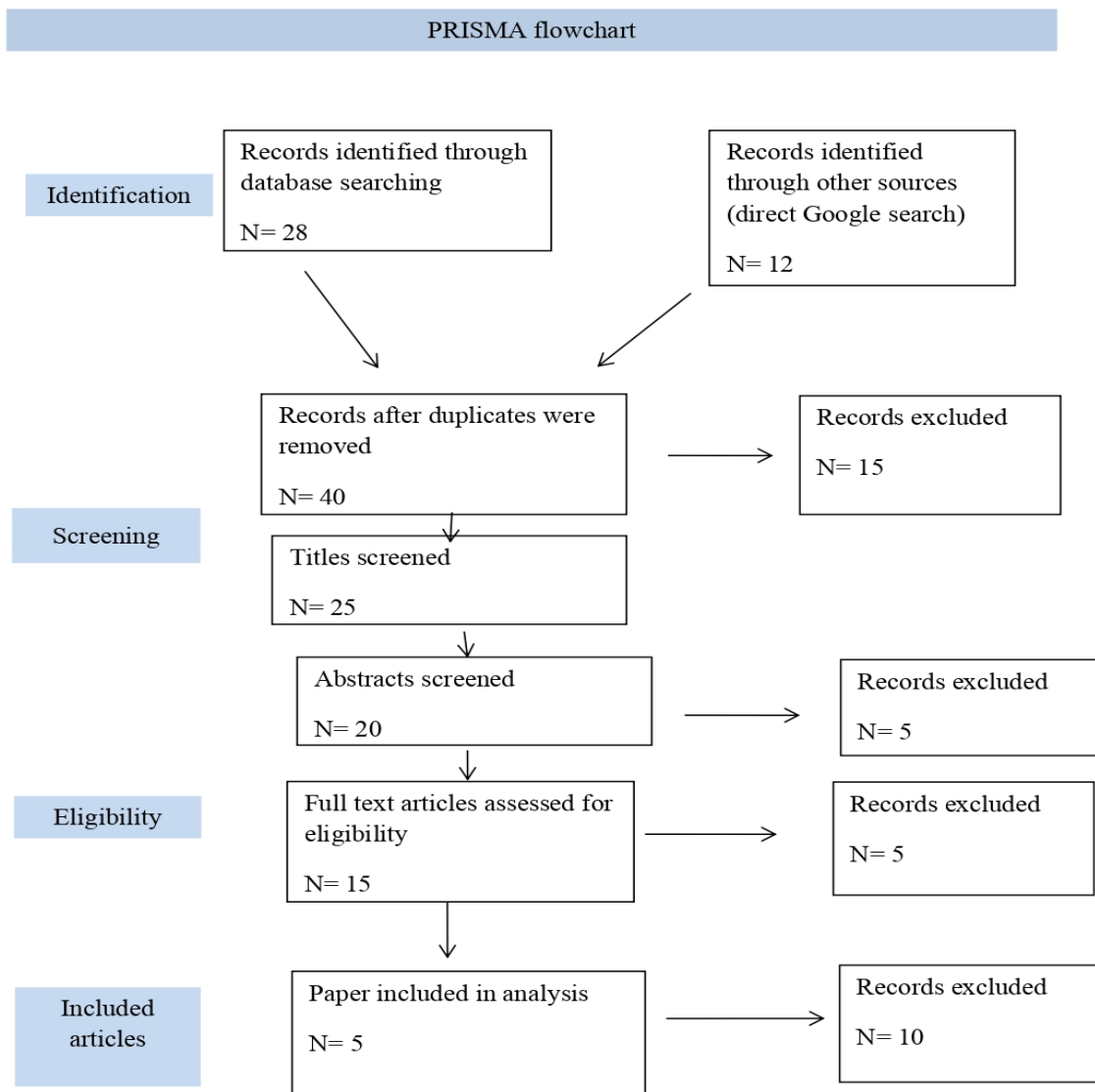
#### Search strategy

To perform this study, various peer-reviewed journals and literature articles will be selected through a systematic screening tool, which is PRISMA. This approach is highly crucial in recognizing the greater quality of research papers through the systematized analysis. Further, under the strategy, two necessary steps will be followed whilst selecting the peer-researched articles.<sup>[4]</sup> The steps include inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
peer-reviewed journals will be selected	Papers which are not fitted into the peer-reviewed journal category
Papers published in the last 10 years	Papers previous to 10 years will be excluded
Articles are fully accessible	Unaccessible papers will be rejected
The research articles directly focus on the research aim, which is the impact of food-drug interaction in patients with CVD.	If papers divert from the aim of the study and are not in English languages, will be excluded.

The **databases** are: MDPI, Sciencedirect, Sagepub, Pubmed PRISMA is an effective approach to evaluating peer research papers based on the exclusion and inclusion criteria. The systematization of the papers tends to support the effective findings of the papers so that a better quality of information can be retrieved.<sup>[4]</sup> Further, ethical considerations for the participants as well as of the healthcare providers are maintained throughout

the research. There is no breakage or breach of their privacy concerns. The information which is retrieved through observational studies by collecting data from different healthcare organizations was not shared with the anonymous participant. Also, under the surveys, the values, dignity, anatomy, and privacy of the participants were found to be ethically justified, with no mental or psychological harm to them.<sup>[5]</sup>



**Figure 5: PRISMA checklist.**

Based upon the PRISMA guidelines, a total of 5 articles are selected through the process of screening. Under screening, the first approach was to select the articles based on duplication of the articles retrieved from different databases. The next step was to select based on the abstract which provides information about the main topic, the implication of drug-food interactions on patients with CVD. The next step was to select the articles based on the eligibility criteria of full accessibility and inclusion of the records relevant to the topic information. Thus, PRISMA supports providing good explanations along with elaboration.<sup>[6]</sup>

### Results and their Significance

There is a critical need for the inclusion of dietary recommendations to make for the patients admitted to the hospitals. The dietary inclusion within the drugs is associated with reduced toxicity effects on the body organs and impacting organ functioning. For example, the consumption of vitamin K food sources at the time of drug consumption tends to reduce the adverse effects of

anticoagulant therapies.<sup>[7]</sup> Besides this, clinicians should provide caution to patients regarding the side effects of the dose variability, time, and duration of the drugs. The sources of vitamin K include broccoli peas, spinach, and green salad. Further, the adverse effect of the diet over the drug interactions can be seen among the patients. For example, if a person had any kind of hemorrhage like medical conditions, the consumption of garlic, ginger, and Ginkgos can pose adverse impacts, which further elevates the conditions of hemorrhage.<sup>[8]</sup>

Concerning the study retrieved from Mother Teresa University Hospital Centre, CVD patients, who developed comorbidities due to improper drug-food interaction include; 41.30% of hypertension cases, 36.10% of diabetes cases, and 9.20% cases of kidney cases. Besides this, 13.40% were the cases reported for the major comorbidities.<sup>[8]</sup>

Further, concerning the statistical significance of the pDDI over the patients, out of 2787 CVD participants,

74% of the participants presented a moderate level of side effects of the clinical interventions, and 17% of participants presented a major severity. The impact of the pDDI was not only in the form of side effects to interfere with the desired goal of therapy, but the increased rate of morbidity, mortality, and health care costs was also discovered. More than 17% of participants were also recorded to be rehospitalized due to concerns about pDDI complications. However, there were encountered most of the avoidable cases of adverse drug events, were related to improper dietary recommendations to the patients. Following the frequency of the severity, CVD patients of patients underwent higher burdens.<sup>[9]</sup>

The bioactive dietary ingredients present in the foods influence the pharmacokinetics and pharmacodynamic properties of the drugs when administered following the drugs.<sup>[10]</sup> As a result of the food-drug interaction, pharmacodynamics modulations tend to pose the effects in terms of additive, synergistic, or antagonistic effects. Hence, healthcare professionals need to completely adhere to the specific clinical guidelines recommended for food-drug interaction.<sup>[10]</sup>

## DISCUSSION

**Patel et al. (2020)** studied the effects of drug-to-drug interaction on gastrointestinal mobility. Food-drug interaction is most commonly regarded by the pharmacokinetics and pharmacodynamics actions, to achieve successful treatment. The concurrent use of other pharmaceutical drugs can cause an impact on gastrointestinal absorption the following effects, including pH alteration, gastrointestinal mobility, reduction in the absorption rate, protein transportation, and chelating effects. However, natural products possessing the same pharmacokinetics and pharmacodynamics principles are important in drug metabolism.<sup>[11]</sup> However, appropriate selection, quantity, and duration of the interaction significantly matter on the metabolic process, which is regarded as a concern for the improvement of drug safety under individualized drug therapy. According to the study of **Spanakis et al. (2022)**, the efficacy of the drugs increases when there is an appropriate combination of the drugs as well as food at the same time. Further, considering an example of the pomelo food and Seville orange taken with the drug consumption, the agents presented in these foods can inhibit the activity of the P450 3A4 (CYP3A4), which can further reduce the capacity of the drug metabolism and pose the negative effects on body's metabolic process.<sup>[12]</sup> There should be increased awareness among clinicians about the drug efficacy and strategies to overcome the side effects. The use of a personalized diet for post-hospital patients can act as an innovative approach for the minimization of side effects and improving the overall health of the patients. The main emphasis needs to pay to the biological effects of the drug-food interaction, which is mediated via the interference of the physio-chemical properties of the drugs as well as food. Further, the pharmacokinetic and

pharmacodynamic food-drug interactions are classified under the broad terms of the action of mechanisms Of Food-Drug Interactions.<sup>[13]</sup> The justification for the study of the efficacy of food-drug interaction was made by a **retrospective study** by **Prifti (2022)**. Considering this study a sample collection of 100 patients was done from a hospital, named Mother Teresa University Hospital. A detailed study was done in these sample records where all the patients were found to be cardiopathic and had undergone the treatment in the pharmacies. An International Classification of Disease (ICD- 9) code was utilized to identify the disease conditions.<sup>[14]</sup> Along with the experimental data collection, surveys were also taken from the patients. Generally, patients had coronary heart diseases and were treated through anticoagulant drugs the findings of the medical records were formulated through the detailed understanding of factors including comorbidities, age, past medical history, hospital stay, prescribed medication, and recommended diet. Further, under the surveys, patients were asked about the following recommendations, diet inclusion, retrieval of information about the disease, and assisting the help of doctors. Considering the findings of the research, it was recognized that patients were not admitted for cardiovascular diseases, but also for the comorbidities that were encountered within CVD, such as hypertension, diabetes, kidney disease, and other minor comorbidities.

The patients who are recommended for pharmaceutical treatments but are not documented for the nutritional diets present severe cases of comorbidities. Many cases are recorded with the side effects of the drugs in any sense. The findings of such cases tend to determine that there is a need to present detailed information about the diet time, duration of drug consumption, and exact dosage of the medicines.<sup>[15]</sup>

Further discussion can be made through the analysis of the **prospective study** of **Akbar et al. (2021)**, where data collection was done from the Ayub Teaching Hospital, Abbottabad, Pakistan. In the study, patients with CVD who were diagnosed with the potential side effects of the drug-to-drug interaction were included. Further, to evaluate the findings, a monitor therapy was implemented for the patients with adverse outcomes to avoid the side effects of the toxicity generated through the drug-to-drug interaction. To identify the risks, DDI screening tools were utilized by clinical pharmacists. To form a detailed analysis of the study a total of 13 medications were taken, which were provided subsequently to the patients. High-risk groups were associated with the complex medication regimen for CVD with the incidence of drug-drug interaction. The interaction resulted in increased chances of morbidity and other complications among the patients. For example, the interaction of enoxaparin + rivaroxaban and Aspirin + rivaroxaban led to an increased risk of bleeding among the patients. Further, Tramadol + dimenhydrinate DDI resulted in an increased CNS depressant effect of

tramadol. The main diagnosis evaluated the males were highly prone to the pDDI side effects throughout their hospital stays.

Further, concerning the study of **Diksis et al. (2019)**, the inclusion of DDI screening tools and availability of the clinical pharmacists tended to reduce the risks and frequencies associated with DDI in hospitals. Finally, considering the outcome of the study patients should be highly recommended for the inclusion of preferable and recommended diet whilst taking the pharmaceutical drugs.<sup>[16]</sup>

Research by **Koziolek et al. (2019)** further suggests that there is a growing use of food supplements and functional food to influence drug interaction with the body. The supplementations tend to improve the process of drug absorption, distribution, metabolism, and elimination, being provided to CVD patients. Though the preferable food-drug interaction, a well Understanding of Gastrointestinal Absorption-related Processes (UNGAP) can be developed through the mechanism of pharmacodynamics (PD) and pharmacokinetics (PK) [10]. PD is the specialized interaction of food to drugs presenting particular pharmacological effects. However, PK is the study of the food movement in the body through biological responses.<sup>[17]</sup> Considering an example of the interaction of grapefruit juice with that of the drugs, cyclosporine and felodipine, the uptake and efflux of membrane transporters and CYP3A4 can be inhibited. Other functional foods can improve the metabolism of drugs, such as by increasing the luminal bile salt concentrations or increasing hepatic perfusion. Examples of functional foods that are effective in reducing the impacts of CVD by increasing the efficacy of drug interaction are Polyphenols and Dietary fibers obtained from cereals, fruits, vegetables, mushrooms, and fortified foods.

Again, high-dose fish oil supplements are recommended for patients with coronary artery disease (CAD), peripheral artery disease (PAD), and hypertriglyceridemia (AHA). Fish oil contains anti-inflammatory properties that will stabilize the condition of the patients and provide significant benefits to patients.<sup>[18]</sup> After the detailed discussion, the findings of the research paper have been accomplished to improve the knowledge and understanding of the health professionals in regards to improving the pharmacological and therapeutic connections of the patients. Many up-to-date and accessible tools are present online to inform patients, care providers and pharmacists to prevent complications by facilitating personalized pharmaceutical care. these tools are complemented by the authentic databases presented with the guideline Decalogue making professionals understand and register under these programs such as the Association of Pharmacists of Barcelona, Food and Nutrition Committee membership, and Department of Pharmacology and Therapeutic Chemistry.<sup>[19]</sup>

## CONCLUSION

Based on the detailed information retrieved from the research paper, it can be illustrated that there should be clinical awareness among healthcare professionals whilst they recommend drugs or medications to patients with comorbidities or illnesses, such as CVD. If health professionals lack the appropriate information about the drug-food interaction, such as (the mechanism of action of prescribed drugs) it may lead to an impact on the treatment and worsen the condition of the patients. The severity of the medication can be from minor to lethal. Some of the comorbidities encountered due to the drug-food interaction include hypertension, diabetes, kidney disease, reduction in the absorption rate, pH alteration, and toxicity. Considering an example of vitamin K supplementation or diet taken by patients with hemorrhage may prevent blood coagulation as it acts against the anticoagulant therapy. The post-hospitalized patients, who rely on nutritional diets throughout their treatment have been well informed about the type of diet and functional foods to be included till the complete recovery. Functional foods provide critical insights into the efficacy of drug interaction by either reducing the rates of drug metabolism or fastening the rate of drug absorption. The healthcare workers, such as physical, and operational therapists, pharmacists, and nurses should undergo effective training and the clinical information needed to improve the patient's health outcomes. The potential interaction of the drugs with the functional foods tends to pose a negative or positive impact based on the following criteria, including the dosage, timing, and duration of drug consumption. Hence, a proper understanding of the food-drug integrations of various over-the-counter (OTC) products, and pharmaceutical drugs can help the healthcare professional to improve the patients' diet in support of the effectiveness of the drug interaction by increasing the drug metabolism. This can further help the recovery phases to make faster.

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