Republic of Yemen
University of Science and Technology
Faculty of Medicine and Health Sciences
Clinical Nutrition & Dietetics Program

Evaluation of Knowledge of Drug–Food Interactions Among Pharmacy Colleges Students In Some Yemeni Universities.

A Graduated Research Report Submitted for Partial Fulfillment of Bachelor's Degree in Clinical Nutrition & Dietetics

By

Oum Kaltoum Mohammed
Buthaina Gaber Al-Antari
Ala'a Mohammed Mimi
Aya Nabil Al-
Rana Raef Al-Sakkaf
Ruqaia Sameer Jubari
Rawan Sadek Al-Herwi
Buroog Abdullah Al-Yafei

Supervisor:

Dr. Sadeq Al-Sharagi

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LIST OF ABBREVIATIONS

FDI : food drug interaction

KAP: knowledge, attitude, and practice

SPSS: Statistical Package for the Social Sciences

SD: Standard Division

WHO: World Health Organization

PCS: Pharmacy colleges Students

ABSTRACT

Introduction:

Drug–food interactions can result in unfavorable outcomes during the treatment of patients. Healthcare professionals (HCPs) should advise patients on drug–food interactions. Knowledge of such interactions is crucial to avoid their occurrence.

However, there is (89.6%) information regarding the knowledge of Students of Pharmacy colleges about drug–food interactions in Yemeni Universities. While (10.4%) of respondents don't have a knowledge about drug- food interaction, but all students (248; 99.2%) thought that it is necessary to know about drug-food Interaction.

Objective:

To assess knowledge of drug–food interactions and associated factors among Pharmcy Colleges students (PCS) in Yemeni Universities from Oct., 5 to Oct., 25, 2022.

Methods:

A cross-sectional study was conducted among Pharmcy collegs students in Yemeni Universities, among 250 PCS. After stratification was done based Age, gender, marital status and study level, the sample size was proportionally allocated for the respective groups. Data were collected using a standardized self-administered questionnaire and analyzed using Statistical Package for Social Sciences 21.0. Descriptive statistics were used to summarize variables. Multivariable logistic regression was done to determine factors associated with knowledge of drug–food interactions. $P < 0.05$ was used to declare significant association.

Results:

The study has included 250 student in clinical pharmacy major in some Yemeni Universities includes fourth, fifth and sixth level. Among 250 student was (92.4%) of male represented the majority, while female represented (37.6%). Student ages ranged between 20-25 years age and above**.**

The basic knowledge of food and drug interaction was evaluated by 250 students, and the result was (89.6%) who possessed basic knowledge of food and drug interaction, while 10.4% were found to have no basic knowledge, which is a small percentage compared to those who have basic knowledge.

The overall scoring of knowledge on drug- food interaction represented (92.9%), while who don't have a knowledge about drug- food interaction represented (7.1%).

The overall scoring of awareness on drug- food interaction represented (93.3%),while who don't have an awareness about drug- food interaction represented (6.7%).

The overall scoring of special knowledge on drug- food interaction represented (63.8%), while who don't have a specific knowledge about drug- food interaction represented (63.2%).

Keywords: drug–food interaction, knowledge, awareness and Colleges Pharmacy Students.

CHAPTER 1: INTRODUCTION

1.1. Background on FOOD DRUG INTERACTION

Medications, both prescribed and over-the-counter, are used every day to treat acute and chronic illnesses. Drug-nutrient interaction is defined as an alteration of kinetics or dynamics of a drug or a nutritional element, or a compromise in nutritional status as a result of the addition of drug (Braun., 2012) . Medications can help people live a healthy life for a prolonged period. Although medicines are prescribed often , it is important to realize that they must still be used with caution. Food becomes harmful to the body when it reacts with medications administered concomitantly in a diseased patient. Precisely a food-drug interaction is the result of a reaction between food and drugs (Adeneye and Olagunju., 2009) .

The effect of food on drugs results in a reduction in the drug's bioavailability and alteration in drug clearance. On the other hand, Drugs can influence food intake, digestion, absorption and excretions (Ayo et al., 2005) . Food and drug interactions play a significantly important role in the pharmaceutical field as they greatly impact the compliance and success of drug therapy. Food can affect one or all areas of pharmacokinetics, including absorption, distribution, metabolism, and elimination (FAD., 2015).

The ability of a natural product to interact with a drug is based on the same pharmacokinetic and pharmacodynamic principles as drug-drug interactions (Ayrton and Morgan., 2001; Jain et al ., 2011). The presence of an additional drug, food, herbs, beverages or environmental chemicals alters the pharmacologic activity of a drug, which may lead to disease (Ayrton and Morgan ., 2001) . The other methods for food-drug interaction include binding or chelation, altering gastric pH, altering gastrointestinal motility, or affecting transport proteins such as P-glycoprotein (Zhanel et al.,1999; Bushra et al., 2011; Otles and Senturk., 2014) .

A food-drug interaction can: Reduce the therapeutic activity of a drug, cause a side effect from a medicine to get worse or better, cause a new side effect (Cartea et al., 2010) .Defined by the Dietary Supplement Health and Education Act (Joseph et al., 2010) ., dietary supplements include a wide array of nonfood, non-drug substances intended to supplement the diet, but are not intended to treat diseases or disorders of the human body (Quintal et al., 2011) . These dietary supplements may also react in the body and produces food – drug interactions.

Risk for food – drug interactions can be affected by many factors such as age, gender, medical co-morbidities, body composition, nutritional status polypharmacy (Owens et al., 2014). This questionnaire study includes some of the basic questions on the interaction of herbal and allopathic drugs, food and drug interaction and which age groups are highly susceptible to food-drug interaction.

Table 1. Examples of food – drug interactions

Food	Active constituent	Drug / Class	Effect
Milk products	Calcium	Tetracycline	tooth discoloration
Cranberry	Vitamin K	Warfarin and other anticoagulants	It increases the INR in patients on warfarin.
Coffee	Caffeine	Bronchodilators	Increases excitability and nervousness
Chocolate	Caffeine	Antidepressants	Decreases antidepressants activity
Banana	Potassium	ACE inhibitors	Increases potassium levels
Grapefruit	Furanocoumarins	Pshycotropics	Increases oral bioavailability
Alcoholic beverages	Ethanol	Antiretrovirals	Toxic Epidermal Necrolysis, Hypersensitivity Syndrome Reaction And Liver Failure.

Mineral supplements (magnesium, calcium, zinc, iron, selenium, iodine) need to be taken at least 2 hours away from antibiotics, as they can bind to the drug and reduce its absorption (Joseph et al ., 2010 ; Otles and Senturk., 2014) .

Penicillin and erythromycin are destroyed by stomach acid when taken with food. So it is most effective when taken on an empty stomach. However, food can reduce the chance of stomach irritation from these drugs (Bobroff et al.,2009) .

Food- drug interactions are equally important as drug drug interactions, but are neglected due to less awareness and knowledge on it. The survey was carried out to determine the degree of awareness on food-drug interactions among College staff members of various departments, Lab technicians and Clinical nutrition students and medical laboratory students.

1.2 Justification

Aggregated evidence from Questiner survey question has showed that phamacists do not have sufficient information about the interaction between food and drug and about the best times to take the medicin and how to avoid interaction between food and drug and how to reduse unwanted effects ,beased on scientific information .

1.3. Importance of study

To the best of the researcher's knowledge, no single study has been conducted in Yemen. The study might highlight a side of food drug interaction to draw attention to the problem by of pharmacitists ignorance of food and drug interaction.

1.4. General objective:

To assess the extent of knowledge in Yemeni pharmacists about the concept of food drug interaction.

1.5. Specific objectives:

- To assess of basic knowledge
- To assess of knowledge among pharmacy student
- To assess of awareness among pharmacy student
- To assess the specific knowledge among pharmacy student

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Food and drugs, both are necessary to maintain the health statue of an individual .However it is to be kept in mind that they sometimes also bring side effect and risks when used at same time. Thus the interactions between food and drug need to be well known and identified .The effect of food on drugs results in a reduction in the drugs bioavailability and alteration in drug clearance .On the other hand ,Drugs can influence food intake , digestion ,absorption and excretions . The interaction undoubtly may result in serious life threatening consequences hence pharmacists should be well aware of the necessity of monitoring for potential drug - food interactions and advising patients regarding foods or beverages to avoid when taking certain medications .

2.2 Mechanisms of food drug interaction

2.2.1 Pharmacokinetic interaction

2.2.1.1 Interaction involving Absorption

Presence of food in the stomach may affect the absorption of many commonly used drugs, duo to alteration of gastric pH , gastric secration , motility and of course transit time of the GIT. For instance , azithromycine absorption is decreased when it is taken with food ,resulting in a significant reduction in bioavailability. However , the components of the food ,such as calcium or iron , may from complexes with the drug that are less easily absorbed . On the other hand , the bioavailbility of some drugs may be enhanced by food . For instance ,an acid environment is necessary for the absorption of ketoconazole . The absorption of griseofulvin is increased by fat in the food.

2.2.1.2 Interaction involving metabolism

Food sometimes interacts with the metabolism (mostly hepatic)of many drugs . For examples ,concentrated grape fruit juice when administered with antihypertensive drugs felodipine and nifedipine ,cause an increase in the biovailability of the both. It is postulated that flavonoid compounds in grapefruit juice concentrate inhibit cytochrome P-450 metabolism of felodipine and nifedipine . This interaction could increase both the efficacy and toxicity of these drugs . Citrus fruit or its juice is a common ingredients of a breakfast so, there is huge clinical significance .Patients should be advised of this possible interaction (Baily DG et al ., 1998).

2.2.1.3 Interaction involving excretion

Many ingredients present in food may alter the pH of the urine .Which eventually cause either decrease or increase in the half of drug taken by patient , Lithium and Sodium are compete for tubular reabsorption in the kidney . A high –salt diet causes more lithium to be excreted, A low –salt diet causes decreased renal excretion of lithium and high serum level of lithium (Bennet PN et al .).

2.2.3 Pharmacodynamics interaction

Green leafy vegetables (spanich,broccoli ets ..), cauliflower ,chick peas ,green tea ,beef liver Are rich source of vitamin K and thus cause antagonism of warfarin , an anticoagulant drug and decreased therapeutic efficacy of the latter . Central nervous system depressant action of benzodiazepines , antihistamines , antipsychotic , narcotic or any drug with sedative action is enhanced beverages (Bailey DG et al ., 1998). Conversely the bioavailability and serum concentration of theophylline is markedly increased by caffeine in the diet .

2.3 The review describes interaction of the some of the commonly used medications with clinical significance

Perhaps the most feared and the most deadliest food –drug interaction is between monoamine oxidase inhibitors (MAOIs) and the amino acid tyramine , as tyramine is found in a varity of aged , fermented , overripe or pickled foods and beverages and , to a lesser extent , chocolate and yeast –contaning foods . Despite the effectiveness of MAOI in the control of depressive disorders ,they are to be consumed with full precautions duo to their interaction with tyramine contaning food 9(matured cheese ,yogurt, ripped bananas ets) because of their tendency to produce hypertensive crises in patient taking MAOIs (Volz HP et al ., 1998).

2.4 Bronchodilator

The effect of food on theophylline ,a bronchodilator can vary based on the nutrient content of the food . Bioavailbility of theophylline is enhanced by high fat diet (food) what it is reduced by high carbohydrate diet. Stuff rich in caffeine (coffee, tea, chocolate etc) should be avoided as it produces synergistic affect and may even reach the toxic level in the serum .

2.5 Non –steroidal Anti –inflamatory Drugs (NSAID)

The maximum serum concentration of ibuprofen is significantly enhanced when consumed with beverage ,coca –cola duo to better bioavailability of the former in presence of coca-cola. Thus the daily dosage and frequency of ibuprofen must be reduced when administered with beverage ,coca-cola (Kandol A et al ., 2003) . The effect of NSAIDs with coffee gives faster relief in patients thus some drug does come in combination of both .

2.6 Warfarin

Warfarin, common anticoagulant is used in routine practice for its vital effect on haemapoietic system (Hornsby LB et al ., 2008). avoiding alcohol is an important issue because it can effect the dose of warfarin .NSAID particularly aspirin can augment the effiency of warfarin duo to its blood thinning property.

2.7 Antitubercular Drugs

The bioavailability of food is greatly decreases by isoniazid , an important member in the family of ant-tubercular therapy (Self TH *et al* ., 1999) . The serum concentration of cycloserine ,a bacteriostatic anti-tubercular drug is significantly reduced by high fat meals thus resulting in incomplete eradication of bacteria (Zhu M et al ., 2001).

2.8 Fruit juice

Among all, Grape fruit juice possesses is a similar name in the context of food drug interaction high interaction by altering normal functioning of the cytochrome oxidase system . One of the most well known food drug interactions in grapefruit juice (GFJ) and the HMG CoA reductase inhibitors or statins .Grapefruit juice ,in large quantities (32 oz.or more per day) ,can inhibit the cytochrome p450 3A4 (CYP3A4)enzyme and increase blood levels of drugs metabolized by this pathway ,such as certain statin drugs . (Leibovich ER *et al.*, 2001) .

It has been reported in an old man who was maintained on cilostazol and aspirin for his peripheral vascular Disease .The patient was concomitantly taking grapefruit juice with the medicines prescribed and reported back to clinic with purpura which later on disappeared with cessation of GFJ . The purpura in this case could possibly duo to inhibition of cilostazol metabolism by GFJ which eventually lead to dramatic increase in the blood concentration of cilostazol.

2.9 Antibiotics

Undoubtly , the most commonly prescribed drugs around the world is the antibiotics . Like other medicines antibiotics does show food drug interaction .The bioavailbility and serum concentration of ciprofloxacin is reduced to a greater extent when consumed with milk the drug undergoes chelation with calcium and casein of the milk (Papai K et al ., 2010) .The oral bioavailbility of Azithromycin (commonly prescribed for the treatment of upper respiratory tract infection)is greatly reduced when taken with food (Gurly BJ et al ., 2003). Mineral supplement (like magnesium , calcium ,zinc ,iron,selenium,iodine)need to be taken

at least 2 hours before or after antibiotics consumption as they can bind to the drug and reduce its absorption of the drug (Lacy CF et al ., 2006).

2.10 Antihypertensive drugs

Consuming a high protein meal and taking propranolol concurrently can increase the bioavailbility of the latter . When propranolol was given with protein rich foods, a mean increase in bioavaibility of 53% was reported (Liedhom H et al ., 1990) . the concentration of serum potassium is remarably elevated by and excess of potassium often results in cardiac palpitation .Some foods like bananas ,oranges,green leafy vegetables contain large amount of potassium hence ;patient should avoid eating these food (Dewardener HE ., 1990).With regard to the salt ,its known that high intake of common salt plays a fundamental role in the development and maintenance of HT (Elliot P et al ., 1996). Nevertheless ,the antihypertensive effect of felodipine (calcium channel blocker with natriuretic properties) is maintained during high salt intake ,al least when given at the maximal antihypertensive dose (Mervaala EMA et al ., 1994) .

2.11 Smoking

Smoking while not a food per se ; is discussed under this review it does play a crucial role in the drug metabolism which is clinically significant . Cigarette smoking remains highly prevalent in most countries. It is associated with interaction with both pharmacokinetic and pharmacodynamics of drugs . Tobacco smoke causes metabolic activation or induction of carcinogen leading to a greater chance of cancer (procarcinogen to carcinogen) ,The noxious compound present is tobacco smoke is polycyclic aromatic hydrocarbons (PAH) while is blamed to be responsible for the induction of cytochrome P450(CYP) 1A1, CYP IA2 and possible CYP2E1. There are genetic polymorphisms in the inducibility of CYP 1A1 ,with some evidence that high inducibility is more common in patient with lung cancer .Also ,cigarette smoking results in faster clearance of heparin , possibly related to smoking –related activation of thrombosis with enhanced heparin binding to antithrombin III .Delay absorption of insulin when given by subcutaneous route duo to cutaneous vasoconstriction is a common phenomenon associated with smokers (Zevin S et al ., 1999).

2.12 Antidiabetics

Alcohol can cause a disulfiram –like reaction when taken in combination with oral sulfonylureas , particularly chlorpropamide . Diabetics not prescribed sulfonylureas are also wise to cease or limit alcohol consumption as it has adverse effects on glycemic control with a tendency towards hypoglycemia .Pre –existing hypoglycemia can be potentiated .Alcohol consumption genrerally

resuts in loss of glycemia control by as it reduces drugs (Triplitt C ,2006) .Glimepiride is a sulfonylurea derived antidiabetic that needs to be administered with the first main meal of the day . The bioavailabity of aglimepiride is so good that empty stomach results in variable pharmacokinetics (Rosskamp R et al ., 1996) .Diabetic patients taking hypoglycemia drugs (likely phenformin and chlorpropamide) or insulin (Kumer SD et al ., 2010) .The use of bitter melon should be avoided or taken with caution as it may potentiate the effectiveness of the drugs and may lead to severe hypoglycemia .

2.13 Previous studies

2.13.1 Food –drug interaction: a survey among students of pharmacy collage in Al –Jouf Region , Saudi Arabia

In that study, knowledge of food -drug interactions (FDI) is necessary to obtain a full therapeutic effect from the medications. Duo to a lack of awareness , they are neglected . Thus , interactions may lead to undesired effect .The present study was conducted to assess the FDI among students of pharmacy collage in Al –Jouf Region ,Saudi Arabia .

2.13.2 Evaluation of community pharmacists 'knowledge and awareness of food –drug interactions in Palestinein - 2 May, 2018.

In that study Food –drug interactions can produce undesirable outcomes during the therapy process .The is responsible for providing patients counseling about common food drug interactions . Knowledge of such interactions is important to avoid their occurrence. Objective. This study aimed to assess the knowledge and awareness of community pharmacists about common food-drug interactions. Setting Pharmacists working in community pharmacies across Northern Palestine. Method This is a cross-sectional study, which involved a convenience sample of 259 pharmacists working in community pharmacies in Palestine. A self-administered questionnaire consisted of 29 questions (mainly yes/no questions) was used to assess pharmacists' knowledge towards the most common and clinically significant interactions between food and medicines. Main outcome measure Pharmacists' issues related to the knowledge of food drug interactions were evaluated. Results A total of 320 questionnaires were distributed of which 259 were completed providing a response rate 80.9%. One pharmacist from each community pharmacy was asked to complete the questionnaire. The overall knowledge score of food-drug interactions for the pharmacists was 17.9 (61.7%) out of a possible maximum of 29. The pharmacists surveyed in this study have demonstrated good knowledge of some interactions; but poor knowledge of others. Conclusion Pharmacists'

knowledge about common food–drug interactions is inadequate. These findings support the need for training and educational courses for pharmacists regarding food–drug interactions.

.2.13.3 Assessment knowledge of food-drug interaction of academician population: Staff members, Students, and teaching assistants in 1 June, 2021.

In that study, Drug-food interactions can lead to a loss of therapeutic efficacy or the toxic effects of drug therapy. Therefore, this study is carried out to show the extent of knowledge regarding drug interactions. The study population included lecturers, teaching assistants, and students. A specially designed scientific questionnaire containing multiple questions was used. The results of this study showed that only 15% of pharmacists provide an explanation of drug interactions with food when they sell the medicine. Also, 26.67%, 15%, and 13.33% of students, lecturers, and teaching assistants, respectively, reported that they are interested in food development processes by following electronic scientific journals. On the other hand, the results indicate that 41.67%, 20%, and 13.33%, respectively, of students, lecturers, and teaching assistants have knowledge about the subject of drug-food.

CHAPTER 3: METHODOLOGY

3.1 Study design

Cross – sectional, descriptive study (Alasfour et al., 2021) .

3.2 Study area

The present survey included randomly selected students of Pharmacy College in University of Science and Technology (boys - girls), alhikma University , National University , modern science University, 21 September university)in Sana'a city (Alasfour et al., 2021) .

3.3 Study duration

Study was carried from October 4^{th} to October 24^{th} (Alasfour et al., 2021) .

3.4 Study population

College of Medicine and Health Sciences , Department of Pharmacy, for the fourth ,fifth and sixth levels, on assessing knowledge and awareness of the food-drug interaction (AL-sharagi et al., 2021) .

3.5 Inclusion criteria

Pharmacy students for the levels that began studying food and drug interactions , the fourth and fifth , sixth levels (AL-sharagi et al., 2021) .

3.6 Exclusion criteria

Pharmacy students were excluded for levels that did not begin with a course study food-drug interaction (AL-sharagi et al., 2021) .

3.7 Sampling method

The Department of Pharmacy in private universities was searched for and coordinated with students to participate in the research and fill out questionnaires, Also, the questionnaire was published on social networking sites and circulated among pharmacy students

3.8 Study Tool

The questionnaire, which consisted of 32 questions, was designed based on a previous survey instrument used in the published paper of (Benni et al.,2012). Also using online Google Forms with some modifications . First part of the questionnaire included The demographic information collected was gender, age, academic level, and marital status. The knowledge section consists of 32 questions. As question 1-10, it measures knowledge of food and drug interactions. 11-19 measures

awareness of the interaction between food and medication. 20-32 measures knowledge of specific food and drug interactions. A copy of the questionnaire is in the appendix (radwan et al., 2018).

3.9 Data collection

These forms were circulated using social media among different individuals and were also distributed directly among pharmacy students in private universities. Numerous articles on assessing healthcare professionals' knowledge about drug and food interactions were taken into account when designing the current questionnaire. Pharmacy students were selected as respondents. In FDI questionnaire (FDIQ), based on FDI prevalence and importance, was used in this study.

The respondents were divided into different groups to assess their knowledge and awareness about food-drug interactions. A total of 250 respondents were in the study. The data was analyzed and the results were expressed in percentages (Alasfour et al., 2021).

3.10 Study variables

1-Dependent variables:

- Basic knowledge , knowledge and awareness and special knowledge in participants student related to food drug interaction .

2-Independent variables:

- Educational level the Search in universities
- Identification data (sex, age, marital status)

3.11Data Analysis

- Statistical Package for the Social Sciences (SPSS) software, version 21 was used for data analysis. Nominal and categorical variables were described by frequencies Statistical and percentages.
- Continuous variables were described by means & SD, minimum and maximum.
- Tables and graphs were used to display data.
- Chi square test was used to test differences between categories.
- The test was considered to be significant if p value < 0.05.

3.12 Ethical consideration

The proposal was reviewed by the supervisor, and then approval was obtained from the Department of Clinical Nutrition and Dietetics. Official letters were obtained from the Deanship of the College of Medicine and Health Sciences. During data collection, the purpose of the study was

briefly explained to the students and coordinators and verbal consent was obtained before starting to ask questions and fill in the questionnaire. They were also informed that the data will only be used for the purpose of research and will be treated confidentially and no indicative information - such as names - will be published.(AL-sharagi et al., 2021).

3.13 Dissemination of the results

Study will be offered to the UST team as partial completion of a Bachelor's degree in Clinical Nutrition and Dietetics (AL-sharagi et al., 2021). The study may also be useful for educational staff to foster interest in the importance of raising awareness and developing more comprehensive approaches to the study of food-drug interactions.

CHAPTER 4: RESULTS

4.1. Distribution of the sample according to age

Our study has included 250 students studying in Pharmacy College. The majority (92.4%) are distributed in the age group between 20 and 25 years. A small proportion (7.6%) of students is more than 25 years in age.

We noticed that the majority of age was between (20-25 years) because this age group make the majority of the pharmacists students between (4^{th} , 5^{th} , and 6^{th} levels) . From the study (Radwan et al., 2018).Showed that the age category of the pharmacists (23-29 years) was the highest in frequency(Table 4.1 and figure 4.1).

Table 4. 1. Distribution of the sample according to age

Age groups	Count	Percent
From 20 to 25 years	231	92.4%
More than 25 years	19	7.6%
Total	250	100%

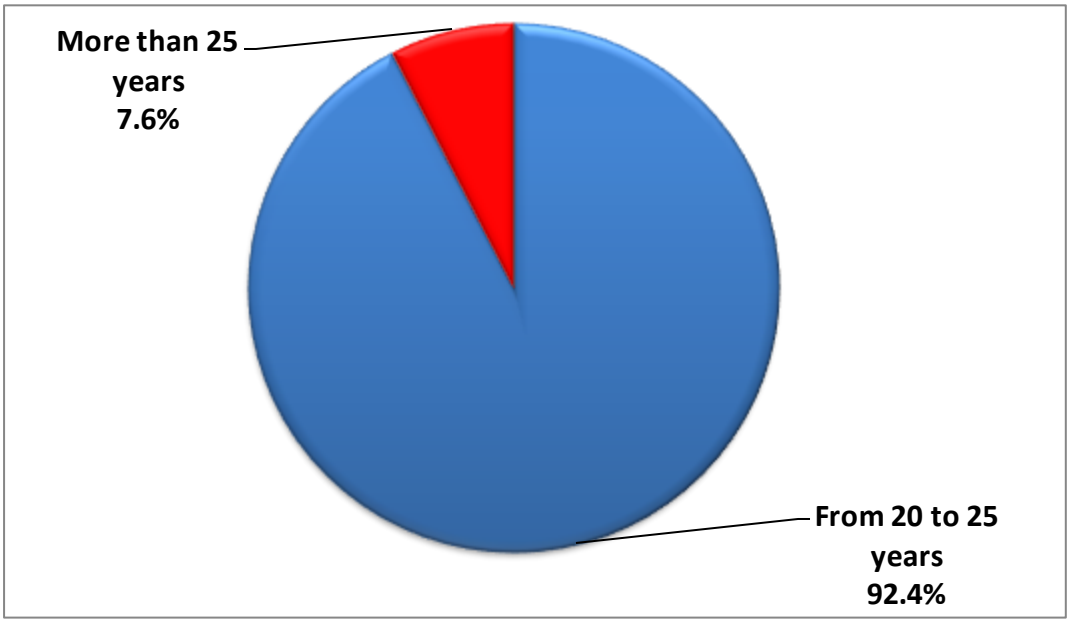

Figure 4. 1. Distribution of the sample according to age

4.1. Distribution of the sample according to gender

Males represented the majority of the sample. They represented 62.4%, while females represented 37.6%; with males to females ratio 1.7:1.

Table 4. 2. Distribution of the sample according to gender

Gender	Count	Percent
Males	156	62.4%
Females	94	37.6%
Total	250	100%

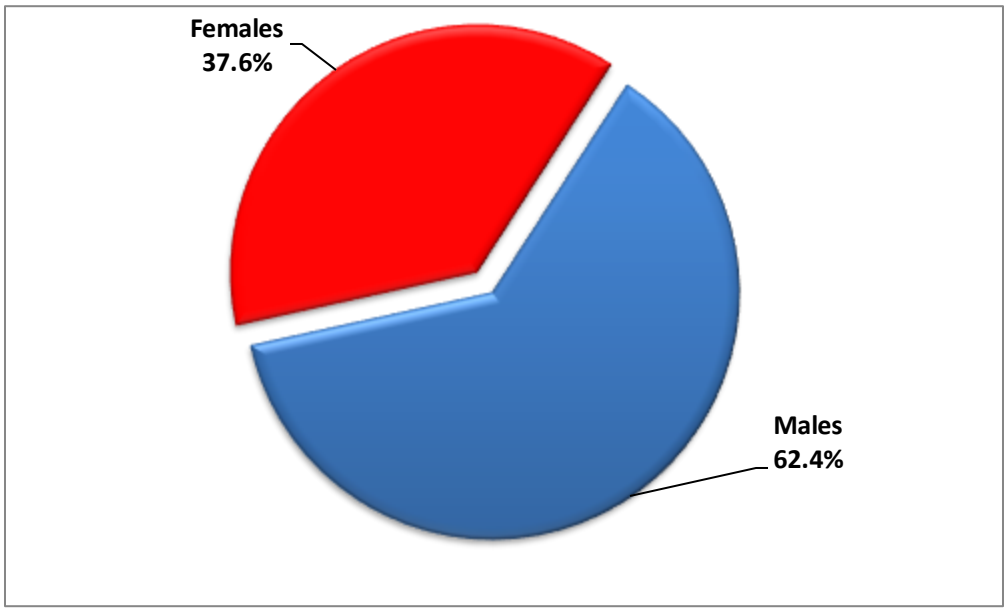

Figure 4. 2. Distribution of the sample according to gender

4.2.Distribution of the sample according to marital status

Most of the participants (80.8%) are not married.

Table 4. 3 Distribution of the sample according to marital status

Marital status	Count	Percent
Unmarried	202	80.8%
Married	48	19.2%
Total	250	100%

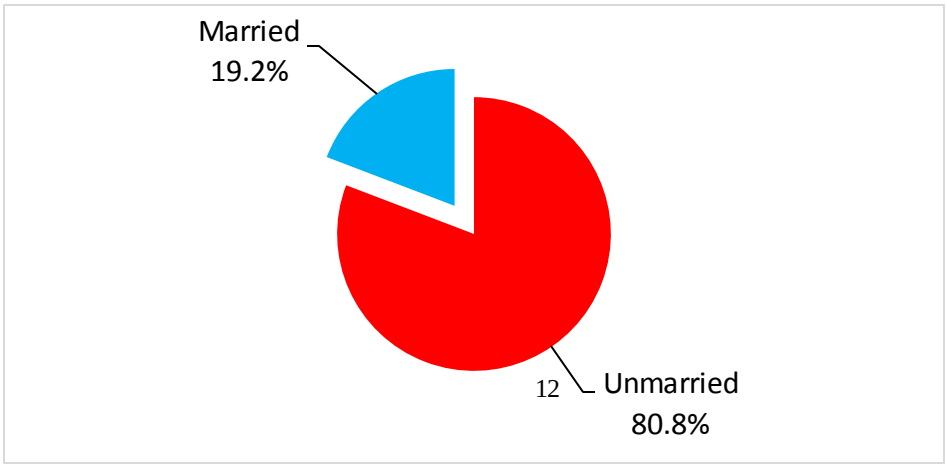

Figure 4. 3. Distribution of the sample according to marital status

4.3. Distribution of the sample according to study level

Participants are mainly distributed in the fifth level which accounted for 46.8%. The remaining are distributed in fourth and sixth levels who represented 38% and 15.2% respectively.

Table 4. 4. Distribution of the sample according to study level

Study level	Count	Percent
Fourth level	95	38.0%
Fifth level	117	46.8%
Sixth level	38	15.2%
Total	250	100%

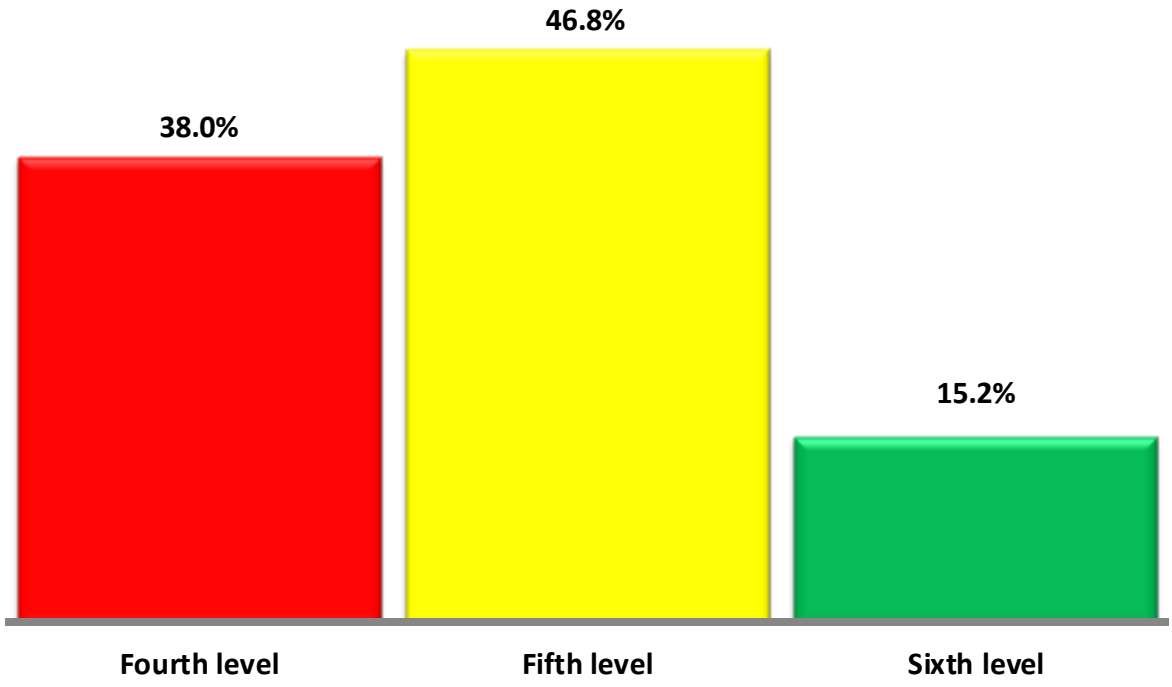

Figure 4. 4. Distribution of the sample according to study level

4.4. Evaluation of Basic knowledge about drug and food Interaction (n=250)

The majority of students (224; 89.6%) answered that they had knowledge about drug-food Interaction. However, almost all students (248; 99.2%) thought that it is necessary to know about drug-food Interaction. Percentages in subsequent tables will be taken out of 224 students who have basic knowledge about drug-food interaction.

Table 4. 5. Basic knowledge about drug-food Interaction

Basic knowledge	Yes	No	Total
Do you have knowledge about drug-food interaction?	224 (89.6%)	26 (10.4%)	250 (100%)
Is it necessary to know about the drug-food interaction?	248 (99.2%)	2 (0.8%)	250 (100%)

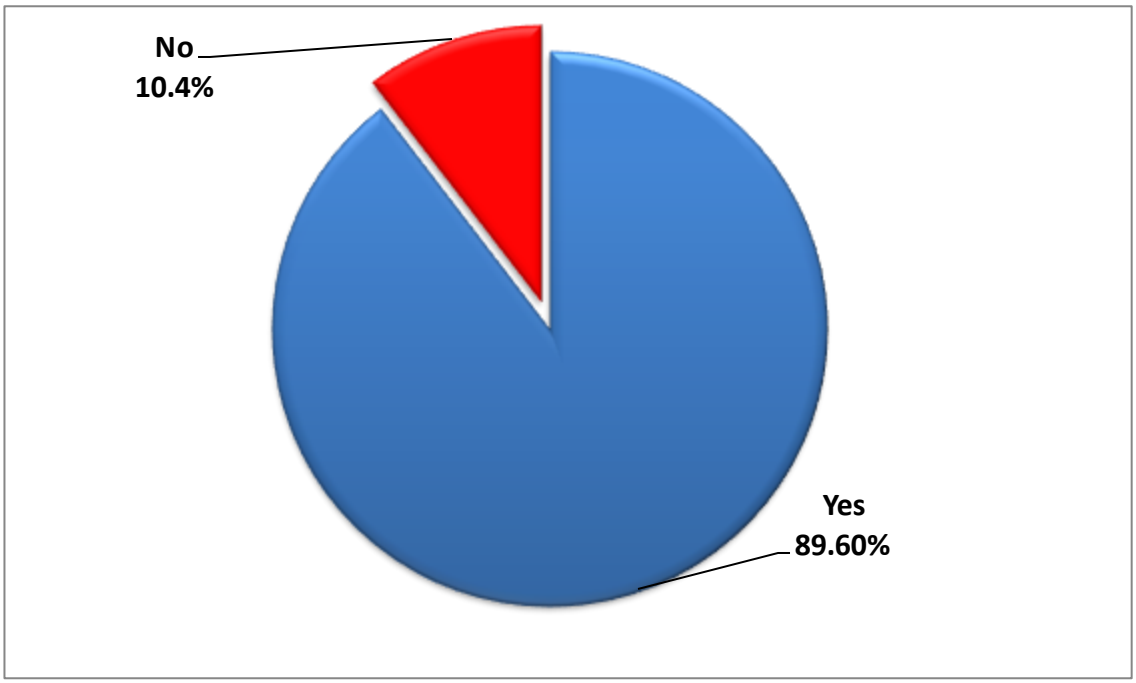

Figure 4. 5. Basic knowledge about drug-food Interaction

4.5. Knowledge about drug-food Interaction

As shown in table 4.6, most of students chose correct answers regarding knowledge about drug-food Interaction. The rate of correct answers exceeds 70% in all questions. For the questions "Can OTC drugs interact with food?" correct answers were 75.9%, for the question "Do you think that food combinations can affect the efficacy of medications?" correct answers were 83.5%, for the question "Do you think Drug-Food Interaction can cause death?" correct answers were 83.5% as well. For remaining questions the rate of correct answers exceeded 90%.

Table 4. 6. Knowledge about drug-food Interaction

Question	Correct answer	Incorrect answer	Total
Over the counter (OTC) drugs interact with food?	170 (75.9%)	54 (24.1%)	224 (100.0%)

Do you think that food combinations can affect the efficacy of medications?	187 (83.5%)	37 (16.5%)	224 (100.0%)
Do you know that food can speed up or slow down the action of a drug	223 (99.6%)	1 (0.4%)	224 (100.0%)
Is the impact of Drug-Food Interaction depending on a various factor like drug dosage, person's age, & health status?	208 (92.9%)	16 (7.1%)	224 (100.0%)
Drug-Food Interaction can lead to serious side effects?	202 (90.2%)	22 (9.8%)	224 (100.0%)
Do you think Drug-Food Interaction can cause death?	187 (83.5%)	37 (16.5%)	224 (100.0%)
All drugs can be taken with food?	207 (92.4%)	17 (7.6%)	224 (100.0%)
All the drugs can be taken on an empty stomach to produce better effects?	215 (96.0%)	9 (4.0%)	224 (100.0%)

4.6. Awareness about drug-food Interaction

As shown in table 4.7, most of students chose correct answers regarding awareness about drug-food Interaction. The rate of correct answers exceeds 70% in all questions except for the question "Which level can drugs interact with food: absorption, distribution, or metabolism?" the rate of correct answer was low (51.8%). For the questions "Which level can drugs interact with food: absorption, distribution, or metabolism?" correct answers were 77.7%, "Which age group of patients do you think are at a greater risk of developing drug-food interaction?" correct answers were 83%, for the question "Which fruit interacts with around 45 different medicines and produces lethal side effects?" correct answers were 75.9%, for the question "Iron supplements have their absorption reduced by?" correct answers were 84.4 %, and for the question "Does drug-food interaction happen when drug interacts with food system, dietary supplements, beverage and juice?" correct answers were 76.3%. For remaining questions the rate of correct answers exceeded 90%.

Table 4. 7. Awareness about drug-food Interaction

Question	Correct answer	Incorrect answer	Total
Acidic foods shouldn't be taken along with antibiotics	174 (77.7%)	50 (22.3%)	224 (100%)
Which age group of patients do you think are at a greater risk of developing drug-food interaction?	186 (83.0%)	38 (17.0%)	224 (100%)
Which of the following beverages do health experts recommend you avoid when taking medications?	208 (92.9%)	16 (7.1%)	224 (100%)

This fruit interacts with around 45 different medicines and produces lethal side effects?	170 (75.9%)	54 (24.1%)	224 (100%)
Iron supplements have their absorption reduced by?	189 (84.4%)	35 (15.6%)	224 (100%)
Does drug-food interaction happen when drug interacts with food system, dietary supplements, beverage and juice?	171 (76.3%)	53 (23.7%)	224 (100%)
Can some drugs change nutritional status for the patient?	214 (95.5%)	10 (4.5%)	224 (100%)
Which level can drugs interact with food: absorption, distribution, or metabolism?	116 (51.8%)	108 (48.2%)	224 (100%)

4.7. Special knowledge about drug-food Interaction (shown in table 4.8.)

Although good basic knowledge and good awareness in general, knowledge about specific drug-food Interaction was not so good. In most questions, correct answers didn't exceed 60%. For the questions "Patient on Amiodarone, Atorvastatin should avoid grapefruit,….?" correct answers were 64.7%, for the question "Patient on Levothyroxine should avoid tomatoes,?" correct answers were 50.9%, for the question "Patient on Coumadin should avoid vegetables and fruits?" correct answers were 54%, for the question "Patient on Levodopa should avoid fatty foods,?" correct answers were only 40.6%, for the question "Patient on Antibiotics should avoid grapefruit?" correct answers were 47.8%, for the question "Patient on Warfarin should avoid spinach?" correct answers were 54.9%, for the question "Glipizide should be taken: before, within, or after meals?" correct answers were only 33%, for the question "Isonizid should be taken: before, within, or after meals?" correct answers were only 36.2%, and for the question "NSAID should be taken: before, within, or after meals?" correct answers were only 18.8%. For remaining questions the rate of correct answers ranged between 80% and 87%, as shown in table 4.8.

Table 4. 8. Special knowledge about drug-food Interaction

Question	Correct answer	Incorrect answer	Total
Patient on Amiodarone, Atorvastatin should avoid grapefruit, ……..	145 (64.7%)	79 (35.3%)	224 (100%)
Patient on Levothyroxine should avoid tomatoes, …	114 (50.9%)	110 (49.1%)	224 (100%)
Patient on Diazepam should avoid caffeine, …	188 (83.9%)	36 (16.1%)	224 (100%)
Patient on Theophylline should avoid having large amount of tea, coffee, …	182 (81.3%)	42 (18.8%)	224 (100%)
Patient on Coumadin should avoid vegetables and fruits , …	121 (54.0%)	103 (46.0%)	224 (100%)

Patient on Tetracycline should avoid milk and dairy products, …	188 (83.9%)	36 (16.1%)	224 (100%)
Patient on Levodopa should avoid fatty foods, …	91 (40.6%)	133 (59.4%)	224 (100%)
Patient on Antibiotics should avoid grapefruit, …	107 (47.8%)	117 (52.2%)	224 (100%)
Patient on Warfarin should avoid spinach, …	123 (54.9%)	101 (45.1%)	224 (100%)
Omeprazole should be taken: before, within, or after meals?	195 (87.1%)	29 (12.9%)	224 (100%)
Glipizide should be taken: before, within, or after meals?	74 (33.0%)	150 (67.0%)	224 (100%)
Isoniazid should be taken: before, within, or after meals?	81 (36.2%)	143 (63.8%)	224 (100%)
NSAID should be taken: before, within, or after meals?	42 (18.8%)	182 (81.3%)	224 (100%)

4.8. Overall scoring of knowledge on drug-food Interaction

The score of overall knowledge about drug-food Interaction among participants is high (92.9%).

Table 4. 9. Overall scoring of knowledge on drug-food Interaction

Overall knowledge	Count	Percent
Good	208	92.9%
Poor	16	7.1%
Total	224	100%

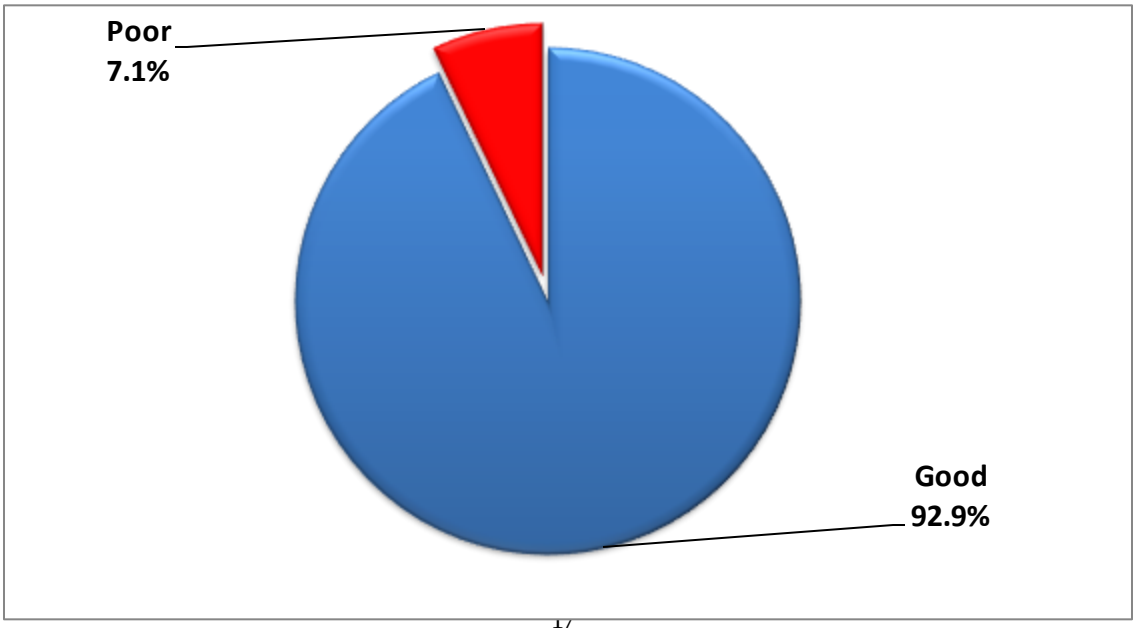

Figure 4. 6. Overall scoring of knowledge on drug-food Interaction

4.9. Overall scoring of awareness on drug-food Interaction

The score of overall awareness about drug-food Interaction among participants is high (93.3%).

Table 4. 10. Overall scoring of awareness on drug-food Interaction

Overall awareness	Count	Percent
Good	209	93.3%
Poor	15	6.7%
Total	224	100%

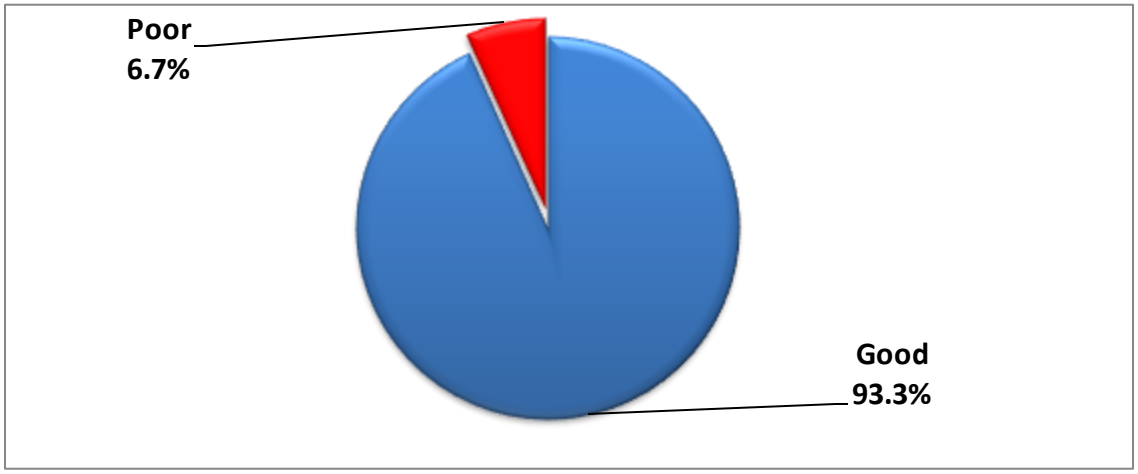

Figure 4. 7. Overall scoring of awareness on drug-food Interaction

4.10. Overall scoring of specific knowledge on drug-food Interaction

The score of overall knowledge about specific drug-food Interaction among participants is low (63.8%).

Table 4. 11. Overall scoring of specific knowledge on drug-food Interaction

Overall specific knowledge	Count	Percent
Good	143	63.8%
Poor	81	36.2%
Total	224	100%

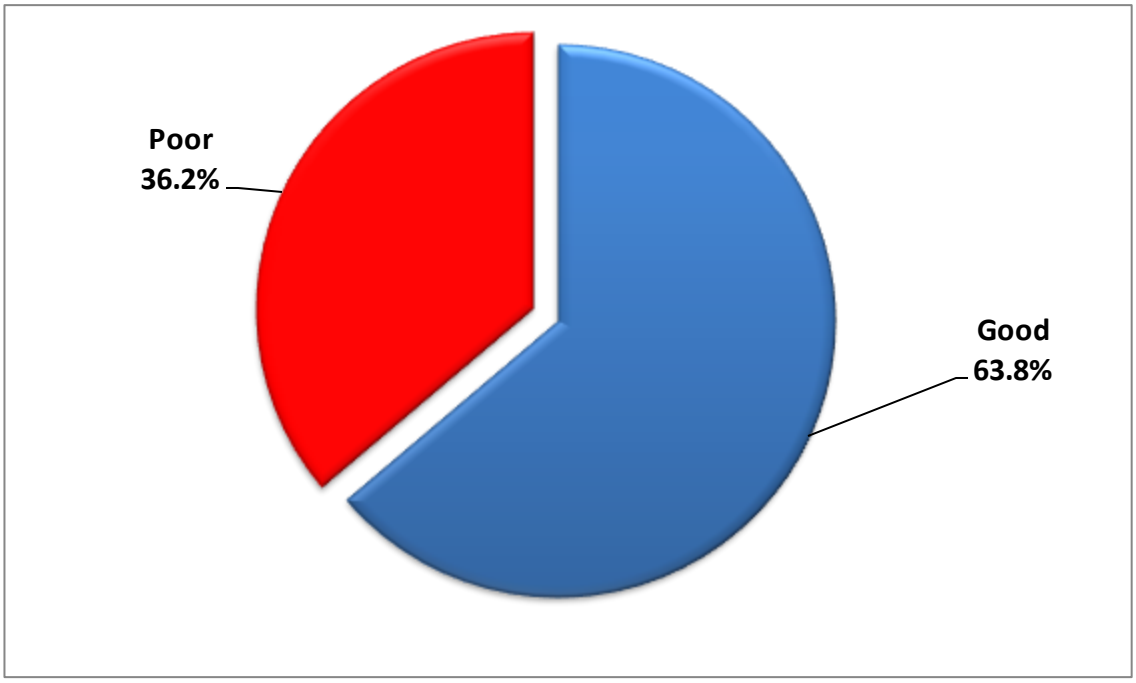

Figure 4. 7. Overall scoring of specific knowledge on drug-food Interaction

4.11. Correlation between gender and scores of knowledge, awareness, and specific knowledge

As shown in table 4.12, females have a slightly higher level in knowledge, awareness, and specific knowledge about drug-food Interaction comparing to males. However, the difference is not significant (p value >0.5).

Table 4. 12. Correlation between gender and scores of knowledge, awareness, and specific knowledge

Gender / Score	Good	Poor	Total	P value
Overall knowledge about drug-food Interaction:				
Males	130 (92.2%)	11 (7.8%)	141 (100%)	0.618
Females	78 (94.0%)	5 (6.0%)	83 (100%)	
Overall awareness about drug-food Interaction:				
Males	129 (91.5%)	12 (8.5%)	141 (100%)	0.157
Females	80 (96.4%)	3 (3.6%)	83 (100%)	
Overall specific knowledge about drug-food Interaction:				
Males	88 (62.4%)	53 (37.6%)	141 (100%)	0.562
Females	55 (66.3%)	28 (33.7%)	83 (100%)	

4.12. Correlation between study level and scores of knowledge, awareness, and specific knowledge

As shown in table 4.13, fifth level and sixth level have higher scores in general knowledge and specific knowledge comparing to fourth levels. The difference is significant (p values <0.05).

However, the difference is not significant regarding awareness (p value >0.05).

Table 4. 13. Correlation between study level and scores of knowledge, awareness, and specific knowledge

Level / Score	Good	Poor	Total	P value
Overall knowledge about drug-food Interaction:				
Fourth level	63 (84.0%)	12 (16.0%)	75 (100%)	
Fifth level	108 (97.3%)	3 (2.7%)	111 (100%)	0.001
Sixth level	37 (97.4%)	1 (2.6%)	38 (100%)	
Overall awareness about drug-food Interaction:				
Fourth level	69 (92.0%)	6 (8.0%)	75 (100%)	
Fifth level	104 (93.7%)	7 (6.3%)	111 (100%)	0.837
Sixth level	36 (94.7%)	2 (5.3%)	38 (100%)	
Overall specific knowledge about drug-food Interaction:				
Fourth level	38 (50.7%)	37 (49.3%)	75 (100%)	
Fifth level	73 (65.8%)	38 (34.2%)	111 (100%)	0.002
Sixth level	32 (84.2%)	6 (15.8%)	38 (100%)	

CHAPTER 5: DISCUSSION

The male group was more participate more than the female group because male group are more interested in studying pharmacology, also because after the qualification the job needs more transportation from area to another area and for late times which is hard for women because this interfere with our culture. From the study (*A. Alwan et al.*,2021). Showed that the female group was more than the male group (Table 4 and Figure 4.2).

The unmarried students was participate more than married students because the age group (20-25years) is for studying not fore marriage and most of the students especially males married after the graduation (Table 4.3 and Figure 4.3).

The 5^{th} level was more than 4^{th} level because they have more knowledge and awareness about the importance of this topic (food- drug interaction) that's why they were more responsive , also the 5^{th} level was more than the 6^{th} level because the 6^{th} level doesn't exist except in clinical pharmacy and this major is new so most of the pharmacy students are in general pharmacy which is only 5 years (Table 4.4 and Figure 4.4).

Food drug interactions bring about marked changes in the absorption, distribution, metabolism, excretion, bioavailability, volume of distribution, therapeutic efficacy (Bland amd Vermeulen, 1998). In the literature lacuna it is found that many studies demonstrated the existence of gap in the knowledge regarding food and drug interactions among the doctors and health care professionals (Lasswell et al, 1995). In our study, 89.6% of the students gave high answer rates regarding knowledge of food and drugs Interaction. Our study findings are similar to the other previous studies (*Benni et al, 2012*) (Table 4.5 and Figure 4.5.).

Also, our study showed that the more we went into the details, the less awareness they had , and this is what we noticed in the (knowledge, awareness , and special knowledge questions) because this topic (food – drug interaction) doesn't exist in their programme or courses and if it exists in the courses they doesn't focus on it or pay attention to it (Table 4.6, Figure 4.6 –Table 4.11 and Figure 4.11).

The female group percentages was higher than the male group in the (knowledge , awareness , and special knowledge) because the female students are more interested in studying and learning more than male students (Table 4.12 and Figure 4.13).

The 6^{th} level has the highest percentages in (knowledge , awareness , and special knowledge) because they specialize more pharmacology than the 4^{th} and 5^{th} levels , and also because they

acquired more experience and informations from training , but in general the percentages between 4^{th} , 5^{th} , and 6^{th} levels was close to each other (Table 4.13 and Figure 4.13). 81.3% of the respondents agreed that the patient who takes the Theophylline drug should avoid having large amount of tea, coffee. From the study (Radwan et al., 2018) the correct answers over 74% while the study (Alasfour et al., 2021) the correct answers was 70%. 83.9% of the respondents agreed that the patient who takes the Tetracycline drug should avoid milk and dairy products .From the study (Radwan et al., 2018) the correct answers was 94.2%. 47.8% of the respondents agreed that the patient who takes the Antibiotics drug should avoid grape fruit. From the study (*Alasfour et al.*, 2021) the correct answers was 34%. 54.9% of the respondents agreed that the patient who takes the Warfarin drug should avoid spinach. From the study (*Alasfour et al.*, 2021) the correct answers was 53%. 87.1% of the respondents agreed that Omeprazole drug should be taken before meals . From the study (Alasfour et al., 2021) the correct answers was 48.28%. 18.8% of the respondents agreed that NSAID drug should be taken within meals. From the study (*Alasfour et al.*, 2021) the correct answers was 13.45%.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

CONCLUSION:

Our study found that pharmacy colleges students in Yemeni Universities had satisfactory knowledge and awareness about common food-drug interactions.

RECOMMENDATIONS

1. A further study on drug–Food Interactions Among Healthcare Professionals Working in Public Hospitals
2. A further study on food and drug interactions among students who are the future doctors to improve the therapeutic efficacy of patients
3. The Ministry of Health and Population alongside the academic sector should start introduce of Awareness programmes to help Healthcare Professionals acquire the essential concepts and practice about common food-drug interactions to improve patient's healthcare and safety

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الملخص بالعربي

المقدمة:

التفاعلات الدوائية والغذائية يمكن أن تؤدي إلى نتائج غير مواتية أثناء علاج المرضى. يجب على المتخصصين في الرعاية الصحية (HCPs) تقديم المشورة للمرضى بشأن التفاعلات الدوائية والغذائية. معرفة مثل هذه التفاعلات أمر بالغ الأهمية لتجنب حدوثها. ومع ذلك هناك (89.6٪) معلومات تتعلق بمعرفة طلاب كليات الصيدلة عن التفاعلات الدوائية والغذائية في الجامعات اليمنية. بينما (10.4٪) من المستجيبين ليس لديهم معرفة بالتفاعل بين الدواء والغذاء ، لكن جميع الطلاب (248 ؛ 99.2٪) يعتقدون أنه من الضروري معرفة التفاعل بين الدواء والغذاء.

الهدف:

تقييم المعرفة بالتفاعلات الدوائية والغذائية والعوامل المرتبطة بها بين طلاب كليات الصيدلة (PCS) في الجامعات اليمنية من 5 أكتوبر إلى 25 أكتوبر 2022.

الطريقة:

تم إجراء دراسة مقطعية على طلاب كلية الصيدلة في الجامعات اليمنية ، بين 250 جهاز كمبيوتر. بعد إجراء التقسيم الطبقي على أساس العمر والجنس والحالة الاجتماعية ومستوى الدراسة ، تم تخصيص حجم العينة بشكل متناسب للمجموعات المعنية. تم جمع البيانات باستخدام استبيان معياري ذاتي الإدارة وتحليلها باستخدام الحزمة الإحصائية للعلوم الاجتماعية 21.0. تم استخدام الإحصاء الوصفي لتلخيص المتغيرات. تم إجراء الانحدار اللوجستي متعدد المتغيرات لتحديد العوامل المرتبطة بمعرفة التفاعلات الدوائية والغذائية. تم استخدام $P < 0.05$ للإعلان عن ارتباط كبير.

النتيجة:

شملت الدراسة 250 طالبة من بعض الجامعات اليمنية، تخصص صيدلة سريرية شملت المستوى الرابع والخامس والسادس من بين 250 طالب وطالبة كان (92.4٪) من الذكور يمثلون الأغلبية، بينما مثلت الإناث (37.6٪)، وقد تراوحت أعمار الطلاب بين 20-25 سنة وما فوق.

في هذه الدراسة تم تقييم المعرفة الأساسية للتفاعل الغذائي والدوائي من قبل 250 طالب وطالبة، وكانت النتيجة (89.6٪) يمتلكون معرفة أساسية بشأن تفاعل الغذاء والدواء، بينما وجد 10.4٪ ليس لديهم معرفة أساسية، وهي نسبة ضئيلة مقارنة بـ (89.6٪),

يمثل المعدل العام للمعرفة بشأن التفاعل الدوائي والغذائي بين مستويات الطلاب (92.9٪)، في حين أن الذين ليس لديهم معرفة بالتفاعل الدوائي والغذائي يمثلون (71.1%).

بلغت النسبة الإجمالية للوعي بشأن التفاعل الدوائي والغذائي (93.3٪) ، بينما بلغت نسبة الذين ليس لديهم وعي بالتفاعل الدوائي والغذائي (6.7٪)

بلغت النتيجة الإجمالية للمعرفة الخاصة حول التفاعل بين الدواء والغذاء (63.8٪)، بينما يمثل الذين ليس لديهم معرفة محددة حول التفاعل بين الدواء والغذاء (63.2٪).

الجمهورية اليمنية
جامعة العلوم والتكنولوجيا
كلية الطب والعلوم الصحية
قسم التغذية العلاجية وعلم التغذية

تقييم معرفة التفاعلات الدوائية والغذائية بين طلاب كليات الصيدلة في بعض الجامعات اليمنية

اطروحة مقدمة كاستيفاء جزئي لمتطلبات الحصول على درجة البكالوريوس في

التغذية العلاجية والحميات

إعداد:

1- أم كلثوم محمد
2- رنا السقاف
3- بثينة جابر النهاري
4- رقية سمير الجباري
5- عُلا محمد ميمي
6- روان صادق الهروي
7- أية نبيل
8- بروق عبدالله اليافعي

إشراف

د. صادق الشراجي

2023م