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The Effect of Food-Drug Interactions Educational Program on Knowledge and Practices of Nurses Working at the Pediatric Out-Patients' Clinics in El-Beheira General Hospitals

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Abstract: *Children deserve medicines that are adapted to their needs. Medical errors resulting in Adverse Drug Reactions (ADRs), pose a significant public health problem. A drug-nutrient interaction is defined as the result of a physical, chemical, physiological, or pathophysiological relationship between a drug and a nutrient. These interactions may occur out of accidental misuse or due to lack of knowledge about the active elements involved in the related substances.* ***Aim of study:*** *is to evaluate the effect of food-drug interactions educational program on knowledge and practices of nurses working at the pediatric out-patients' clinics in El-Beheira General Hospitals. A quasi-experimental research design. The study was conducted at pediatric out-patients' clinics in El-Beheira General Hospitals. Two tools were used to collect data included the food drug interaction self-administered questionnaire, and practices of food-drug interaction structured observational checklist. A total of 106 pediatric out patients' nurses participated in this study, the mean age of the subjects was 28.3±8.65. The highest percentage of samples had technical nursing school (42.5%), and 23.5% held Bachelor degree in nursing. The majority of nurses at intervention group had poor knowledge at pre intervention phase compared to nearly three quarters at 3 months post program. It was exciting that less than half of nurses at intervention group had good knowledge at 3 months post program evaluation. More than one third of nurses at intervention group had good practice level at 3 months post program evaluation compared to only one tenth of them at pre intervention phase. More than half of the study sample stated educational background as the main sources of their knowledge related to food-drug interactions.* ***Conclusion:*** *The majority of nurses had a significant improvement in their total mean scores of knowledge and practices of food-drug interactions after program than before.* ***Recommendations:*** *Setting food drug interactions course for the undergraduate students' in nursing curriculum will be definitely useful. Moreover, implement in-service training for nurses which including up to date of food-drugs information on regular basis.*

Keywords: *pharmacokinetics, food and drug interactions (FDI), Knowledge, practices.*

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I. Introduction

In children undetected food-drug interactions may lead to serious morbidity and mortality. Children deserve medicines that are adapted to their needs. Children differ from adults in a number of ways that are relevant to the use of medicines. These differences include the ways in which medicines are adsorbed, distributed, metabolized and excreted by the body (pharmacokinetics) and what medicines do to the body (pharmacodynamics) [1]. Children are often unable to take the dosage forms that are designed for adults. Many of the medicines currently used to treat children are based upon extrapolation of adult data [2]. Medicines are thus manipulated by the physical alteration of a dosage form. For example, tablets that allow for adult doses may need to be split before being given to younger children. Manipulations may be time consuming, can be inaccurate, and have unknown effects on the stability and bioavailability of the drug. Recent recognition of the effects of certain foods on many drugs have increased awareness for prevention of food-drug interactions [3, 4].

Medicines can treat and cure many health problems. However, they must be taken properly to ensure that they are safe and effective [5, 6]. Medications should be extremely specific in their effects, have the same predictable effect for all patients, never be affected by food or other medications, exhibit linear potency, be totally non-toxic in any dosage. Many medicines have powerful ingredients that interact with the human body in different ways. Diet and lifestyle can sometimes have a significant impact on drugs. A drug interaction is a situation in which a substance affects the activity of a drug, i.e. the effects are increased or decreased, or they produce a new effect that neither produces on its own. Typically, interactions between drugs come to mind

(drug-drug interaction). However, interactions may also exist between drugs and foods (drug-food interactions), as well as drugs and herbs (drug-herb interactions). These may occur out of accidental misuse or due to lack of knowledge about the active ingredients involved in the relevant substances [7]. Lack of knowledge of potentially significant drug–food interactions can lead to poor clinical outcomes [8].

Drug/ nutrient interaction define as the use of prescription or over-the-counter drugs or medications that have been shown to interfere with nutrient intake or utilization, to an extent that nutritional status is compromised. Another comprehensive definition of drug-nutrient interaction is that it is an interaction resulting from a physical, chemical, physiologic, or pathophysiologic relationship between a drug and a nutrient, multiple nutrients, food in general, or nutritional status [9]. Drugs and nutrients share several characteristics, including similar sites of absorption in the intestine, the ability to alter physiological processes and the capacity to cause toxicity in high doses. It is not therefore surprising that drugs can interact with nutrients in several ways [10]. Interactions between food and drugs may accidentally reduce or increase the drug effect. The majority of clinically relevant food-drug interactions are caused by food induced changes in the bioavailability of the drug. Major side-effects of some diet (food) on drugs include alteration in absorption by fatty, high protein and fiber diets. Bioavailability is an important pharmacokinetic parameter which is correlated with the clinical effect of most drugs [7, 8].

In order to understand food/drug and drug/nutrient interactions, it's important to understand how drugs work in the body. There are four stages of drug action for medicines taken by mouth includes: the first stage, drug dissolves into a useable form in the stomach. The second stage, the drug is absorbed into the blood and transported to its site of action. The third stage, the body responds to the drug and the drug performs a function. The fourth stage, where the drug is excreted from the body either by the kidney, the liver, or both [9, 11].

Foods can interfere with the stages of drug action in a number of ways. Firstly, the most common effect is for foods to interfere with drug absorption and this can make a drug less effective because less gets into the blood and to the site of action. Secondly, nutrients or other chemicals in foods can affect how a drug is used in the body. Thirdly, excretion of drugs from the body may be affected by foods, nutrients, or other substances. Effects of drug/nutrient and food/drug interactions vary according to type of medication, form of drug (pill, liquid, etc.), dosage, site of absorption (mouth, stomach, intestine) and route of administration (oral, intravenous, etc.). With some drugs, it's important to avoid taking food and medication together because the food can make the drug less effective. For other drugs, it may be good to take the drug with food to prevent stomach irritation. 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 [8, 11].

Drug-food interactions take place mechanistically due to altered intestinal transport and metabolism, or systemic distribution, metabolism and excretion [12]. In addition, some people have greater risk of food and drug interactions who have a poor diet, have serious health problems, children and pregnant women. Risk for food/drug and drug/nutrient interactions can be affected by many factors such as: age, gender, medical history, body composition, nutritional status and number of medication used [11]. Younger children are often given medications by their parents, whereas older adolescents may self-medicate. Though, parents and adolescents may have insufficient knowledge about the medicines they use, which can lead to inappropriate drug use – even to serious, adverse drug effects among self-medicating children and adolescents. Children need to take long-term prescribed medicines for various reasons, such as asthma, epilepsy, diabetes, severe allergy) and Attention Deficit Hyper-activity Disorder. Pediatric OTC drugs cover a wide range of medications including cough and cold medicines, antipyretic analgesics, vitamin supplements and dermatological products, etc. Considering that experiences during drug usage may affect the future attitudes of children, interventions to prevent these difficulties experienced by children gain importance [13, 14].

Drugs are grouped into classes based on illnesses for which they are prescribed. They can also be grouped in other ways, such as their chemical make-up or actions in the body. Different foods can interact with more than one class of drugs:

1. Analgesic

Analgesics are drugs that relieve pain. Analgesics often cause stomach irritation. It's a good idea to take analgesics, like aspirin, with food. A full stomach lowers the risk for stomach irritation [11].

2. Antacid, Acid Blocker

Antacids neutralize stomach acid, and acid blockers reduce stomach acid production. Long term use of these drugs may lead to certain nutrient deficiencies. This is because stomach acid is important in the digestion and/or absorption of nutrients. When people produce less stomach acid, which leads to low absorption of

vitamin B12. Regular use of antacids or acid blockers lowers B12 absorption even more. Vitamin B12 supplements may be needed in this situation.

3. Antibiotic

Antibiotics are widely prescribed in medical practice. Many of them induce or are subject to interactions that may diminish their anti-infectious efficiency or elicit toxic effects. Food intake can influence the effectiveness of an antibiotic. Tetracycline antibiotics bind to calcium found in dairy products. This can decrease the absorption of the antibiotic. Other drugs like penicillin and erythromycin are most effective when taken on an empty stomach. This is because they may be partially destroyed by stomach acid when taken with food. However, food can reduce the chance of stomach irritation from these drugs. 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 [15].

4. Anticoagulant

Anticoagulants slow the process of blood clotting. This can decrease risk of strokes in patients whose blood tends to clot too easily. These drugs, like warfarin (Coumadin), work by interfering with the use of vitamin K in blood clotting. Warfarin is commonly used to treat or prevent thromboembolic events [16]. People taking these anticoagulants should be consistent in the amount of vitamin K they get from foods. It's very important to avoid eating large amounts of foods rich in vitamin K include liver, and green vegetables such as broccoli, spinach and other leafy greens [7].

5. Anticonvulsant

Anticonvulsant drugs help control seizures. Phenytoin (Dilantin), phenobarbital and primidone may cause diarrhea and a decrease in appetite. These drugs also increase the use of vitamin D in the body and this means that vitamin D supplements may be needed for important functions such as calcium absorption. Some anticonvulsants also interact with the B vitamin -folic acid. When drug therapy is started, folic acid levels in the body decrease. Because folic acid supplements affect blood levels of the drug, folate supplementation must be supervised by a doctor [11].

6. Antihistamine

Antihistamines are used to treat allergies. Many of these drugs often cause drowsiness. They may also increase the appetite, which can lead to weight gain. Increased physical activity can help reduce weight gain [17].

7. Anti-inflammatory

Anti-inflammatory medication is prescribed to patients for a number of problems such as chronic joint pain, headaches, and arthritis. Long-term use may lead to stomach irritation and eventually ulcers. These medications should be taken with food [18].

8. Cancer Drugs

Antineoplastic agents are used to treat different forms of cancer. These drugs can irritate the cells lining the mouth, stomach, and intestines. Many of them cause nausea, vomiting, and/or diarrhea and all of these can affect nutrient status. Methotrexate reduces availability of the B vitamin-folic acid. Supplementation of folic acid may be recommended for people taking this drug.

9. Diuretic

Diuretics cause the body to excrete more urine and are often used to treat high blood pressure and fluid buildup. Some diuretics increase urine losses of minerals such as potassium, magnesium, and calcium. Others limit mineral loss (especially potassium). It is important to talk with your doctor about whether you need to take or avoid mineral supplements.

10. Laxative

Laxatives speed up the movement of materials through the digestive tract and reduces the time for nutrient absorption. Excessive use of laxatives can deplete vitamins and minerals needed for normal body function and increase fluid losses which may lead to dehydration.

11. Mental Health Drugs

Psychotherapeutic drugs treat depression, anxiety, and other mental health conditions. Some of these drugs increase appetite while others decrease it, subsequently, either effect can impact weight in a significant way [11].

12. Bronchiodilators

Bronchodilators like theophylline, albuterol, and epinephrine possess different effects with food. The effect of food on theophylline medications can vary widely. High-fat meals may increase the amount of theophylline in the body, while high carbohydrate meals may decrease it. Avoid eating or drinking large amounts of foods and beverages that contain caffeine (e.g., chocolate, colas, coffee, and tea) where these substances contain xanthine. Hence consuming large amounts of these substances while taking theophylline, increases the risk of drug toxicity [7].

Knowledge and practices of food and drug interactions (FDI) among nurses is important issue. Nurses play important roles in patient safety [19]. Medication errors resulting in adverse drug reactions (ADRs) pose a significant public health problem. Awareness of that a number of other factors in individual patients can influence their sensitivity to food-drug interactions. Dietary habits, specific diseases, polypharmacy, compliance and enzyme constitution can all affect a patient's potential for developing interactions with food, and dosage adjustments need to be individualized [7]. Nurses should be attentive in monitoring for possible FDI and in counseling patients on food and beverages to avoid when taking certain medications. Studies on the knowledge, and practices of food and drug interactions (FDIs) among nurses are lacking [19].

Significance of the study:

Interactions between the food and drugs can have profound influence on the compliance and success of drug treatment. In the health care setting, adverse drug reactions (ADR) and drug interactions (DI) present a growing concern. Several studies had shown the drug interactions incidence ranging from 3% to 30%. Presence of additional drug, food, herbs, beverages or environmental chemicals alters the pharmacologic activity of a drug, leading to drug interactions. A food-drug interaction is the effect of food or a nutrient in food on the medications. Most of the people have an insight that being natural all herbs and foods are safe, but by altering, mainly the drug pharmacokinetics, they might cause adverse drug reactions or oppose the effect of drugs. So, there is crucial needs to increase nurses' knowledge and enhancing their practices about food drug interaction to prevent such adverse reactions.

Aim of the Study: The study aimed to evaluate the effect of food-drug interactions educational program on knowledge and practices of nurses working at the pediatric out- patients' clinics in El-Beheira General Hospitals.

Hypothesis of the study:

Nurses working at the pediatric out-patients' clinics in El-Beheira General Hospitals who engage in food-drug interactions educational program exhibit higher level of knowledge and practices than those who are not.

II. Material And Methods

Materials:

Research design: A quasi-experimental research design was adopted to carry out this study.

Setting: The study was conducted at pediatric out-patients' clinics in El-Beheira General Hospitals.

By simple random sampling technique six districts were picked up from the available sixteen districts in El-Beheira Governorate. Then one General Hospital was selected randomly from each of the six previously selected districts.

These six general hospitals are:

1. Damanhour General Hospital from Damanhour district
2. El Mahmoudiyah General Hospital from El Mahmoudiyah district
3. Housh Eissa General Hospital from Housh Eissa district
4. Kom Hamada General Hospital from Kowm Hamada district
5. Kafr El Dawar General Hospital from Kafr El Dawar district
6. Abu al-Matamir General Hospital from Abu al-Matamir district

Subjects: All available Nurses who work at pediatric out-patients' clinics in the previously mentioned settings and accepted to participate in the study (106 nurses) were recruited.

Inclusion criteria:

- Not attending any training program related to food-drug interactions.
- Willing to participate in the study.

The study sample was randomly assigned to one of two groups, either an intervention group (n = 53) or control group (n = 53). The intervention group received food-drug interactions educational program, while the control group received flyers and handout later after the completion of the study.

Tools for data collection:

Two tools were developed after reviewing literature and used by the researchers in order to collect the necessary data from nurses.

Tool I: Food Drug Interaction Self-administered Questionnaire: It consists of three parts:-

Part I: This part consists of socio-demographic data includes age, residence, qualification, years of experience.

Part II: Nurses' knowledge about food drug interaction

It consists of 5 items for assessing knowledge of nurses: concept of food drug interaction, classification of medications, common food affect drugs administration for children, appropriate time for administration of medication (before, with or after food intake), and types' food-drug interaction. The correct answers were pre-determined according to the literature. A score of (2) was given to the correct complete answer, a score of (1) for correct but incomplete answer and a score of (0) for the wrong or missed answers. The score ranged from 0-10 points. Total scores were categorized as <50% poor level of knowledge, 50-<75% satisfactory level of knowledge and ≥75% good level of knowledge.

Part III: -Sources of knowledge related to food-drug interactions.

Tool II: Practices of food-drug interaction structured observational checklist

This tool was used for assessing nurses' practices regarding food-drug interaction, that includes: take a thorough medication history, reading of prescription label, educate patients about precautions on drug inserts, educate patients about appropriate times for drug administration, educate patients about food interact with medications, give patients instruction about don't take medication with cigarettes, teaching to patients about drug-drink/Herbal interaction, monitoring the level of blood-potassium used diuretic and laxative, monitoring the level of blood-sodium used diuretic and laxative, consulting with the hospital pharmacy.

This tool was assessed on 10 questions. The response of each practice question was scored as 0 for not perform, and 2 for perform. A total score for practices related to food-drug interaction was obtained by summing the scores of these 10 questions which ranged from 0-20 and was then leveled as follows:

- Good practice level ≥ 75 %
- Fair level 50 - < 75 %
- Poor level < 50 %

Methods

1. An official letter from Faculty of Nursing-Damanhour University was directed to the responsible authorities of the previously mentioned hospitals to obtain their permission for conducting the study.
2. Tools were developed by the researchers after review of recent relevant literature.
3. Tools were revised by a jury composed of five experts in the field of community health nursing and pediatric nursing for content validity and recommended modifications were done accordingly.
4. Tools (I, II) were tested for reliability by test- retest technique, the Cronbach's alpha test were 0.92 for tool (I) and 0.980 for tools (II).
5. A pilot study was conducted on 11 nurses working at pediatric out-patient clinics of another general hospital out of the previously mentioned hospitals (excluded from the study subjects) to ascertain the clarity, feasibility and applicability of the tools and to identify obstacle that might interfere with the process of data collection.
6. Meetings were held with nurses of the selected hospitals to clarify the purpose of the study and to gain their cooperation during data collection.
7. The 106 nurses working at pediatric out-patient clinics of general hospitals were divided into two equal groups (intervention and control).
8. Food-Drug interactions educational program was carry out for the intervention group (53 nurses).
9. Questionnaire sheet (Tool I) was provided for each subject at break time. The duration of respondents ranged between 15-20 minutes. 2 days/week were specified for data collection over a period of three months, started from the beginning of June till the end of August 2018. Averages of 4-5 nurses were met daily. They were observed for their practicing with 3 cases using tool (II), then average score were estimated.
10. Implementation of the Food-Drug interactions educational program was executed over a period of one month (November 2018).

11. Evaluation of the program was conducted immediately at the end of November 2018 and 3 months later at February 2019.

1- Preparatory phase:

Preparation and organization of Food-Drug interactions educational program's sessions:

- Food-Drug interactions educational program's sessions were prepared by the researchers for the intervention group. The content of the sessions was based on review of literature, results of assessment as well as characteristics of nurses and their needs.

-Each subject obtain tool (I) questionnaire sheet and duration of respondents ranged between 15-20 minutes and was observed for practicing with 3 cases by using tool (II). This phase lasted for over a period of three months, started from the beginning of June till the end of August 2018.

The aims of the sessions are to:

- Help nurses to recognize concept of food/drug and drug/nutrient interactions.
- Determine the effects of drug/nutrient and food/drug interactions.
- Apply food drug interactions knowledge.

Food-Drug interactions educational program strategies

A. Food-Drug interactions educational program methods:

Different methods of instructions were adopted as brain storming, group discussion, case study and role play.

B- Teaching aids:

Different aids were used to facilitate and illustrate teaching such as posters, flyers and handouts.

2- Program implementation phase:

This phase included the implementation of the planned Food-Drug interactions educational program. The intervention group (53 nurses) was divided into six groups according to the (8-9 nurses/group). Therefore, Food-Drug interactions educational program were implemented through three sessions for each group over a period of one month. Each session lasted approximately 60 minutes. Firstly, discussion of the session objectives and content were dedicated. Then, time was available for nurse's participation and interaction. Different methods of instructions and teaching aids mentioned before were used. This phase take one month (November 2018).

Session (1):

- Overview of Drug/ nutrient interaction
- Main concepts of food drug interaction
- Identify how drugs work in the body
- Concept of pharmakines
- Common causes of FDI

Session (2):

- Factors affecting drug absorption
- Effects of drug/nutrient and food/drug interactions varies by factors
- Classifications of drugs
- Different foods which can interact with more than one drug
- Drugs and alcohol
- Drugs and grapefruit juice

Session (3):

-Timings of food and drug intake

- Major side-effects of some diet (food) on drugs
- Role of nurses in medication safety and education of patients.

3- Evaluation phase:

-Reassessment was done immediately for intervention group after the completion of the educational program and lately for both groups after one month from its completion.

-Intervention group was assessed to determine the effect of food-drug interactions educational program on their knowledge and practices.

Ethical consideration;

For each subject an informed oral consent was obtained after explaining the purpose of the study. In addition her anonymity, privacy, freedom to withdraw from the study at any time and confidentiality of her data were all emphasized prior starting the interview.

Statistical analysis:

After collection of data, they were coded and transferred into especially designed formats to be suitable for computer feeding. Following data entry, checking and verifying processes were carried out to avoid any errors during data entry.

- Data was analyzed using PC with Statistical Package for Social Sciences (SPSS) version 20.0.
- The level of significance selected for this study was p equal to or less than 0.05.

The following statistical measures were used:

A- Descriptive statistics:

Count and percentage: Used for describing and summarizing quantitative data, Arithmetic means and Standard deviation (SD): They were used as measures of central tendency and dispersion respectively to summarize quantitative data.

B-Analytical statistics:

t test: used to compare means of two independent groups for normally distributed data.

Chi-Square test: was used as test of significant for comparing two qualitative variables.

One Way ANOVA test: Parametric statistical tests were used to compare the means for quantitative data of more than two independent groups and detect significant differences.

III. Result

The demographic characteristics of the study subjects are shown in table 1. The age of the nurses who are less than 25 years was 43.4%, while nurses who are between 25-35 years was 34.0%, and nurses who are 35 years and more was 22.6%. The mean age of the subjects was 28.3±8.65. Of all participants in the study, 61.3% were urban residence. The highest percentage of samples had technical nursing school (42.5%), more than one third (34.0%) held secondary nursing school, and 23.5% held Bachelor degree in nursing. Exactly half of nurses 50.0% had nursing experience less than 10 years, while 41.5% of the nurses had experience between 10 and less than 20 years and the minority of the nurses 8.5% had experience more than 20 years and the mean working experience among nurses were 12.3±6.25 years.

Table (1): Distribution of the study subjects according to their socio-demographic characteristics

Socio-demographic characteristics	No (106)	%
Age group		
< 25	46	43.4
25-	36	34.0
35+	24	22.6
Mean ± SD	**28.3±8.65**	
Qualifications		
Bachelor degree	25	23.5
Secondary nursing school	36	34.0
Technical nursing school	45	42.5
Residence		
Rural	41	38.7
Urban	65	61.3
Years of experience		
<10 years	53	50.0
10-	44	41.5
20+ years	9	8.5
Mean ± SD	**12.3±6.25**	

Table (2) shows the distribution of the study subjects according to their sources of knowledge about food-drug interactions. The table shows that more than half of nurses (51.9%) they report their educational background as the main sources of their knowledge related to food-drug interactions, while those mentioned networks/websites were 28.3%, and doctors were 27.4%.

Table (2): Distribution of the study subjects according to sources of their knowledge related to food-drug interactions

Items	No (106)	%
Source of their knowledge related to food-drug interactions [#]		
- Educational background	**55**	51.9
- Networks/Websites	**30**	28.3
- Doctors	**29**	27.4
- Others	**16**	15.1

[#] **More than one source**

Table (3) reveals descriptive statistics of knowledge of nurses working at the pediatric out-patients' clinics in El-Beheira General Hospitals about food-drug interactions. Five items of knowledge were assessed in the table; a) Concept about food drug interaction, b) Classification of medications, c) Common food affect drugs administration for children, d) Appropriate time for administration of medication and, e) Types' food-drug interaction. As for food drug interaction items, the highest mean percent score before program implementation for intervention group related to common food which affect drugs administration for children was 25.6±14.6 compared to 32.1±12.6 scores at 3 months post program. The same was observed at the control group where the classification of medications knowledge was 26.8±10.9 scores before program implementation versus to 22.31± 0.58 scores at 3 months post program. The difference was statistically significant between intervention and control group at 3 months post program regarding the classification of medications knowledge (X2= 3.25, P =0.006). While appropriate time for administration of medication was the lowest (4.58±2.62) for nurses at the intervention group before program implementation compared to 7.31±3.31 scores at 3 months post program. The mean score percent for different types' food-drug interaction was 2.32±1.75 and 4.21±2.11 scores for nurses at the intervention group before and 3 months post program respectively. The difference was statistically significant between intervention group before and 3 months post-intervention regarding the different types' food-drug interaction knowledge (X2= 18.25, P =0.001).

Table (3): Effect of food-drug interactions educational program on the study subjects' mean of knowledge about food drug interaction

Knowledge items	Intervention group (n =53)			Control group (n =53)	
	Pre program	Immediate evaluation	3 months post program	Pre program	3 months post program
	Mean±S.D	Mean±S.D	Mean±S.D.	Mean±S.D	Mean±S.D
Concept about food drug interaction	24.2±7.25	33.2±90.3	30.6±14.5	25.8±8.45	25.3±10.2
F **P1**	**15.65** **0.002***			**1.32** **0.103**	
t-test **P2**	----------			**2.25** **0.26**	**4.77** **0.002***
Classification of medications	21.31±0.54	36.2±0.99	24.78±0.56	26.8±10.9	22.31± 0.58
F **P1**	**17.5** **0.001***			**0.994** **0.201**	
t-test **P2**	----------			**0.87** **0.341**	**3.25** **0.006***
Common food affect drugs administration for children	25.6±14.6	45.8±16.2	32.1±12.6	22.22±0.61	25.9±11.8
F **P1**	**16.85** **0.003***			**0.689** **0.468**	
t-test **P2**	----------			**0.405** **0.4122**	**5.01** **0.003***
Timings of food and drug intake	4.58±2.62	7.98±2.98	7.31±3.31	3.65±2.01	3.96±2.11
F **P1**	**17.2** **0.001***			**15.5** **0.001***	
t-test **P2**	----------			**0.76** **0.221**	**3.35** **0.005***
Different types' food-drug interaction	2.32±1.75	5.99±2.76	4.21±2.11	5.31±2.56	5.69±1.98
F **P1**	**18.25** **0.001***			**0.861** **0.456**	
t-test **P2**	----------			**0.699** **0.385**	**4.81** **0.004***

t: Independent sample t-test F: One Way ANOVA test *Significant at P≤0.05

P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time.

Table 4 presents the knowledge of the study subjects who working at pediatric out-patient clinic, about effects of the nutrition/diet contents on medicines. It was found that 24.5% of the nurses at intervention group know of the effects of the grapefruit and acid juice at pre-program compared to less than two thirds at 3 months post program. However, 56.6% of those nurses at the control group know its effect too at pre-program. While, 52.8% of the nurses at intervention group know of the effects of the herbal at pre-program compared to less than three quarters at 3 months post program. However, 43.4% of those nurses at the control group know its effect too at pre-program.

Concerning the effects of the iron and green leafy vegetables, it was found that 41.5% of the nurses at intervention group at pre-program know its' effect on drug administered compared to nearly two thirds at 3 months post program. In addition, about half of the nurses at intervention group at pre-program know of the effects of milk and dairy products compared to three quarters at 3 months post program and 39.6% of the nurses at intervention group at pre-program versus 58.5% of them at 3 months post program know of the effects of the sodium on importance of the using medicines. The difference was statistically significant between intervention group before, immediate and 3 months post-intervention regarding the knowledge about common food affect drugs (X2= 18.65, P =0.001). In addition to, statistical significant differences between intervention and control groups at 3 months post-intervention (X2= 21.3, P =0.0021).

Table (4): Distribution of the study subjects at pre and post-intervention phases regarding their knowledge about common food affect drugs

Common food affect drugs	Intervention group (n =53)						Control group (n =53)			
	Pre program		Immediate post program		3 months post program		Pre program		3 months post program	
	No.	%	No.	%	No.	%	No.	%	No.	%
- Grapefruit and acid juice	13	24.5	41	77.4	32	60.4	30	56.6	26	49.1
- Diet rich in iron (Green leafy vegetables)	22	41.5	40	75.5	35	66.0	20	37.7	16	30.2
- Banana and diet rich in potassium	20	37.7	39	73.6	39	73.6	17	32.1	15	28.3
- Milk and dairy products	26	49.1	41	77.4	40	75.5	14	26.4	13	24.5
- Diet rich in sodium (canes, salty food)	21	39.6	43	81.1	31	58.5	18	34.0	16	30.2
- Diet rich in vitamin k	16	30.2	32	60.4	39	73.6	13	24.5	13	24.5
- Garlic	20	37.7	44	83.0	30	56.6	15	28.3	15	28.3
- Herbals (Ginger, Ginseng, Licorice)	28	52.8	46	86.8	38	71.7	23	43.4	18	34.0
- Cigarettes	19	35.8	44	83.0	40	75.5	9	17.0	13	24.5
- Soybean and walnuts	11	20.8	43	81.1	36	67.9	17	32.1	17	32.1
- Caffeine	20	37.7	43	81.1	32	60.4	25	47.2	18	34.0
- Tyramine containing foods (salami)	21	39.6	45	84.9	38	71.7	30	56.6	29	54.7
- Histamine containing foods (tuna, fish)	21	39.6	33	62.3	32	60.4	22	41.5	25	47.2
- Vitamin C	27	50.9	43	81.1	36	67.9	25	47.2	22	41.5
X^2 P1	**18.65 0.001***						**0.895 0.2365**			
X^2 P2	----------						**18.9 0.323**		**21.3 0.0021***	

P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time. X^2: Chi-Square test
***Significant at P≤0.05**

Regarding the effect of food-drug interactions educational program on the study subjects' total mean knowledge scores, **table (5)** portrays that the majority of nurses at intervention and control groups (79.2%, 83.0% respectively) had poor knowledge at pre intervention phase compared to (20.8%, 71.7%) for intervention and control groups at 3 months post program respectively. While, less than half of nurses (45.2%) at

intervention group had good knowledge at 3 months post program evaluation compared to none of them at pre intervention phase. Moreover, 20.8% of nurses at intervention group had satisfactory level of knowledge at pre intervention phase versus to one third at 3 months evaluation. There was a significant differences between intervention group total mean knowledge scores at pre, immediate & 3 months post-intervention (X2= 14.25, P= 0.001). In addition to, statistical significant differences between intervention and control groups at 3 months post-intervention (X2= 20.25, P =0.0001).

Table (5): Effect of food-drug interactions educational program on the study subjects' total mean knowledge scores

Total mean knowledge scores	Intervention group (n =53)						Control group (n =53)			
	Pre program		Immediate post program		3 months post program		Pre program		3 months post program	
	No.	%	No.	%	No.	%	No.	%	No.	%
Poor knowledge level (< 50%)	42	79.2	9	17.0	11	20.8	44	83.0	38	71.7
Satisfactory (50 - < 75%)	11	20.8	16	30.2	18	34.0	9	17.0	13	24.5
Good (≥75%)	0	0.0	28	52.8	24	45.2	0	0.0	2	3.7
X^2 P1	14.25 0.001*						0.992 0.245			
X^2 P2	----------						9.9 0.21		20.25 0.0001*	
Mean score	12.65± 3.03		15.22±2.56		14.6±3.58		10.86±3.25		11.10±4.02	

P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time. X^2: Chi-Square test
***Significant at P≤0.05**

Table (6) shows that about one fourth of nurses at intervention group versus to more than half of those at the control group at pre intervention indicated that they always take a thorough medication history. While, this percentage increased to be 60.4% for intervention group at 3 months post program. As regards to discuss food drug interaction in patient teaching, 37.7% of the nurses at the intervention group at pre-program reported that they discuss it versus to more than one fourth of those at the control group. This percentages was increased as to be more than half of nurses at 3 months post program. In addition, more than half (52.8%) of the nurses at intervention group stated they give patients instruction about don't take medication with cigarettes pre-program and became 71.7% at 3 months post program compared to one third for nurses at the control group. Moreover, 39.6% of nurses at intervention group compared to more than half of nurses at the control group at pre-program stated that they monitored the level of blood-potassium for patient who used diuretic and laxative versus to nearly three quarters for intervention group at 3 months post evaluation. There was a significant differences between intervention group at pre, immediate and 3 months post-intervention regarding their practices for food/nutrition-drug interactions (X2= 19.56, P= 0.005). In addition to, statistical significant differences between intervention and control groups at 3 months post-intervention (X2= 16.52, P =0.0014).

Table (6): Distribution of the study subjects at pre and post-intervention phases regarding their practices for food/nutrition-drug interactions

Practices items	Intervention group (n =53)						Control group (n =53)			
	Pre program		Immediate post program		3 months post program		Pre program		3 months post program	
	No.	%	No.	%	No.	%	No.	%	No.	%
- Always take a thorough medication history	13	24.5	41	77.4	32	60.4	30	56.6	26	49.1
- Reading of prescription label	22	41.5	40	75.5	35	66.0	20	37.7	16	30.2
- Educate patients about precautions on drug inserts	20	37.7	39	73.6	39	73.6	17	32.1	15	28.3
- Educate patients about appropriate times for drug administration	26	49.1	41	77.4	40	75.5	14	26.4	13	24.5
- Educate patients about food interact with medications	20	37.7	44	83.0	30	56.6	15	28.3	15	28.3
- Give patients instruction about don't take medication with	28	52.8	46	86.8	38	71.7	23	43.4	18	34.0

cigarettes										
- Teaching to patients about Drug-drink interaction	20	37.7	43	81.1	32	60.4	25	47.2	18	34.0
- Monitoring the level of blood-potassium used diuretic and laxative	21	39.6	45	84.9	38	71.7	30	56.6	29	54.7
- Monitoring the level of blood-sodium used diuretic and laxative	11	20.8	43	81.1	36	67.9	17	32.1	17	32.1
- Consulting with the hospital pharmacy	21	39.6	33	62.3	32	60.4	22	41.5	25	47.2
X^2 P1	**19.56 0.005***						**0.844 0.299**			
X^2 P2	----------						**17.65 0.621**		**16.52 0.0014***	

P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time. X^2: Chi-Square test
***Significant at P≤0.05**

Regarding the effect of food-drug interactions educational program on the study subjects' total mean practices' scores, **table (7)** reveals that the majority of the of nurses at intervention and control groups (70.9%, 69.1% respectively) had poor practice level at pre intervention phase compared to (20.0% & 61.8%) for intervention and control groups at 3 months post program respectively. While, more than one third of nurses (36.4%) at intervention group had good practice level at 3 months post program evaluation compared to only one tenth of them at pre intervention phase. Moreover, 18.2% of nurses at intervention group had fair practices level at pre intervention phase versus to nearly half at 3 months evaluation. There was a significant differences between intervention group at pre, immediate & 3 months post-intervention (X2= 21.65, P= 0.001).

Table (7): Effect of food-drug interactions educational program on the study subjects' total mean practices' scores

Total mean practices' scores	**Intervention group (n =55)**						**Control group (n =55)**			
	Pre program		**Immediate post program**		**3 months post program**		**Pre program**		**3 months post program**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Good practice level (≥75%)	6	10.9	6	10.9	20	36.4	5	9.1	6	10.9
Fair practice level (50 - < 75%)	10	18.2	15	27.3	24	43.6	12	21.8	15	27.3
Poor practice level (< 50%)	39	70.9	34	61.8	11	20.0	38	69.1	34	61.8
X^2 P1	**21.65 0.001***						**0.895 0.2365**			
X^2 P2	----------						**0.785 0.311**		**15.6 0.002***	
Mean score	**12.65± 4.03**		**17.22±3.56**		**15.6±3.98**		**11.96±4.25**		**12.10±4.12**	

P1 comparison between pre, immediate and 3 months post program implementation in each group.
P2 comparison between intervention and control group at the same time.
X^2: Chi-Square test *Significant at P≤0.05

Table 8 represents the relation between the total mean score of knowledge on food-drug interactions, practices and nurses' age, qualification and years of experience. The total mean knowledge of those nurses had less than 25 years of age were (17.22±3.56), those 25 years to less than 35 (14.6±3.58), and those nurses ≥35 years (16.21±4.21). Significant differences were found among those nurses had <25 years of age and their total mean scores of knowledge (P= 0.002). While, the total mean score of practices in relation to nurses' age were as follows: less than 25 years of age were (20.02±2.37), those 25 years to less than 35 (24.01±3.24), and those nurses ≥35 years (31.14±0.16). Significant differences were found among those nurses who had less than 25 years of age and their total mean scores of practices (P= 0.001).

The total mean knowledge of those nurses who had secondary nursing school were (23.32±2.43), those had technical nursing school (23.32±2.43), and those nurses had bachelor degree (11.26±4.21). While, the total mean score of practices in relation to nurses' qualifications were as follows: secondary nursing school were

(24.12±2.21), those had technical nursing school (18.31±1.26), and those bachelor degree (14.66±2.01). Significant differences were found among those nurses who had bachelor degree and their total mean scores of practices (P= 0.005).

Total mean score of knowledge among study subjects about FDI as displayed in table 8 were as follows: <10 years (23.10±2.37), 10 to less than 20 years (18.81±3.84), and ≥ 20 years (12.3±1.36). Significant differences were found among those nurses had 0-9 years of experiences and their total mean scores of knowledge (P= 0.001). Regarding the total mean score of practices among those nurses as demonstrated in table 8 were as follows: 0-9 years (19.32±3.03), 10-19 years (20.55±2.22), and ≥ 20 years (19.8±3.1). No significant differences were found among nurses' years of experiences and their total mean scores of practices.

Table 8: Relation between total mean scores' of knowledge and practices on food-drug interactions among the study subjects according to their age, qualification and years of experience (N. 106)

Items	Age			Qualification			Years of experience		
	<25 (n=46)	25- (n=36)	35+ (n=24)	Secondary nursing school (n=36)	Technical nursing school (n=45)	Bachelor degree (n=25)	<10 (n = 53)	10+ (n =44)	≥20 (n= 9)
Total Mean Score of Knowledge on FDI									
Mean ± SD	17.22±3.56	14.6±3.58	16.21 ±4.21	23.32±2.43	21.21±5.04	11.26±4.21	23.10±2.37	18.81±3.84	12.3±1.36
P value	**0.002***	**0.307**	**0.698**	**0.007**	**0.652**	**0.007***	**0.001***	**0.43**	**0.354**
Total mean practices' scores									
Mean ± SD	20.02±2.37	24.01± 3.24	31.14 ±0.16	24.12±2.21	18.31±1.26	14.66±2.01	19.32±3.03	20.55±2.22	19.8±3.1
P value	**0.001***	**0.67**	**0.45**	**0.86**	**0.37**	**0.005***	**0.35**	**0.56**	**0.236**

IV. Discussion

Nowadays, patient safety is one of the basic principles in the world. Pediatric patients in the outpatient setting has many challenges. Some of them may see more than one medical provider, go to more than one pharmacy, and may be under the care of different parents/guardians. Additionally, pediatric patients may be taking over-the-counter medications, which may interact with medications taken for chronic disease. Chronic diseases like hypertension, diabetes, and asthma that require daily medications further increasing the risk of polypharmacy in the pediatric population [20].

In young children, the correct use of medicines poses specific challenges to parents, caregivers and health care professionals that are usually not encountered in adults [21]. One of the challenges facing parents is that children often struggle with swallowing oral medication because the tablet or capsule is too large to swallow whole or the liquid is too bitter or unpleasant. Many parents and nurses will therefore often mix the medication (after opening the capsule or crushing the tablet) into a soft food product, e.g. yoghurt or jam, or into a liquid such as diluting juice. Co-mixing of medication into foodstuff is a common practice. Consequently, the majority of nurses are unaware of potential drug stability/degradation issues and/or the clinical impact of these practices [22, 23].

Regarding to nurses' discussion food drug interaction in patient teaching the present study reveals that, 37.7% of the nurses at the intervention group at pre-program reported that they discuss it against to more than one fourth of those at the control group. This percentages was increased as to be more than half of nurses at 3 months post program. There was a significant differences between intervention group at pre, immediate and 3 months post-intervention regarding their practices for food/nutrition-drug interactions. In addition to, statistical significant differences was observed between intervention and control groups at 3 months post-intervention (Table 6). These results were in line with Riet-Nales et al., 2015 [21] they reported that clear instructions on how to overcome any administration challenges are hardly available.

Medication use in children presents some encountered difficulties. Where, a small error in dose of medication given to children has a greater risk of harm compared to the adult population [24]. As a consequence, parents, caregivers and health care professionals may handle medicines in ways that they consider best in a particular situation, such as breaking, crumbling or crushing tablets, mixing medicines with food or drink, or even refraining from administering them (Richey et al., 2013) [3]. All these strategies may reduce clinical efficacy and/or increase the risk of adverse drug reactions when the dosing accuracy, chemical stability, physical stability and/or bio-availability of a formulation is affected [21]. There is a positive effect of providing education/training to staff and/or patients or their parents [24]. The present study shows that more than half of

nurses' report their educational background as the main sources of their knowledge related to food-drug interactions, while more than one fourth mentioned Networks/Websites (Table 2).

Provision of safe primary care is a priority. Every day, millions of people across the world use primary care services. Therefore, the potential and necessity to reduce harm is very considerable. Good primary care may lead to fewer avoidable hospitalizations, disability and even death [25]. Nurses are one of the healthcare professionals who must be trained on the side effects of drugs and ways to reduce many adverse outcomes of prescribing them. Their knowledge and role in patient education in various areas is also important [26, 27]. The level of knowledge of pharmacology of nurses play an important role in the prevention of adverse drug reactions including food-drug interactions [28]. The present study reveals that the majority of nurses at intervention and control groups (79.2%, 83.0% respectively) had poor knowledge at pre intervention phase compared to (20.8%, 71.7%) for intervention and control groups at 3 months post program respectively. These findings were consistent with Moradi et al., 2016 [28] who reported that the mean scores of the drug-food interaction questionnaire were at a low level between nurses. This was expected because the healthcare professionals lacking in time and knowledge of properly manage drug-food interactions. Heavy workloads and insufficient training may contribute to this. These findings highlighted the need for conducting periodically training program about food-drug interactions to improve nurse's knowledge.

Nursing profession plays a critical role in patient safety [28]. The present study shows a significant differences among those nurses had <10 years of experiences in relation to the mean scores of knowledge. These were contradicted with Enwerem and Okunji (2015) [29], they reported that although new nurses possess a strong theoretical knowledge of nursing, but experience from practice is important in providing a safer level of practice. Furthermore, nurses with more years of experience did not scored better than nurses with less years in FDI knowledge. Also, they suggested that a better patient outcome is linked to nursing experience. These were disagree with Turner et al. 2014 [1], they reported that nurses with ≥20 years of experience more frequently observed FDI. The retention of experienced nurses in practice, would require a continuous, career long learning. These differences could be that experienced nurses, integrate skill, cues, knowledge and intuition in patient care more than the less experienced nurses. This observation supports the strategy of retaining experienced nurses in the workforce for a longer period through cultivating a climate of continuous, career-long learning [29]. Nurses should have adequate knowledge about medication administration, and they should consider drug interactions during medication administration [30].

With knowledge of the nutritional status of the patient that is an important effect on the appropriate response to drug treatments, can be prevented the risk of many adverse drug reactions including food-drug interactions that it also requires having knowledge of the case. The level of knowledge of nurses about pharmacology and patient's nutritional status has very important role in the prevention of adverse drug reactions such as food-drug interactions. This requires continuous clinical monitoring in populations with high-risk diets and education of patients [28]. As for food drug interaction, the present study shows the highest mean percent score before program implementation for intervention group related to common food which affect drugs administration for children was 25.6±14.6 compared to 32.1±12.6 scores at 3 months post program. The difference was statistically significant between intervention group before and 3 months post-intervention regarding the different types' food-drug interaction knowledge. (Table 3) Thus, it is necessary to take due actions such as developing in-service training courses to promote nurses' pharmacological knowledge.

Drug interaction does not only occur between two drugs. They can occur between drugs and between any kind of foreign substance, food (e.g. grapefruit juice, broccoli, barbecue) as well as caffeine and alcohol. FDI occur when the presence of a food changes the bioavailability of a drug co-administered together. This variation can result in therapeutic failure especially with orally administered drugs. Vegetables, such as broccoli, kale, spinach, rich in vitamin K, when consumed in large quantity, will interfere with the effectiveness and safety of warfarin. Foods can change drug bioavailability through various mechanisms which include change in gastric emptying, and changes in the activity of drug metabolizing enzymes. Improper timing of foods and drugs are contributors to treatment failure [29]. These were congruent with the results of the present study where appropriate time for administration of medication was the lowest scores (4.58±2.62) for nurses at the intervention group before program implementation compared to 7.31±3.31 scores at 3 months post program. (Table 3) It was found that one fourth of the nurses at intervention group know of the effects of the grapefruit and acid juice at pre-program compared to less than two thirds at 3 months post program. It also reveals that 41.5% of the nurses at intervention group at pre-program know the effects of the iron and green leafy vegetables on drug administered compared to nearly two thirds at 3 months post program. In addition, about half of the nurses at intervention group at pre-program know of the effects of milk and dairy products compared to three quarters at 3 months post program. The difference was statistically significant between nurses at intervention group before, immediate and 3 months post-intervention regarding their knowledge about common food affect drugs ($X2= 18.65$, $P =0.001$). (Table 4) This issue emphasized the importance of holding periodic training on food-drug interactions in order to improve knowledge among nurses. In addition, nurses should be watchful in

monitoring for possible FDI and in counseling patients on food and beverages to avoid when taking certain medications. It is essential that nurses be alert on the probable FDI of medications to ensure that they function properly as patient advocates [29].

V. Conclusion and recommendations

Based on findings of the present study, it could be concluded that the study hypothesis is accepted where nurses working at the pediatric out-patients' clinics in El-Beheira General Hospitals who engage in food-drug interactions educational program exhibit higher level of knowledge and practices than those who are not. It was clearly that majority of nurses had a significant improvement in their total mean scores of knowledge and practices of food-drug interactions after program than before.

Based on the current study findings the following recommendations could be made:

1. Setting food drug interactions course for the undergraduate students' in nursing curriculum will be definitely useful.
2. Implement in-service training for nurses which including up to date of food-drugs information on regular basis.
3. Educational programmes or standard operating procedures should be available in hospital departments. When discharged from hospital, the patients should be given information, orally as well as written, of potential food-drug interactions.
4. Primary health care, pediatric outpatients and districts' nurses require a continuously updated knowledge of food-drug interactions, as they are key people for providing the non-hospitalized patient with information on relevant food-drug interactions.

References

[1]. Turner et al. Paediatric drug development: The impact of evolving regulations. Advanced Drug Delivery Reviews 73 (2014) 2–13.
[2]. Mukattash T, Hawwa F, Trew K, McElnay C. Healthcare professional experiences and attitudes on unlicensed/off-label paediatric prescribing and paediatric clinical trials. Eur J Clin Pharmacol (2011) 67:449–461.
[3]. Richey et al. Manipulation of drugs to achieve the required dose is intrinsic to paediatric practice but is not supported by guidelines or evidence. BMC Pediatr, 13 (2013), p. 81.
[4]. McCabe B. Prevention of food-drug interactions with special emphasis on older adults. Current Opinion in Clinical Nutrition and Metabolic Care. 7(1):21-26, JAN 2004.
[5]. Frankel EH. (2003). Basic Concepts. In: Hand book of food-drug Interactions, McCabe BJ, Frankel EH., Wolfe JJ (Eds.) pp. 2, CRC Press, Boca Raton, 2003.
[6]. Ayo JA, Agu H, Madaki I. Food and drug interactions: its side effects. Nutr Food Sci 2005; 35(4):243-252).
[7]. Bushra R, Aslam N, Yar Khan A. Food-Drug Interactions. Oman Medical Journal, 2011; Vol. 26, No. 2: 77-83.
[8]. Piscitelli S, Rodvold K, Pai M. Drug Interactions in Infectious Diseases. Third Edition. Springer New York Dordrecht Heidelberg London. Humana Press. www.springer.com. 2011.
[9]. Ötles S, Senturk A. 2014. Food and drug interactions: A general review. Acta Sci. Pol., Technol. Aliment. 13(1), 89-102.
[10]. Mason P. Important drug–nutrient interactions. Proceedings of the Nutrition Society (2010), 69, 551–557.
[11]. Bobroff B.L., Lentz A., Turner E.R., 2009. Food/drug and drug/nutrient interactions: what you should know about your medications. Univ. Florida IFAS Extens., 1-10.
[12]. Won et al. Mechanisms Underlying Food-Drug Interactions: Inhibition of Intestinal Metabolism and Transport. Pharmacol Ther. 2012 November; 136(2): 186–201.
[13]. Costello I, Wong IC, Nunn AJ. A literature review to identify interventions to improve the use of medicines in children. Child Care Health Dev 2004; 30: 647–65.
[14]. Yong Du & Hildtraud Knopf. Self-medication among children and adolescents in Germany: results of the National Health Survey for Children and Adolescents (KiGGS). Br J Clin Pharmacol / 68:4 / 599–608.
[15]. Hodel M, Genné D. Rev Med Suisse. Antibiotics: drug and food interactions. 2009 Oct 7; 5(220):1979-84.
[16]. Hornsby LB, Hester EK, Donaldson AR. Potential interaction between warfarin and high dietary protein intake. Pharmacotherapy 2008 Apr; 28(4):536-539.
[17]. Ratliff et al. Association of prescription H1 antihistamine use with obesity: Results from the National Health and Nutrition Examination Survey. Obesity (Silver Spring). 2010 December; 18(12): 2398–2400.
[18]. Jin J. Nonsteroidal Anti-inflammatory Drugs. JAMA. 2015; 314(10):1084.
[19]. Enwerem N, Okunji P. Knowledge of Food and Drug Interactions among Nurses: Assessment Strategy for Continuing Education. International Journal of Higher Education Vol. 6, No. 1; 2017.
[20]. Yewale V, Dharmapalan D. Promoting Appropriate Use of Drugs in Children. International Journal of Pediatrics Volume 2012, Article ID 906570, 5 pages.
[21]. Riet -Nales et al. Methods of administering oral formulations and child acceptability. International Journal of Pharmaceutics. 491(2015)261–267.
[22]. Enwerem N, Okunji P and Johnson A. Food-Drug Interactions: Implications for Nursing Practice. Nurs Health Care Int J 2017, 1(1): 000102.
[23]. Liu et al. Patient-Centred Pharmaceutical Design to Improve Acceptability of Medicines: Similarities and Differences in Paediatric and Geriatric Populations. Drugs (2014) 74:1871–1889.
[24]. Wimmer S, Neubert A, Rascher W. The Safety of Drug Therapy in Children. Dtsch Arztebl Int. 2015 Nov; 112(46): 781–787.
[25]. World Health Organization 2016. Medication Errors: Technical Series on Safer Primary Care.
[26]. Marsh H. Baseline Audit Assessing Pharmacist, Nurse and Patient Awareness into Potential Food Drug Interactions. Cross University Hospital NHS. Trust, London. At: http://www.londonpharmacy.nhs. 2010.

[27]. Abbasinazari M et al. The Role of Clinical Pharmacists in Educating Nurses to Reduce Drug-Food Interactions (Absorption Phase) in Hospitalized Patients. Iranian Journal of Pharmaceutical Research (2011), 10 (1): 173-177
[28]. Moradi et al. Nurses' pharmacology knowledge of food-drug interactions in Ayatollah Taleghani Hospital of Orumieh, Iran. 2016, 9, 3.
[29]. Enwerem N, Okunji P. Knowledge, Attitudes and Awareness of Food and Drug Interactions among Nurses with Different Levels of Experience.InternationalJournalofNursing June 2015, Vol. 2, No. 1, pp. 1-9
[30]. Karahan, et al. Oncology nurses awareness of drug interactions. Asia-Pacifc Journal of Oncology Nursing 2015, 2, 4.

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