An-Najah National University

Faculty of Graduate Studies

Nurses' knowledge and Practice of Mixing Medications with Foodstuff: A Cross-Sectional Study from Palestine

By

Marah Atallah Daibes

Supervisor
Dr. Sa'ed H. Zyoud
Dr. Samah W Al-Jabi

This Thesis is submitted as Partial Fulfillment of the Requirements for the Degree of Master of Clinical Pharmacy, Faculty of Graduate Studies, Al-Najah National University, Nablus, Palestine

2021

Nurses' Knowledge and Practice of Mixing Medications with Foodstuff: A Cross-Sectional Study from Palestine

By

Marah Atallah Daibes

This thesis was defended successfully on 9/ 6/ 2021 and approved by:

Defense Committee Members	**Signature**
1. Dr. Sa'ed H. Zyoud / Supervisor	.....
2. Dr. Samah Al-Jabi / Co-supervisor	.....
3. Dr. Thaer Abdelghani / External Examiner	.....
4. Dr. Ramzi Shawahna / Internal Examiner	.....

الإهداء

أهدي هذا الانجاز العلمي

إلى أغلى ما أهدتني الحياة أمي الحبيبة التي علمتني كيف أحقق ذاتي التي سندتني عمراً ولم تتعب يوماً الى الداعم الأول لي التي من دونها ما كنت لأنجز هذة الأطروحة

إلى أبي الغالي الذي تمنيت أن يشاركني لحظات نجاحي

إلى أخواتي الغاليات اللوات شاركنني طريق الحياة

إلى كل الأصدقاء الأوفيات الذين شاركوني أجمل الذكريات

إلى أساتذتي الأفاضل الذين أناروا الي درب العلم الطويل

إلى كل من ساهم في هذا الإنجاز

الشكر والتقدير

الشكر للرب الذي قادني لإتمام هذه الطريق وكللها بهذا الإنجاز العلمي .

خالص شكري وإمتناني الى أساتذتي الأفاضل في كلية الصيدلة في جامعة النجاح الوطنية وأخص بالذكر:

الدكتور سائد زيود المشرف على هذه الأطروحة الذي لم يبخل علي لا بالوقت ولا بالعلم .

الدكتوره سماح الجابي التي دعمتني وساندتني طوال دراستي لتخصص ماجستير الصيدلة السريرية.

الدكتور نصر شريم الذي شجعني لإختيار هذا التخصص وكان طوال مسيرتي العلميه نعم المربي الفاضل.

إلى وزارة الصحة الفلسطينية التي أذنت لي باتمام هذة الأطروحة العلمية.

إلى كل ممرض منحني من وقته الثمين لإنجاز هذه الاطروحة العلمية.

ولكل من مد لي يد العون وساهم في إنجاز هذا العمل له مني كل الشكر والتقدير.

الإقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Nurses' knowledge and practice of mixing medications with foodstuff: a cross-sectional study from Palestine

أقر بأن ما اشتملت عليه الرسالة هو من نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل أو أي جزء منها لم يقدم من قبل لنيل أي درجة أو لقب علمي أو بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provides in the thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: **اسم الطالب:** مرح عطاالله يوسف دعيبس

Signature: **التوقيع:**

Date: **التاريخ:** ٢٠٢١/٦/٩

Table of Contents

List of Tables

List of Appendices

List of Abbreviation

DF	Dosage form
Cmax	Maximum plasma concentration
CT/OC	Crushing tablets or opened capsules
EC	Enteric-coated
ER	Extended-release
GI	Gastrointestinal
ICU	Intensive care unit
IM	Intramuscular
IV	Intravascular
M.O.H	Ministry of health
MAO	Monoaminoxidase
MMW	Men medical work
MR	Modified release
NGT	Naso-gastric tube
NICU	Neonatal intensive care unit
PD	Pharmacodynamic
PK	Pharmacokinetic
SR	Sustained release
Tmax	Time to maximum concentration
WMW	Women medical work

Nurses' knowledge and Practice of Mixing Medications with Foodstuff: A Cross-Sectional Study from Palestine

By
Marah Atallah Daibes
Supervised
Dr. Sa'ed Zyoud
Dr. Samah Al-Jabi

Abstract

Background: Different pharmaceutical characteristics of the dosage form (DF) have a direct effect on how easily oral solid medicine is swallowed. The majority of the older population experience some degree of dysphasia, and swallowing difficulty is a common treatment barrier among children. Medication formulations are often modified by crushing tablets or opening capsules (CT/OC) to ease the administration of medication, but this modification affects the safety and efficacy of the medication and may cause adverse effects. Also, medications for patients with a nasogastric tube (NGT) should be crushed or opened before administration. Co-administration of medications with food can cause changes in drug absorption and lead to an alteration in gastrointestinal motility, which can cause an unexpected effect on the dissolution and absorption of the drug. Therefore, this study aimed to investigate the knowledge and practices of nurses regarding mixing medications with food or drink in Palestine.

Methods: This cross-sectional study involved nurses in government hospitals in different districts of Palestine. Data collection was done by a face-to-face interview questionnaire.

Result: A total of 200 nurses participated in the study. The data show a significant difference between participants according to work department ($p < 0.001$). The highest median [interquartile] score of 15[12-15] was found for nurses working in the neonatal intensive care unit. Also, nurses in the paediatric ward and the men's medical ward had high scores of 13[11.5-15] and 13[11-14], respectively. The results show that 88% of nurses modified oral DF prior to administration to patients. CT/OC and mixing medicine into juice were the most common procedures performed by nurses (about 84%); 35% of nurses used orange juice to mix with medicine. The most common reason for crushing was to give medications to patients with NGT (41.5%). Additionally, 58% of nurses usually asked pharmacists for information about medications. Aspirin was the most frequently used medicine that was crushed by the nurses (44%); however, 35.5% of nurses did not feel sufficiently trained to carry out this practice.

Conclusions: The results of this study show that crushing and mixing medications with food is common among nurses, and the majority of nurses are unaware of the dangerous effect of this practice on patient health. Pharmacists should effectively educate nurses about unnecessary crushing situations or when crushing should be avoided and attempt to find an alternative, when available, to aid administration.

Chapter One
Introduction

1. Introduction

1.1 Background

1.1.1 Swallowing difficulties (dysphagia)

Patient acceptability of medication products is a cornerstone of the development of dosage forms (DF) and prescribing medicines. However, older adults and children differ from other age groups and require careful consideration, particularly regarding medication acceptability (Clauson et al., 2016). Different pharmaceutical characteristics of DF, like the shape, size and surface texture of the tablet have important effects on how easily an oral solid DF of medicine is swallowed and passed throughout the pharynx and oesophagus (Nouraei et al., 2018).

1.1.1.1 Adolescence

More than 30% of adolescents face difficulties when taking oral pharmaceutical DF, particularly tablet swallowing. One of the most common difficulties they experience concerns the palatable properties of medications, like the taste, so they develop strategies to overcome it, such as crushing solid tablets (Hansen et al., 2008).

1.1.1.2 Old age

Dysphagia, i.e. difficulties in the swallowing process, is prevalent among the elderly; 70-90% of the older age population group is estimated to have

some degree of dysphasia. Increasing age leads to physiological changes associated with swallowing, and age-related diseases are important factors that affect the presence and severity of dysphagia, like stroke and dementia. A high rate of dysphagia is also seen in oesophageal and pharyngeal cancers as well as depression (Sura et al., 2012, Nouraei et al., 2018). Dysphagia is more common among the older population and affects about one in nine persons who are living independently in the community. Although cognitive factors like memory recall have not been found to affect dysphagia, dysphagia is strongly associated with depression (Holland et al., 2011).

Older patients are the biggest medicine consumers, usually with polypharmacy, and they often have clinical conditions that act as barriers to their ability to take oral medications, like difficulties in swallowing. Since the oral route of administration is still the most common and preferable route for administrating medication, the properties of different pharmaceutical DF have an effect on patient acceptability in this population, since acceptability of the pharmaceutical DF has an impact on adherence and therapeutic outcomes (Liu et al., 2016, Taylor and Glass, 2018). Medication formulations are often modified by this group of patients by crushing tablets or opening capsules (CT/OC) for easier swallowing of the medication. This is an unlicensed medicine use and can, unfortunately, cause a decrease in the effectiveness of crushed medication or cause toxicity from the medicine (Caussin et al., 2012).

Medication administration in this patient population (with dysphagia) is difficult and has a higher potential error risk, because matching between the formula of medications and swallowing ability is needed in these patients. There is a higher rate of error in patients suffering from swallowing difficulties when administering medication, requiring caution on the part of healthcare professionals when administering, dispensing and prescribing medicines to these patients. It is also important to increase reporting and awareness on the part of nurses (Kelly et al., 2011, Kelly and Wright, 2012). Medication administration to elderly patients with dysphagia is a challenge for nurses, so they usually modify oral pharmaceutical DF by CT/OC, which increases the risk of medication administration errors (Sefidani Forough et al., 2020).

1.1.1.3 Children

Difficulty in swallowing tablets is a common treatment barrier among children. An important cause of this difficulty is dysphagia, which can occur due to many medical conditions such as oropharyngeal structural abnormalities, autism and neurological impairments (Liu et al., 2014, Shawahna et al., 2021). Also, the acceptability of different pharmaceutical DF by children has an impact on the therapeutic outcome. The acceptability in children can be affected by the qualities of the DF, for example the size, shape, taste and aftertaste of the tablet. Taste, smell, volume, viscosity, mouthfeel and appearance are important for liquid DF (Ternik et al., 2018, Childress et al., 2018, Shawahna, 2016). Moreover,

children with epilepsy are usually aware of the taste of different medications, because of their previous experiences with anticonvulsants, which have a bitter taste. Parents usually have to exert additional effort to make the taste of this medication more acceptable (Meltzer et al., 2006).

Unfortunately, it is sometimes necessary that the contents of capsules be mixed with food or drink because children are sometimes not able to or refuse to swallow capsules. Parents are thus obliged in this situation to be creative to some extent to disguise medication from their child, possibly by mixing the required medication with an appropriate type of liquid or food (Zajicek et al., 2013).

To solve the problem of swallowing difficulties, many patients usually ask the pharmacist for a clinical solution to this medical condition, so the pharmacist should discuss the situation with the patients and support them to find a suitable solution that not affect the desired clinical effect of the medication or cause harm to the patient (Marquis et al., 2013). A range of medicine DF is now available for patients with swallowing difficulties like effervescent, orodispersible tablets, oral disintegrating tablets or mini-tablets; all of these are more easily swallowed. Chewable tablets or granules are unfavourable alternatives because patients may not accept the taste, so this DF has limited availability (Liu et al., 2016).

1.1.2 Dosage forms (DF)

Oral medication administration seems to be the safest and simplest way of treating patients. Unfortunately, patients who have problems with

swallowing oral medication (dysphagia) or in the use of oral medications in general may have problems in finding suitable a pharmaceutical DF. So, they usually need to CT/OC, which for many medications is an unlicensed procedure (Gill et al., 2012, Teder et al., 2018). Modifying solid oral medication has an impact on the safety, quality and efficacy of the medication and may cause adverse effects (Lau et al., 2015). Unfortunately, modification of DF can affect the chemical or physical stability of the drug or drug bioavailability, which can lead to increased toxicity or reduced efficacy and interfere with patient outcomes (Standing and Tuleu, 2005, van Riet-Nales et al., 2015). Moreover, the manufacturer will not bear any responsibility for any harm to the patient after changing a pharmaceutical DF (Griffith and Davies, 2003).

Not all oral medications can be split. Moreover, splitting (cutting in half) or crushing pharmaceutical DF like extended-release (ER) tablets may be harmful or dangerous in some situations. In addition to older adults with swallowing difficulty crushing their medications for easier administration, nurses also crush medications for patients on a feeding tube. If these medications are not intended for crushing, this procedure can be problematic and may be harmful. Patients should be advised not to crush or split the medication without checking if this is suitable by discussing it with a pharmacist or other health care provider (Gill et al., 2012, Wright et al., 2020, Shawahna and Rahman, 2011). Administration of crushed medication may lead to therapeutic failure, patient injury or drug toxicity. Drugs labelled as controlled-release (CR), sustained-release (SR),

modified-release (MR) or extended-release (ER) should be swallowed whole and should not be crushed or split (Shawahna, 2016, Shawahna and Rahman, 2011, Kortejarvi et al., 2010). Crushing this DF will mean the patient receives the entire dose of medication at once, not over a prolonged period. This leads to medication toxicity, with life-threatening outcomes. Other medications of concern have narrow therapeutic windows, such as phenytoin, digoxin and sodium valproate (Mc Gillicuddy et al., 2017, Mc Gillicuddy et al., 2019).

Pharmaceutical companies market oral pharmaceutical DF that are absorbed by the gastrointestinal tract at the intended site and at the correct rate of release. Thus, the pharmacodynamics (PD) and pharmacokinetics (PK) of the medication are affected by modification of the DF, most likely decreasing the time to reach maximum concentration (Tmax) and increasing the maximum plasma concentration (Cmax). This decreases efficacy, increases toxicity, leads to a sub-therapeutic drug level between doses and can induce adverse drug reactions (Nissen et al., 2009).

As a part of clinical treatment, crushing medications is an accepted practice to obtain the desired prescribed dose of medication if the dose is not available as a manufactured tablet. Thus, geriatric or paediatric patients often need DF that are not available. Also, in cases where there is a need for a fraction of the available doses, this may increase or reduce the dosage regimen of the patient (Mitchell, 2014).

Some pharmaceutical DFs should never be crushed. An important one is an EC medication that is inactivated in the acidic medium of the stomach or may irritate the gastric mucosa. Sublingual DF are designed to be dissolved quickly in the sublingual area, which leads to better and faster drug absorption, so the drug reaches the bloodstream within a shorter time period. Certain sugar-coated tablets are designed to mask unpleasant smells and flavours. Also, DF may be designed to protect active ingredients that could be inactivated by light or humidity (Elliott et al., 2014, Zaid et al., 2013, Wilczynski et al., 2016, Helmy, 2015, Kortejarvi et al., 2014). Effervescent or dispersible pharmaceutical DF are designed to be dispersed or dissolved in water before ingestion, so if crushed, this DF loses its ability to dissolve in water quickly. Soft gelatine capsules (with liquid contents) should not be crushed or split, because releasing the liquid inside may lead to incorrect dosing by losing some portion of the liquid remaining in the capsule (Virili et al., 2016, Kirkevold and Engedal, 2010).

The biopharmaceutical classification system is a scientific framework for classifying a drug substance based on its aqueous solubility and intestinal permeability, when combined with the in vitro dissolution characteristics of the drug product. This system takes into account three major factors: solubility, intestinal permeability, and dissolution rate, the drugs can be categorized in to four basic groups on the bases of their solubility and permeability GI mucosa:

Class I drugs exhibit a high absorption number and a high dissolution number. The rate limiting step is drug dissolution and if dissolution is very rapid then gastric emptying rate becomes the rate determining step.

Class II drugs have a high absorption number but a low dissolution number. In vivo drug dissolution is then a rate limiting step for absorption except at a very high dose number.

Class III Low Permeability High Absorption is rate . drugs permeability is rate limiting step for drug absorption. These drugs exhibit a high variation in the rate and extent of drug absorption.

Class IV Low Permeability /Low Absorption. Several factors such as dissolution rate, permeability and gastric emptying form the rate limiting steps for the drug absorption.

Goals of the biopharmaceutical classification system guidance:

To improve the efficiency of drug development and the review process by recommending a strategy for identifying expendable clinical bioequivalence tests.

To recommend a class of immediate-release solid oral DFs for which bioequivalence may be assessed based on in vitro dissolution tests .

To recommend methods for classification according to dosage form dissolution, along with the solubility and permeability characteristics of the

drug substance.(Bou-Chacra et al., 2017, Williams et al., 2018, Saxena and Jain, 2019).

1.1.3 Medication administration for patients with a nasogastric tube (NGT)

Children suffering from neurological disabilities may require NGT for feeding and the administration of drugs. So, all drugs will need to be dispersed or dissolved in a liquid before administration. Sometimes it is necessary to open capsules and mix the contents with food or drink because children may not be able to swallow capsules (Shah et al., 2008).

Hospitalised patients with swallowing disorders that require NGT for feeding cannot swallow solid oral forms of medications like tablets or capsules. Liquid dosage forms are available for some medications. But, for many medications, an oral liquid DF is not available, so CT/OC and mixing the contents with food or the administration of crushed DF through an NGT is necessary (Cornish, 2005). Although crushing is a reasonable choice for many capsules or tablets that are uncoated or compressed, certain medication formulations should not be crushed or split. Crushing a DF could alter the intended medication effect and cause an adverse event (Gimenes et al., 2019).

The treatment of patients with NGT has many challenges regarding safety and the efficiency of treatment. In the absence of a liquid formulation or other routes of administration, i.e. intravascular (IV) or intramuscular (IM), tablets or capsules may be crushed or opened before administration, which could lead to (1) pharmaceutical instability, (2) aero-contamination or loss of medication, (3) drug-food interactions or (4) enteral feeding tube blockage or clogging (Salmon et al., 2013). The latter is a serious problem with crushing medication and administering it via an NGT; this tube has a small lumen and it is difficult to replace after clogging. Clinicians often refuse this option for drug administration in patients with a small-bore NGT. Although pharmacies can prepare suspensions of some medicines that are not commercially available, not all medicines can be suspended, and stability data are typically restricted (Sohrevardi et al., 2017, Li et al., 2017).

Another problem is ER medications. Crushing these formulations could cause a more rapid, profound or unsustained effect than is desired. Also, many medications cannot be crushed for different reasons, ranging from the onset of action to cytotoxic potential (Kruer et al., 2014).

1.1.4 Food-medication interactions

Medicine co-administration with food is defined as ‘the use of small amounts of food to aid administration’ rather than ‘dosing with a meal’ (Batchelor et al., 2018). This co-administration can lead to changes in drug absorption, affected by the fat, fibre and protein content in food. However,

regarding the increasing number of nutrient substances and dietary supplements, PD interactions between foods and drugs may still be undetected (Ayo et al., 2005).

Non-specific binding with a food component can lead to unexpected kinetics, poor solubility and may cause alterations in drug PK. Moreover, co-administration may have an unwanted effect on drug release from the DF, absorption from the gastrointestinal tract (GIT), distribution throughout the body, metabolism and/or elimination of the drug. Also, the efficacy of pharmacotherapy and the safety of the patient may be affected. Food-drug interactions are one of the biggest challenges associated the administration of oral DF (Grimm et al., 2018).

Food intake with medication can cause an alteration in GIT movement, which can have an unexpected effect on dissolution and absorption in the GIT (Janssen et al., 2011). Negative food effects via increased GIT viscosity could reduce drug bioavailability. Viscosity delays the diffusion of drugs to the region of absorptive membranes in the GIT, leading to poorly permeable drugs. Also, binding of the drug to food components reduces absorption (Radwan et al., 2017).

One of the most significant parameters is the pH of the GIT, as many drugs can be ionised above or below a certain pH value. Food that alters the GIT pH value will lead to an altered drug ionisation state in the GIT and affect drug absorption and bioavailability, since absorption only occurs for non-ionised drug molecules (Koziolek et al., 2015).

The cheese reaction occurs between food containing tyramine, such as cheese, and drugs that inhibit monoaminoxidase (MAO). Tyramine works indirectly as a sympathomimetic agent, and is degraded by the MAO enzyme. When MAO inhibitors are present, tyramine escapes the degradation process and reaches the bloodstream, where it is taken up by adrenergic receptors and causes a hypertensive crisis (Asher et al., 2017).

An example of a food-drug interaction involves chelating compounds such as calcium ions or magnesium ions which are present in many types of foods. In this reaction, a non-absorbable insoluble chelate complex is formed with certain medications such as tetracyclines, bisphosphonates and quinolones in the presence of multivalent ions present in milk products (e.g. Ca^{2+}, Mg^{2+}).

The oral bioavailability of demeclocycline decreases by 83% when it is administered with milk, and ciprofloxacin bioavailability is reduced by 30-36% with milk (Stojkovic et al., 2014). Milk has a high protein content; casein comprises approximately 85% of the milk protein content and can cause drug-protein binding with certain medications, thereby reducing absorption (Radwan et al., 2017).

Grapefruit juice is highly reactive with many drugs. The juice modifies drug metabolism pathways by inhibiting CYP3A4 enzymes in the liver and intestine so the oral bioavailability of CYP3A4 substrate medications is increased, like in the case of felodipine, midazolam and cyclosporine, leading to medication concentrations above toxic concentration levels

(Dewanjee et al., 2017). Patients are usually advised to avoid the ingestion of grapefruit juice within 1-2 hours of taking medication (de Castro et al., 2007).

1.2 Problem statement

Modification of oral DFs may affect chemical or physical medication stability, which may alter its clinical performance or affect its bioavailability. These unwanted changes could cause a reduction in efficacy or an increase in toxicity, so patient outcomes will be adversely affected (Standing and Tuleu, 2005). The literature on this important topic is mostly concerned with elderly or paediatric patients in nursing homes or hospitals (Paradiso et al., 2002, Stubbs et al., 2008, Treloar et al., 2000, Wright, 2002).

Evidence that confirms this practice is widely available, but published information about this common practice in Palestine is lacking. So, as nurses have a central role in the medication administration process, researchers need to explore nurses' knowledge about mixing medications with food since it is an important factor that affects the medication administration process. Without this clear understanding, it is difficult to develop effective preventive strategies that aim to reduce medication administration errors. In Palestine, no study has yet discussed the mixing

of medication with food among nurses as a component of medication errors.

To the best of our knowledge, considering the limited number of reports that have investigated nurses' knowledge and practice of mixing medication with different foods or drinks (Batchelor et al., 2018, Standing and Tuleu, 2005), no study has been performed in Palestine on this topic.

1.3 Objectives of the study

The aims of our study were:

1- To examine the nature and frequency of crushing medications and mixing them with food, considering the safety of this practice for patients and nurses. Also, to identify the reasons for and documentation of this change in pharmaceutical DF before administration in Palestine.

2- To measure the knowledge and practices of nurses regarding mixing medications with food or drink in government hospitals and to make recommendations according to nurses' knowledge to reduce medication errors in hospitals.

3- To investigate nurses' understanding of potential drug stability issues that could be affected when crushing medications or mixing them with food.

1.4 Significance of the study

In hospitals, mixing medications with food tends to be a widely accessible procedure. When combining various drugs with food, the majority of nurses seem to be unaware of medication degradation, stability and bioavailability issues. The clinical team should be aware of this when asking nurses to administer medications, especially when the patient cannot swallow (Akram and Mullen, 2012). The significance of the study comes from the fact that CT/OC are common practices, and sometimes contraindicated for some preparations. However, this is rarely reported as a medication error that caused patient harm.

In hospitals, only one patient can administer up to 18 doses of different medications per day, and a nurse will administer as many as 50 medications to patients per shift. This places nurses at the front line regarding medication errors (Mayo and Duncan, 2004).

Little is published in the literature on this topic, so this study makes a valuable contribution to the literature and highlights major gaps in the administration process of medications in undergraduate pharmacy, nursing and medical education. This study would be one of the first to examine the knowledge and experience of nurses in Palestine regarding mixing medication into food. Therefore, the results of this study will be of significant value due to the following:

1. As nurses have a central role in the medication process, it is necessary to explore nurses' knowledge about mixing medications with food and understanding of potential drug stability issues that may be cause by

mixing medication with food, as an important factor that influencing the medication process.

2. Developing appropriate preventative measures to minimise errors in the administration of medication via a training course on drug-food interactions and what medications can or cannot be mixed with food and, if so, the appropriate foods to use.

3. In hospitals, the role of clinical pharmacists should be highlighted by asking them about food-drug interactions, the PK and PD properties of drugs that may be changed when mixed with food and the appropriate foods to use with each drug.

Chapter Two
Literature Review

2. Literature Review

Many articles have been published addressing the knowledge and practice of mixing medications with foods by nurses in several countries around the world (Akram and Mullen, 2012, Akram and Mullen, 2015, Clauson et al., 2016, Zaid et al., 2019, Tahaineh and Wazaify, 2017, Mercovich et al., 2014).

In the United Kingdom

A study was performed by Akram and Mullen (Akram and Mullen, 2012) in the United Kingdom aim to investigating about knowledge of nurses' work in the paediatric department and understanding potential drug stability issues resulting from mixing medication with food. This study was designed as a self-administered questionnaire followed by in-depth interviews.

The study was conducted at regional children's hospital, part of the National Health Service (NHS) in Scotland. The questionnaire was answered by 14 paediatric mental health and 16 paediatric general nurses. This study found that, with the exception of one nurse, all paediatric general nurses and all paediatric mental health nurses reported that they had modified oral pharmaceutical DF or had mixed it into food before administration; 26 nurses of 30 nurses had practiced CT/OC and given the medication as a powder and 23 had mixed the contents into juice. Fruit

yogurts, diluted juice or concentrated juice were the most common foods used to mix with medications. More than half of the nurses felt sufficiently trained to do this procedure, but regarding medication stability, 27% did not feel sufficiently knowledgeable and few understood the pharmaceutical implications of crushing pharmaceutical DF, such as impaired medication stability or altered PKs. Only three nurses mentioned that they received training about drug stability, while 19 nurses thought that modifying pharmaceutical DF is a part of a nurse's roles and responsibilities.

In the interview, all nurses preferred mixing medication with drinks like juices rather than solid foods that is because it is an easier procedure to perform and the child could usually administer the whole product. Nurses in the interview lacked knowledge about legal and professional issues related to this procedure and from where they can access information for advice or guidance. Also, awareness was raised as to whether the child received the whole medication dose when given it in this way. Only one nurse showed concern regarding the daily effect of crushing tablets (with a mortar) on nurses' health and the possibility of inhaling the powder (which contains the active ingredient).

Several training issues were identified in this study, including the need for more training about drug-food compatibilities for mixing practice and the need for standardised documentation for these procedures for all clinical wards. As conclusions, this study found that mixing of medication with

food is widespread among nurses and unfortunately the majority of them were unaware of potential drug stability effects, degradation issues or the impact on clinical performance. However, a limitation of this study was the relatively small sample size, so the generalisability of the findings is affected; nevertheless, it is a valuable contribution to the literature because little is published in this area.

Another study by the same authors (Akram and Mullen, 2015) performed among a total of 111 nurses working in Scotland hospitals who administer medicine to children completed an online self-administered questionnaire and semi-structured interviews. The study found that 87% of the nurses in the sample had modified medications by mixing in food before administration. Fruit juice (diluted and concentrated, 34%) and yogurts (34%) were most commonly used to mix with medication. Adding medication to food appeared to be the most common way of mixing, as opposed to adding food to the medication. The reasons that lead to crushing medications were that patients did not accept the medicine as a whole tablet or capsule (44%), the large size of the tablets (36%), the bitter taste of the medication (32%) and to disguise the medicine from patients (28%). Regarding the nature of the modification, 27% of nurses gave the medicine as a powder after crushing, while 28% performed CT/OC and mixed it into juice. 31% mixed the medication into food (e.g. yogurt) or added juice (29%) or soft food (i.e. yogurt) (21%) to a liquid medicine. Regarding patient awareness that the medicine had been mixed into the

food, half of the nurses (51%) answered sometimes, while 18% always wrote that they modified medicine in their nursing notes.

In France

A study was done by Clauson et al. (Clauson et al., 2016) in 2014 among 46 health facilities in Auvergne, in which 1110 nurses answered a self-completed questionnaire about general medication issues, prescription, preparation and administration of crushed medications. CT/OC was performed by most nurses (81%) and was reported as a daily practice by 28%. Pharmacists were rarely contacted to ask about crushing medications (71% never asked a pharmacist), and two-thirds of participants mentioned that they performed this at least several times a month. These changes to pharmaceutical DF were seldom written in patient files, and medications were crushed and administered together in 44% of cases.

Regarding medication formulations that can be crushed, nurses reported that this could be done for SR tablets (11%), EC tablets (13%), soft gelatine capsules (8%), uncoated immediate release tablets (83%), chewable tablets (80%) and sublingual tablets (42%), despite the fact that these formulations should not be crushed. Only 38% of nurses always asked for available alternative DF such as liquid medications or dispersible tablets for patients with swallowing difficulties. Fewer than 50% of nurses performed CT/OC by following prescriptions written by doctors and 25% of nurses reported that the reason for CT/OC is never written in patient notes.

Crushed medications are administered to the patient most of the time just after crushing (78%) and most frequently with water (21% always) or with food (15% always). More than 60% of the nurses said that they always washed their hands after administering a crushed medication to a patient. 77% of the nurses were involved with NGT patients on their wards/healthcare units, and 67% of nurses said that they always crushed together medications given through the NGT, compared to only 6% who administered medications one after the other. In almost cases (90%), feeding tubes were always rinsed after medication was administered to the patient.

In Palestine

A cross-sectional analytical study was conducted by Zaid et al. (Zaid et al., 2019). A total of 325 questionnaires were answered by pharmacists in government hospitals, community pharmacies and primary healthcare centres in the West Bank region of Palestine. This study was designed to measure pharmacists' practices and knowledge about crushing or splitting solid pharmaceutical DF.

Only 29.3% answered correctly with no to the question that ER can be crushed or split because this formulation is designed to release its contents into the stomach or intestine; 25.7% of the pharmacists agreed that Tegretol CR® 400 mg divitabs can be split but 79.3% answered no regarding crushing. 87% said that because baby aspirin cardio is an EC tablet it should not be split. For fluvastatin XL®, 11.8% did not know that

splitting or crushing is not allowed because it is an ER formulation. 63.3% agreed with the statement that omeprazole EC granules will be inactivated by gastric acid if the capsules are opened and crushed. More than half (62.6%) knew that nifedipine XL® toxicity will be increased if crushed. 29% did not know that crushing anti-neoplastic tablets exposes pharmacist health to dangerous risks. About 80% knew that crushing sulfasalazine EN tablets leads to earlier medication release. 74.2% correctly answered that irritation of the oesophagus results from crushing alendronate before administration. 61% of participants in this study said that they are sometimes not sure about the suitability of tablets for crushing, and 44% stated that information about tablet suitability for crushing should be in the medication package leaflet. 95% did not receive any training on drug stability after crushing oral solid DF. Regarding how often the pharmacists crushed tablets, this occurred daily (3.6%), weekly (4.3%), monthly (22.3%) and never (69.6%).

In Jordan

A study by Tahaineh and Wazaify (Tahaineh and Wazaify, 2017) aimed to determine the prevalence of swallowing difficulties among the Jordanian population, to investigate techniques used by patients to solve this problem and the role of pharmacists and physicians in managing these difficulties. A prospective study was conducted at the King Abdulla University Hospital (KAUH), the Princess Basma Teaching Hospital (PBTH) outpatient pharmacy and the Anjarah Healthcare Centre (AHC) regarding

the modification of oral DF by nurses in Jordan. Adult patients (18 years old and older) were included who were taking at least one oral solid DF. This study found that 82.3% complained of swallowing difficulties at that time and 92.3% had experienced in the past some swallowing difficulties. To overcome swallowing difficulties, most of the patients (86.2%) drank more water and 42.3% tried to change their head posture. 18.5% mentioned that they sometimes skip medication doses. 16.9% cut or crushed medication tablets, 10% opened capsule, 10.8% mixed medication with food and 10.4%dissolved medication in water. 85.4% said that they did not discuss their problem with swallowing medication with their physician or pharmacist.

In Oman

Mafiana et al. published a descriptive study (Mafiana et al., 2014) evaluating the practice and knowledge of solid oral pharmaceutical DF administration in patients with swallowing difficulties among 200 nurses in different specialties at Sultan Qaboos University Hospital (SQUH). They found that about half of nurses (53%) checked the type of pharmaceutical DF before crushing. About 14% stated that administering the medication to the patient is more important than checking the physical characteristics of the medication, and 16.27% assumed that the prescriber took into consideration the type of pharmaceutical DF before prescribing the medication. 16.87% did not believe that a medication’s physical characteristics are important. 42.16% crushed all medications together.

According to the nurses' questions about crushing oral solid pharmaceutical DF, they consulted a doctor (1.8%), pharmacist (69.3%), reference book (27.7%) or nobody/nothing (1.2%).

In Australia

A pilot study by Mercovich et al. (Mercovich et al., 2014) among a convenience sample of nurses in two aged care facilities (ACFs) in the Australian Capital Territory (ACT) found that 18% of the sample had performed at least one modification of a medication prior to administration to the patient; 41% modified a single medication and 59% administered two or more different modified medications in combination. The most commonly used foods were thickened pear juice (55.0%), strawberry jam (24.0%), yoghurt (6.9%) and chocolate milk (3.4%).

Chapter Three
Methodology

3. Materials and methods

3.1 Study design

This was a cross-sectional questionnaire-based analytical study, designed to measure nurses' knowledge and practices about mixing medications with food.

3.2 Setting

Palestine consists of two geographic areas: the West Bank and the Gaza Strip. There are about 4.88 million inhabitants in Palestine, with 60.9% in the West Bank and 39.1% in the Gaza Strip. There are three regions in the West Bank:

1. The north region, which is divided into six governorates: Jenin, Tulkarm, Nablus, Qalqilya, Tubas and Salfit.
2. The middle region, which is divided into three governorates: Jerusalem, Ramallah and Jericho.
3. The south region, which is divided into two governorates: Bethlehem and Hebron.

The current study was carried out in the north region of West Bank in Palestine. A list of the names and addresses of government hospitals was obtained from the Ministry of Health (M.O.H). Based on these lists, we

visited the following West Bank governorates: Nablus, Jenin, Qalqilya, Tulkarm and Tubas. (Ministry of Health and Palestinian Health Information Center (PHIC), 2017).

3.3 Study population

There are 4,142 registered nurses employed in Palestine's government hospitals and health care units (Ministry of Health and Palestinian Health Information Center (PHIC), 2017). The population was selected from the nurses employed in government hospitals.

3.4 Sample size calculation

There are 1,566 nurses in the West Bank government hospitals. We assumed that in these hospitals there would be about 400 nurses included in our study. The sample size needed for our analysis was determined using the Raosoft sample size calculator (Raosoft Inc, 2004) to achieve a 95% confidence level and a 5% error margin. An approximate sample size of 200 nurses was given.

3.5 Sampling procedure

In this study, the population was chosen from nurses in government hospitals in the north region of the West Bank of Palestine, according to data taken from the Palestinian Health Information Centre. Nurses from different hospitals were invited to take part in the study by a convenience sampling technique.

3.6 Inclusion criteria and exclusion criteria

- The inclusion criteria were as follows: a nurse of Palestinian nationality and a registered nurse in the Palestinian M.O.H., with at least a certificate or a higher degree of qualification and employed in a government hospital.
- The exclusion criteria were as follows: nurses who declined to engage in our study or students at the undergraduate nursing school.

3.7 Data collection instrument form

The semi-structured questionnaire(Appendix1) had been developed for a previous study (Akram and Mullen, 2012, Akram and Mullen, 2015). It was reused but modified slightly according to our situation. The questionnaire contains five sections:

1. The first was the demographic section, which included issues relating to age, gender, working years, marital status, a region of residence, level of education, place of graduation, year of graduation, experience and training background or specialty.
2. The second section is divided into three parts:

- The first one evaluated how frequently the nurses modified the dosage form and how they dealt with this modification by adding crushed tablets or capsules to food or drinks or inversely. This was based on a literature review, researchers' experience and clinical expert consultation. This part consisted of seven questions, each answered by yes or no.

- The second part determined how frequently each kind of food (banana, milk, juice, etc.) was used to mix with crushed medicine. The list contained seven kinds of foods or drinks and the nurses could add other kinds. They were asked how frequently food was mixed with medicines (never, rarely, sometimes, often or very often).
- The third part was a list of drugs and the nurses chose from it what medication they commonly crushed and mixed with food to determine the most common drugs crushed and mixed with food by nurses.

3. The third section determined the reasons for modification of the dosage form of the drug in hospitals and consisted of five potential reasons based on the literature review and clinical expert consultation (never, rarely, sometimes, often or very often).
4. The fourth section was divided into two parts:

- The first one evaluated nurses' knowledge about mixing medicines with food, food-drug interactions and drug stability, and if they were sufficiently prepared to carry this procedure or reporting every time they modified a dosage form. It consisted of 18 questions answer yes, no or I don't know.
- The second part was a multiple-choice question about the nurses' sources of information about splitting or crushing tablets or capsules; they could choose more than one.

5. The fifth section was about the transparency of the modification procedure, asking about receiving permission from patients to mix medicine with food or if they asked them about their favourite food to

use for mixing with medication. It was also asked if the mixing procedure was written in nurses' notes or mentioned by the prescriber. It consisted of seven questions answered by never, rarely, sometimes, often or always.

3.8 Ethical approval

Prior to the start of this study, authorisation in all aspects, including access to and use of nurses information in our study procedure, was obtained from the Institutional Review Boards (IRB) (Appendix4), M.O.H (Appendix2,3) and local health authorities. Prior to filling out the questionnaire, verbal consent was received from nurses.

3.9 Pilot study

The questionnaire was reviewed by consensus by a panel of three experts in the field drawn from academia for its content validity (one expert in clinical pharmacology and two experts in clinical pharmacy). All experts stated that the questions adhered exclusively to the study's objectives. A pilot study with 25 participants was conducted to test the instrument of our study to ensure the readability and to estimate the time and then adjust the data collection form (questionnaire) as needed.

3.10 Statistical analysis

Using the IBM Statistical Kit for Social Sciences version 21 program (SPSS), data were entered and analysed. Data for continuous variables were reported as mean ± SD, and categorical variables were reported as

frequencies (percentages). Non-normal variables were reported as median (interquartile range [IQR]. Variables were tested for normality using the Kolmogorov-Smirnov test. The Kruskal-Wallis or Mann-Whitney test were used to assess the median differences between groups. Significance was indicated by a p-value < 0.05.

Chapter Four
Results

4 Results

4.1 Socio-demographic data

This study was a cross-sectional study that was conducted among 200 nurses working in six government hospitals in the West Bank region of Palestine.

As Table 4-1 indicates, the majority of the nurses (about 75%) were married, and female (about 57%), divided equivalently between hospitals. 66% of the sample had a bachelor's degree in nursing, and the vast majority of them (about 87%) were younger than 40 years old. Moreover, 45.5% of the participating nurses had 5-10 years of work experience. The nurses were distributed among several departments, with most of them in the internal medicine department (about 29%), paediatrics (16.5%) and ICU (14.5%).

Table 4-1: Respondent demographics.

Variable	*Frequency N(%)*
Gender	
Male	86(43)
Female	114(57)
Marital status	
Single	50(25)
Married	150(75)
Hospital	
Rafidia	33(16.5)
Watany	33(16.5)
Jenin	33(16.5)
Tubas	33(16.5)
Tulkarm	33(16.5)
Qalqilya	35(17.5)
Work department	
Emergency room	1(0.5)
ICU	29(14.5)
NICU	15(7.5)
Paediatric	33(16.5)
MMW	27(13.5)
WMW	31(15.5)
Bone	13(6.5)
Nephro	21(10.5)
Surgery	21(10.5)
Wound	4(2)
Delivery	4(2)
General	1(0.5)
Years of work	
Less than 3 years	41(20.5)
5 years - 10 years	91(45.5)
More than 10 years	68(34)
Age	
20-29	80(40)
30-39	95(47)
40-49	20(10)
50-59	5(2.5)
Education level	
Diploma	57(28.5)
Bachelors	132(66)
Masters	11(5.5)

ICU: intensive care unit/ NICU: neonatal intensive care unit /MMW: men's medical ward /WMW: women's medical ward.

4.2 Self-knowledge score and socio-demographic variables

Table 4-2 shows a significant difference between participants according to work department (p-value < 0.001). The highest median[interquartile] score of 15[12-15] was found for nurses working in the neonatal intensive care unit. Also, nurses in the paediatric ward and the men's medical ward had high scores of 13[11.5-15] and 13[11-14], respectively. The wound and delivery departments had high score but there were only four participants from these departments. No significant differences were noted regarding gender, marital status, hospitals, years of work, age and educational level.

Table 4-2: Score knowledge by socio-demographic and clinical variables.

Variable	*Percentage (%)*	*Median [Q1-Q3]*	*Mean rank*	*P-value*
Gender				
Male	86(43)	12[9.7-4]	90.6	**0.035** [a]
Female	114(57)	13[11-15]	107.97	
Marital status				
Single	50(25)	12[10-15]	102.16	**0.814** [a]
Married	150(75)	12[11-14]	99.95	
Hospital				
Rafidia	33(16.5)	13[12-15]	124.15	
Watany	33(16.5)	12[10-14]	97.44	
Jenin	33(16.5)	12[10-13.5]	87.89	**0.171** [b]
Tubas	33(16.5)	12[9.5-14]	97.5	
Tulkarm	33(16.5)	12[11-14.5]	101.83	
Qalqilya	35(17.5)	12[11-14]	94.54	
Work department				
Emergency room	1(0.5)	-	195.5	
ICU	29(14.5)	11[8-12]	64.83	
NICU	15(7.5)	15[12-15]	138.4	
Paediatric	33(16.5)	13[11.5-15]	119.62	
MMW	27(13.5)	13[11-14]	101.7	**0.000** [b]
WMW	31(15.5)	11[7-14]	78.94	
Bone	13(6.5)	12[10-14.5]	100.54	
Nephro	21(10.5)	12[11-14]	94.64	
Surgery	21(10.5)	12[11-14]	107.26	
Wound	4(2)	13.5[13-14.75]	134.63	

Delivery	4(2)	14.5[11.75-15.75]	138.88	
General	1(0.5)	--	167.00	
Years of work				
Less than 3 years	41(20.5)	13[11-15]	111.39	
5 years - 10 years	91(45.5)	12[10-14]	94.91	**0.310** [b]
More than 10 years	68(34)	12[11-14]	101.41	
Age				
20-29	80(40)	12[10-14.75]	101.61	
30-39	95(47)	12[10-14]	96.6	**0.674** [b]
40-49	20(10)	13[11-14.75]	113.68	
50-59	5(2.5)	12[11-14.5]	104.10	
Education level				
Diploma	57(28.5)	12[10-14.5]	99.29	
Bachelors	132(66)	12[11-14]	100.73	**0.966** [b]
Master	11(5.5)	12[11-14]	104.05	

[a] Statistical significance of differences calculated using the Mann-Whitney U test.

[b] Statistical significance of differences calculated using the Kruskal-Wallis test.

ICU: intensive care unit/ NICU: neonatal intensive care unit /MMW: men's medical ward /WMW: women's medical ward.

4.3 Type of oral DF modification

Table 4-3 shows that 88% of nurses modified oral DF prior to administration. There were a number of procedures used for modifications, but CT/OC and giving the medicine as a powder was the most common procedure used by nurses (about 80.5%). CT /OC and mixing the medicine into juice was also used by 42%, adding juice to a spoonful of liquid medicine by 40%, and adding soft food (i.e. yogurt) to a spoonful of liquid medicine by 26%. About 24% of nurses had opened an ampoule and mixed its contents with a drink, or performed CT/OC and mixed the medicine into food (e.g. yogurt); this was the least frequent procedure performed by nurses (about 20%).

Table 4-3: Type of oral dosage form modified by nurses before administration.

Type of modification	Total frequency (%)N=200
Have you ever modified an oral DF prior administering it to a patient?	
Yes	176(88)
No	24(12)
Have you performed CT/OC and given the medicine as a powder?	
Yes	161(80.5)
No	39(19.5)
Have you performed CT/OC and mixed the contents into a drink?	
Yes	84(42)
No	116(58)
Have you performed CT/OC and mixed the contents into food (e.g. yogurt)?	41(20.5)
Yes	159(79.5)
No	
Have you ever added juice to a spoonful of liquid medicine?	
Yes	80(40)
No	120(60)
Have you ever added soft food (i.e. yogurt) to a spoonful of liquid medicine?	
Yes	52(26)
No	148(74)
Have you ever open an ampoule and mixed its contents in a drink?	
Yes	48(24)
No	152(76)

DF: dosage form/ CT/OC: crushing tablets or opening capsules

4.4 Food used to mix with medicine.

Table 4-4 shows that 71.5% of nurses never mixed milk with medicine and only 9% of nurses sometimes mixed milk with medicine. Regarding orange juice, 35% of nurses mixed it with medicine at some time; it seemed to be the preferable food for use in mixing with medicine, followed by strawberry juice (17.5% used it sometimes), then banana (11%) and yogurt (10.5%). The least preferably for was chocolate (77% answered that they never used it), while water was the most commonly used liquid in mixing with medicine (41.5% answered very often). Some nurses mentioned other

foods they use like grapefruit juice and soup. Nurses in the NICU mentioned that they usually mix omeprazole capsules with $NaHCO_3$ for neonates.

Table 4-4: Foods used to mix with medicine.

Food type	Never	Rarely	Sometimes	Often	Very often
Milk	143(71.5)	31(15.5)	18(9)	5(2.5)	3(1.5)
Orange juice	78(39)	26(13)	70(35)	17(8.5)	9(4.5)
Yoghurt	140(70)	30(15)	21(10.5)	5(2.5)	4(2)
Banana	144(72)	26(13)	22(11)	5(2.5)	3(1.5)
Strawberry	126(63)	31(15.5)	35(17.5)	6(3)	2(1)
Chocolate	154(77)	28(14)	13(1.5)	3(1.5)	2(1)
Water	24(12)	19(9.5)	4(2.5)	33(16.5)	83(41.5)

4.5 Reasons for crushing medications.

Table 4-5 shows the possible reasons for CT/OC and mixing the contents with food. According to the nurses, the strongest reason that obliges nurses to perform this procedure is to give medications to patients with NGT; 41.5% of nurses answered with very often. Moreover, 41.5% select sometimes when the tablet or capsule was too large for the patient to swallow as a whole, so they crushed or opened it. 39% answered that they sometimes perform CT/OC if the patient will not accept the medicine as a whole tablet or capsule. CT/OC was also done by 26.5% to disguise the sour or bitter taste of medicine and by 24.5% to disguise the medicine from the patient.

Table 4-5: Reasons for crushing medications.

The reason	Never	Rarely	Sometimes	Often	Very often
The tablet or capsule is too large to be given to the patient as a whole	43(21.5)	25(12.5)	83(41.5)	25(12.5)	24(12)
To disguise from the patient the sour or bitter taste of the medicine	42(21)	46(23)	53(26.5)	33(16.5)	27(13.5)
The patient will not accept the medicine as a whole tablet/capsule	33(16.5)	24(12)	78(39)	38(19)	27(13.5)
To disguise or conceal the medicine from the patient	72(36)	26(13)	49(24.5)	35(17.5)	18(9)
To give medicine to the patient on NGT	12(6)	18(9)	38(19)	49(24)	83(41.5)

NGT :nasogastric tube

4.6 Source of information.

Table 4-6 shows the source of information that nurses usually use when they need to ask about drug issues regarding modification to a DF and mixing with food. 58% of nurses usually asked pharmacists, 44% asked other nurses, 38.5% chose a medical book, doctors, leaflet for drug, and the internet equally, while 36.5% use publications of the M.O.H. Journals and the media were the least used sources of information.

Table 4-6: Source of information.

Information source	Yes	No
Medical book	77(38.5)	123(61.5)
Other nurses	88(44)	112(56)
Publication of M.O.H	73(36.5)	127(63.5)
Doctors	77(38.5)	123(61.5)
Pharmacists	116(58)	84(42)
leaflet for drug	77(38.5)	123(61.5)
Publication of association	28(14)	172(86)
Journals	18(9)	182(91)
Internet	77(38.5)	123(61.5)
Media (newspaper, T.V)	18(9)	182(91)

MOH: Ministry of Health

4.7 Transparency and patient consent.

Table 4-7 concerns issues of transparency and patient consent before modification of the DF or mixing medication with food. 39% of nurses said that the patient is often aware that their medication is mixed into the food, and 26.5% says that the procedure of mixing medication into the food is rarely ‘carefully planned’ in the nursing notes, while 31.5% answered that sometimes the requirement for mixing the medicine into the food is specified in the prescription. Regarding consent from patients guardians before mixing drugs into food, 33% said sometimes, while 30.5% said they never asked the patient themselves. Regarding whether nurses asked the patient about the food they preferred to mix with the drug, 25% of them answered never, while 31.5% asked the patient/guardian about food the patient preferred to mix with the drug.

Table 4-7: Transparency and patient consent.

The question	Never	Rarely	Sometimes	Often	Very often
Is the patient aware that their medicine is mixed into the food?	33(16.5)	29(14.5)	78(39)	78(39)	31(15.5)
Is the procedure of mixing medicine into the food 'carefully planned' in the nursing notes?	36(18)	53(26.5)	50(25)	26(13)	35(17.5)
Is the requirement of mixing the medicine into the food explicitly mentioned in the prescription?	42(21)	41(20.5)	63(31.5)	28(14)	26(13)
Did you obtain consent from the patient's guardian before mixing medicine into food?	43(21.5)	36(18)	66(33)	27(13.5)	28(14)
Did you ask the patient's guardian about the preferred food to mix with medicine?	46(23)	41(20.5)	63(31.5)	26(13)	24(12)
Did you obtain consent from the patient before mixing the drug into food?	61(30.5)	45(22.5)	56(28)	20(10)	18(9)
Did you ask the patients about the food they preferred to mix with medicine?	50(25)	43(21.5)	57(28.5)	30(15)	20(10)

4.8 Medications.

Table 4-8 shows that Aspirin was the most frequent medicine crushed by nurses (44%), followed by paracetamol (33%) and atorvastatin (33%); 29% of nurses said that they usually open omeprazole EC capsules. Azithromycin capsules were opened and mixed with food by 24% of nurses, 29% of nurses crushed ranitidine tablets and 17.5% crushed

famotidine tablets. One-quarter of them crushed frusemide and clopidogrel tablets. 22% mixed a paracetamol suspension with food and 12.5% mixed azithromycin and an amoxicillin/clavulanic acid suspension. 15% of nurses broke dexamethasone ampoules to give it orally. Nurses also mentioned other medications they often crush and mix with foods, like alfacalcidol, calcium, propranolol, spironolactone, NSAIDs, hypnotics, carbamazepine, phenytoin, lamotrigine and phenobarbital.

Table 4-8: List of medications that are crushed and/or mixed in food.

Medication name	**Yes**	**No**
Omeprazole capsule	58(29)	142(71)
Atorvastatin tablet	66(33)	134(67)
Azithromycin capsule	48(24)	152(76)
Aspirin tablet	88(44)	112(56)
Ciprofloxacin tablet	35(7.5)	165(82.5)
Ampicillin	9(4.5)	191(95.5)
Amoxicillin tablet	16(8)	184(92)
Doxycycline tablet	18(9)	182(91)
Furosemide tablet	50(25)	150(75)
Bisoprolol tablet	47(23.5)	153(76.5)
Enalapril tablet	63(31.5)	137(68.5)
Clopidogrel tablet	50(25)	150(75)
Ranitidine tablet	58(29	142(71)
Famotidine tablet	35(17.5)	165(82.5)
Azithromycin suspension	25(12.5)	175(87.5)
Ibuprofen suspension	24(12)	176(88)
Paracetamol suspension	44(22)	156(78)
Dexamethasone ampoule	30(15)	170(85)
Diclofenac ampoule	17(8.5)	183(91.5)
Amoxicillin/clavulanic acid suspension	25(12.5)	175(87.5)
Ibuprofen tablet	36(18)	164(82)
Paracetamol tablet	66(33)	134(67)
Amlodipine tablet	52(26)	148(74)

4.9 Nurses' competencies and knowledge regarding carrying out drug-dosage procedures.

According to table 4-9 this study found that 35.5% of nursed do not feel sufficiently trained to carry out these practices (CT/OC and mixing it with food) and 19.5% did not know if they were qualified to carry out this practice. Also, 45.5% said that they did not feel sufficiently knowledgeable in the area of drug stability. About 50% of nurse said that modifying the DF is not a part of the nurse's roles or responsibilities. Regarding training courses, 65.5% of nurses mentioned that they had never taken any training courses on mixing drugs into food, 64.5% had not taken any training courses on drug stability and 47.5% of them had not taken training courses on drug-food interactions. 34% answered the question 'Did you chick the DF before crushing the drug?' with no and 32% answered no according to the question 'Did you ask the clinical pharmacist before modifying the DF?'. Moreover 57% were not sure whether tablets are suitable for splitting or crushing before performing those procedures. 76% thought that if tablets were not suitable for splitting or crushing, this information should be in the package leaflet. And half of the nurses (50%) were worried about inhaling or take some amount of drug that they crushed. 35.5% of nurses mentioned that they crushed an ER tablet and 40.4% crushed an EC tablet.

Table 4-9: The perceptions of respondents of their competencies and knowledge in the application of drug-dosage procedures.

Question	Yes	No	I do not know
Do you feel sufficiently trained to carry out these procedures?	90(45)	71(35.5)	39(19.5)
Do you feel sufficiently knowledgeable in the area of drug stability?	74(37)	91(45.5)	35(17.5)
Do you feel sufficiently supported by your colleagues when administering medication as a co-mixture?	81(40.5)	86(43)	33(16.5)
Do you feel sufficiently supported by your management when administering medication as a co-mixture?	67(33.5)	92(46)	41(20.5)
Did you report every time you mix medicine with food in the nursing note?	103(51.5)	83(41.5)	14(7)
Do you think modifying the DF is part of a nurse's roles or responsibilities?	79(39.5)	99(49.5)	22(11)
Did you take training courses on drug stability?	52(26)	129(64.5)	19(9.5)
Did you take training courses on mixing drugs into food?	52(26)	131(65.5)	17(8.5)
Did you take training courses on drug-food interactions?	92(46)	95(47.5)	13(6.5)
Did you check the DF before crushing the medication?	123(61.5)	67(33.5)	10(5)
Did you ask the clinical pharmacist before modifying the DF?	130(65)	63(31.5)	7(3.5)
Sometimes I am not sure whether tablets are suitable for splitting or crushing.	113(56.5)	70(35)	17(8.5)
If tablets are not suitable for splitting or crushing, I expect to find this information in the package leaflet.	145(75.5)	34(17)	21(10.5)
Are you certain that the patient takes the whole amount of drug when mixing with food?	101(50.5)	75(37.5)	24(12)
Did you feel worried about inhaling or taking some amount of drug while crushing it?	101(50.5)	77(38.5)	22(11)
Have you crushed an ER tablet?	71(35.5)	98(49)	31(15.5)
Have you crushed an EC tablet?	81(40.5)	99(49.5)	20(10)
Did you check the DF before crushing the tablet?	135(67.5)	54(27)	11(5.5)

DF: dosage form/ ER: extended release/ EC: enteric coated.

These questions were adapted from the Akram and Mullen study (Akram and Mullen, 2012).

Chapter Five
Discussion

5. Discussion

This study was one of the first performed in Palestine to examine nurses' knowledge and practice of mixing medications with food, how widespread this practice is, the most common foods used with crushed medications, and how the medication is crushed. We also assessed the most common medications being crushed and the extent to which nurses feel confident and well-trained to perform this practice. Moreover, we asked which medical references they frequently use to find information about this practice.

88% of nurses frequently modified pharmaceutical DF before administration to patients, consistent with the results of a similar study performed in Scotland (Akram and Mullen, 2012) at 87% and one in France at 81% (Clauson et al., 2016). 80% performed CT/OC and gave it to the patient as a powder; other common ways were mixing medication with juice (42%) and adding juice to a spoonful of liquid medicine (40%). In the study performed in Scotland (Akram and Mullen, 2012), 87% of nurses gave medication as a powder after CT/OC, 96% mixed it with food and 76% mixed it with juice.

About 40% of nurses used water to mix it with crushed medication, and orange juice was the most commonly used food for mixing, followed by milk, banana and strawberry. In the Scottish study from 2012 (Akram and

Mullen, 2012), the most common food was fruit yogurts, or fruit juice in another study performed in 2015 (Akram and Mullen, 2015). Fruit juice was used by 34% and yogurts by 34%; these were the most commonly used foods to mix with medication. In a study performed in France (Clauson et al., 2016). the nurses used water (21% always) to mix with crushed medications or food (5% always), while in an Australian study (Mercovich et al., 2014), the most common food used was thickened pear juice (55.0%), followed by strawberry jam (24.0%), yoghurt (6.9%) and chocolate milk (3.4%).

The effects of food on the physicochemical properties of medications are largely ignored in the literature, but nurses should understand the potential of these physiochemical changes. In our study, orange juice and yogurt were the most commonly used foods. Most fruit juices have a pH value between 3-5. The chemical stability of many acid-sensitive medications is affected at that pH range, particularly if the EC of the DF has been destroyed by CT/OC. Therefore, the time between the addition of food to medicine and administration of the medication to the patient is considered an important factor for the clinical performance of crushed medications. Furthermore, even simple foods such as milk can affect dissolution and therefore potentially impact drug bioavailability. Using yoghurt as a vehicle to mix with crushed tablets and administering it to the patient is controversial because drug dissolution may be affected. Moreover, drug bioavailability is dependent on gastric emptying time, which is affected by food in the stomach. Studies have shown that liquids such as juice, water

and milk products, due to variations in solution properties such as viscosity, osmolality and calorie content, can lead to some major differences in gastric emptying times. There can also be major qualitative variations for each dosage administered and clinical effect variability if different foods are used each time to mix with the drug before being administered. Although some information is available about crushing the tablet and the consequent effect on stability/degradation, there is considerable concern regarding the administration of medication via NGT (Manrique et al., 2014, Bowles et al., 2010, Martir et al., 2020). Therefore, clinical pharmacists need to be familiar with the scientific properties of foods (e.g., pH, osmolality, viscosity, calorie content and chemical composition), common foods used by nurses for mixing with medication prior to administration, and be able to predict the possible impact on biopharmaceutical proparites of medications DF after mixing with various foods (e.g. disintegration and dissolution, absorption and bioavailability of the drug, and effects on gastric emptying time) to better inform nursing and medical colleagues on how to assist with administration without disrupting the properties of the medication and the clinical result needed.

The most common reasons for CT/OC was to give medications to patients on NGT, due to a bad medicine taste and patient acceptance of medicine. In a study performed in Scotland (Akram and Mullen, 2015), of the reasons that led to crushing medications, patients not accepting the medicine was the most prevalent reason. The second one was the size of the tablets (36%), bitter taste of the medication (32%) and to disguise the medicine

from patients (28%). In France (Clauson et al., 2016), 77% of nurses were involved in their wards/healthcare units with NGT and 67% of nurses said that they always crushed all medication and gave them together through the NGT.

Pharmacists should be aware of this medication administration struggle and be able to find a solution to aid administration without affecting drug chemical properties and clinical effects specific to patients with NGT or swallowing difficulties and medications with a bad taste.

The pharmacist was the preferred source of information for nurses (58%) when they needed to ask about crushing medication or mixing medications with foods. Also, other nurses were an important source of information (44%). These findings raise the importance that clinical pharmacists and nurses should be familiar with the fields of drug stability, food/drug interactions, the properties of DF, the suitability of crushing and the availability of alternative DF.

More than half of nurses did not feel sufficiently trained to carry out this practice, or sufficiently educated in the area of drug stability. About 70% of nurses did not take any training courses in the field of drug stability or mixing medication with different foods. It is very important to activate the clinical pharmacist’s role in continuous education in this area to help nurses achieve safe and effective drug administration to patients. Also, more courses should be included for nursing students.

Unfortunately, more than 50% of the time, the medication being modified and mixed with food was not recorded in the nursing notes or even mentioned by the prescriber, although this practice can be a reason for medication administration error and could cause harm to the patient or treatment failure. When it is not noted, we cannot identify it as an error or try to solve it. Administration of any medicine after alteration of the original DF by any healthcare provider is considered an off-label use of medication and has liability consequences, as modification neither labelled nor approved for the medication by it is producer, administration of medication particularly after mixed with food or a thickening agent could be observed as an unlawful practice (Nissen, 2012).

Most of the time, nurses were not sure that tablets were suitable for crushing or splitting; 40% of nurses mentioned that they had crushed EC tablets and 35% had crushed ER tablets. ER drugs are primarily intended to release the drug over an extended time. If this formulation is crushed, the time in which the medication released is shortened and the amount of the medication can be released instantly, which may cause medication toxicity. Crushing EC medications can cause damage to the coating of the drug and expose the medication directly to the acidic atmosphere in the stomach, which can have an effect of upsetting and causing irritation to the stomach lining. Also, this can lead to inactivation of the drug if it is unstable in an acidic medium or susceptible to acid degradation. Crushing these formulations (ER or EC) is a medication error that should be avoided (Haywood and Glass, 2013, Gracia-Vásquez et al., 2017).

Omeprazole is commercially available as EC granules because it is an acid-labile medication that is inactivated by gastric acid. It is often crushed and mixed with water or sodium bicarbonate, which may decrease bioavailability and effectiveness, resulting in treatment failure (El-Mahdy et al., 2017, Bestebreurtje et al., 2020). Unfortunately, about 30% of nurses in this study had crushed an omeprazole EC capsule. Aspirin, which is an EC tablet, had been crushed by 44% of nurses; this may cause local irritation of the stomach mucosa after oral administration (Verma and Kumar, 2018).

Other medications crushed with high frequency among nurses (atorvastatin 33%, enalapril 31%, amlodipine 26%, clopidogrel 25%, bisoprolol 23%) could lead to losing some portion of the dose. Also, mixing with a different food each time could lead to different amounts of drug being absorbed into the bloodstream, resulting in dose fluctuation and disease instability.

Milk and yogurt affect the bioavailability of tetracycline and quinolone and lowering plasma concentrations if ingested concomitantly by producing a non-absorbable insoluble chelate complex. To avoid therapeutic failure, ingestion of dairy products with ciprofloxacin or doxycycline is not recommended. Also, a reduction in dissolution rates and prolongation in disintegration time has been observed with concomitant ingestion of ciprofloxacin with food, caused by an increase in gastric viscosity and reduced solubility at elevated gastric pH (Radwan et al., 2017, Wenzler et

al., 2018). In this study, we found that 7.5% of nurses usually gave ciprofloxacin with food and 9% gave doxycycline in food.

In addition, the physiological response to food intake, such as gastric acid secretion and gastric viscosity, may reduce the bioavailability of certain drugs preferentially given on an empty stomach. In this study, we found that may of these drugs were administered with food (azithromycin 24%, ranitidine 29%, famotidine 17.5%, amoxicillin 8%) (Wenzler et al., 2018).

Some drugs can be safely chewed, crushed or cut (split) to assist administration, but due to their formulations or PK properties. There is a growing list of items that are dangerous and unsafe to use in this way. One of them is anti-epileptic medications which are not preferred or limited regarding use in elderly patients with swallowing problems due to the fact that this medication must not be cut, crushed or chewed (Paparella, 2010, Charfi et al., 2018). In our study, some nurses mentioned anti-epileptic medications that they usually crushed before administration like carbamazepine, phenytoin, lamotrigine and phenobarbital.

5.1 Strengths and limitations

5.1.1 Strengths

To the best of our knowledge, this study is one of the first to investigate nurses' knowledge and practice of mixing medications with food in Palestine, as well as conducting face-to-face interviews to obtain more complete data. Furthermore, our study was conducted in 6 major

government-run hospitals at distinct locations in different cities of Palestine, covering a relatively large number of hospitals.

5.1.2 Limitations

1. Collecting samples only from government hospitals in the north part of the West Bank is considered a limiting factor in this study.
2. This was a cross-sectional study, so causal relationships between the scores and their related variables are difficult to prove.
3. Data were obtained via a face-to-face interview that may have introduced the effects of the interviewer’s bias.
4. In this study, the convenience sample of participants did not accurately represent all nurses employed in Palestinian government hospitals.

Chapter Six
Conclusions and Recommendations

6. Conclusions and Recommendations

6.1 Conclusions

The results of our study show that crushing and mixing different medications into many foods is a widespread practice among nurses in Palestine, although many DF are inappropriate for modification. Most nurses were unaware of drug stability, bioavailability, degradation, clinical safety or effectiveness, and their professional shortcomings when performing these practices. The medical staff indicated that they were aware of this when asking nurses to perform this practice. Also, this study further identified disparities in undergraduate nursing education in the administration of medications, drug stability and drug-food interactions. In educating nurses about conditions where crushing drugs is inappropriate or must be avoided, pharmacists may play an important role and should recommend suitable alternatives where available. In order to enhance this practice, the collaboration between nurses and pharmacists to increase pharmaceutical knowledge among nurses requires more study.

6.2 Recommendations

Based on this report's findings and conclusions, many training concerns will be important to enable health facilities to upgrade their staff on quality practices, including more training to enhance their food-drug compatibility knowledge. There is a need for structured documents that could be applied at the ward level on the procedures of crushing medication and mixing medications with food. Also, introducing more courses for undergraduate nurses about medication administration and activation of the role of the clinical pharmacist in hospitals in the continuous education of nurses about medication handling and administration, as well as further investigations into inappropriate DF modification are needed. In industrial level manufacturer should developing more suitable DF of different medications with suitable dose specially for children and patient with swallowing difficulties.

References

- AKRAM, G. & MULLEN, A. B. 2012. **Paediatric nurses' knowledge and practice of mixing medication into foodstuff**. *Int J Pharm Pract,* 20**,** 191-198.

- AKRAM, G. & MULLEN, A. B. 2015. **Mixing medication into foodstuffs: identifying the issues for paediatric nurses**. *Int J Nurs Pract,* 21**,** 125-131.

- ASHER, G. N., CORBETT, A. H. & HAWKE, R. L. 2017. **Common Herbal Dietary Supplement-Drug Interactions**. *Am Fam Physician,* 96**,** 101-107.

- AYO, J., AGU, H. & MADAKI, I. 2005. **Food and drug interactions: its side effects**. *Nutr Food Sci,* 35**,** 243-252.

- BATCHELOR, H., KAUKONEN, A. M., KLEIN, S., DAVIT, B., JU, R., TERNIK, R., HEIMBACH, T., LIN, W., WANG, J. & STOREY, D. 2018. **Food effects in paediatric medicines development for products Co-administered with food**. *Int J Pharm,* 536**,** 530-535.

- BESTEBREURTJE, P., ROELEVELD, N., KNIBBE, C. A. J., VAN SORGE, A. A., PLOTZ, F. B. & DE WILDT, S. N. 2020. **Development and Stability Study of an Omeprazole Suppository for Infants**. *Eur J Drug Metab Pharmacokinet,* 45**,** 627-633.

- BOU-CHACRA, N., MELO, K. J. C., MORALES, I. A. C., STIPPLER, E. S., KESISOGLOU, F., YAZDANIAN, M. & LÖBENBERG, R. 2017. **Evolution of choice of solubility and dissolution media after two decades of biopharmaceutical classification system**. *The AAPS journal,* 19**,** 989-1001.

- BOWLES, A., KEANE, J., ERNEST, T., CLAPHAM, D. & TULEU, C. 2010. **Specific aspects of gastro-intestinal transit in children for drug delivery design**. *Int J Pharm,* 395**,** 37-43.

- CAUSSIN, M., MOURIER, W., PHILIPPE, S., CAPET, C., ADAM, M., REYNERO, N., JOUINI, C., COLOMBIER, A. S., KADRI, K., LANDRIN, I., GREBOVAL, E., REMY, E., MARC, F., TOUFLET, M., WIROTIUS, F., DELABRE, N., LE HIRESS, C., RORTEAU, V., VIMARD, M., DUFOUR, M., THARASSE, C., DIEU, B., VARIN, R. & DOUCET, J. 2012. **[Crushing drugs in geriatric units: an "handicraft" practice with frequent errors which imposed recommendations]**. *Rev Med Interne,* 33**,** 546-551.

- CHARFI, R., MIZOURI, R., SASSI, M. B., GAIES, E., ELJEBARI, H., JEBABLI, N., ZEREI, S., SALEM, F. B., SAID, D. B., KLOUZ, A., DAGHFOUS, R., SALOUAGE, I. & TRABELSI, S. 2018. **[Antiepileptic drugs administration by nasogastric tube in comatose patients]**. *Therapie,* 73**,** 223-230.

- CHILDRESS, A. C., WIGAL, S. B., BRAMS, M. N., TURNBOW, J. M., PINCUS, Y., BELDEN, H. W. & BERRY, S. A. 2018. **Efficacy and Safety of Amphetamine Extended-Release Oral Suspension in Children with Attention-Deficit/Hyperactivity Disorder**. *J Child Adolesc Psychopharmacol,* 28**,** 306-313.

- CLAUSON, H., RULL, F., THIBAULT, M., ORDEKYAN, A. & TAVERNIER, J. 2016. **Crushing oral solid drugs: Assessment of nursing practices in health-care facilities in Auvergne, France**. *Int J Nurs Pract,* 22**,** 384-390.

- CORNISH, P. 2005. **"Avoid the crush": hazards of medication administration in patients with dysphagia or a feeding tube**. *CmAJ,* 172**,** 871-872.

- DE CASTRO, W. V., MERTENS-TALCOTT, S., DERENDORF, H. & BUTTERWECK, V. 2007. **Grapefruit juice-drug interactions: Grapefruit juice and its components inhibit P-glycoprotein (ABCB1) mediated transport of talinolol in Caco-2 cells**. *J Pharm Sci,* 96**,** 2808-2817.

- DEWANJEE, S., DUA, T. K., BHATTACHARJEE, N., DAS, A., GANGOPADHYAY, M., KHANRA, R., JOARDAR, S., RIAZ, M., FEO, V. & ZIA-UL-HAQ, M. 2017. **Natural Products as Alternative Choices for P-Glycoprotein (P-gp) Inhibition**. *Molecules,* 22**,** 871.

- EL-MAHDY, M. A., MANSOOR, F. A. & JADCHERLA, S. R. 2017. **Pharmacological management of gastroesophageal reflux disease in infants: current opinions**. *Curr Opin Pharmacol,* 37**,** 112-117.

- ELLIOTT, I., MAYXAY, M., YEUICHAIXONG, S., LEE, S. J. & NEWTON, P. N. 2014. **The practice and clinical implications of tablet splitting in international health**. *Trop Med Int Health,* 19**,** 754-760.

- GILL, D., SPAIN, M. & EDLUND, B. J. 2012. **Crushing or splitting medications: unrecognized hazards**. *J Gerontol Nurs,* 38**,** 8-12.

- GIMENES, F. R. E., PEREIRA, M. C. A., PRADO, P. R. D., CARVALHO, R., KOEPP, J., FREITAS, L. M., TEIXEIRA, T. C. A. & MIASSO, A. I. 2019. **Nasogastric/Nasoenteric tube-related incidents in hospitalised patients: a study protocol of a multicentre prospective cohort study**. *BMJ open,* 9**,** e027967.

- GRACIA-VÁSQUEZ, S. L., GONZÁLEZ-BARRANCO, P., CAMACHO-MORA, I. A., GONZÁLEZ-SANTIAGO, O. & VÁZQUEZ-RODRÍGUEZ, S. A. 2017. **Medications that should not be crushed**. *Medicina Universitaria,* 19**,** 50-63.

- GRIFFITH, R. & DAVIES, R. 2003. **Tablet crushing and the law: the implications for nursing**. *Prof Nurse,* 19**,** 41-42.

- GRIMM, M., KOZIOLEK, M., SALEH, M., SCHNEIDER, F., GARBACZ, G., KUHN, J. P. & WEITSCHIES, W. 2018. **Gastric Emptying and Small Bowel Water Content after Administration of Grapefruit Juice Compared to Water and Isocaloric Solutions of Glucose and Fructose: A Four-Way Crossover MRI Pilot Study in Healthy Subjects**. *Mol Pharm,* 15**,** 548-559.

- HANSEN, D. L., TULINIUS, D. & HANSEN, E. H. 2008. **Adolescents' struggles with swallowing tablets: barriers, strategies and learning**. *Pharm World Sci,* 30**,** 65-69.

- HAYWOOD, A. & GLASS, B. D. 2013. **Liquid dosage forms extemporaneously prepared from commercially available products - considering new evidence on stability**. *J Pharm Pharm Sci,* 16**,** 441-455.

- HELMY, S. A. 2015. **Tablet splitting: is it worthwhile? Analysis of drug content and weight uniformity for half tablets of 16 commonly used medications in the outpatient setting**. *J Manag Care Spec Pharm,* 21**,** 76-86.

- HOLLAND, G., JAYASEKERAN, V., PENDLETON, N., HORAN, M., JONES, M. & HAMDY, S. 2011. **Prevalence and symptom profiling of oropharyngeal dysphagia in a community dwelling of an elderly population: a self-reporting questionnaire survey**. *Dis Esophagus,* 24**,** 476-480.

- JANSSEN, P., VANDEN BERGHE, P., VERSCHUEREN, S., LEHMANN, A., DEPOORTERE, I. & TACK, J. 2011. **Review article: the role of gastric motility in the control of food intake**. *Aliment Pharmacol Ther,* 33**,** 880-894.

- KELLY, J. & WRIGHT, D. 2012. **Medicine administration errors and their severity in secondary care older persons' ward: a multi-centre observational study**. *J Clin Nurs,* 21**,** 1806-1815.

- KELLY, J., WRIGHT, D. & WOOD, J. 2011. **Medicine administration errors in patients with dysphagia in secondary care: a multi-centre observational study**. *J Adv Nurs,* 67**,** 2615-2627.

- KIRKEVOLD, O. & ENGEDAL, K. 2010. **What is the matter with crushing pills and opening capsules?** *Int J Nurs Pract,* 16**,** 81-85.

- KORTEJARVI, H., MALKKI, J., SHAWAHNA, R., SCHERRMANN, J. M., URTTI, A. & YLIPERTTULA, M. 2014. **Pharmacokinetic simulations to explore dissolution criteria of BCS I and III biowaivers with and without MDR-1 efflux transporter**. *Eur J Pharm Sci,* 61**,** 18-26.

- KORTEJARVI, H., SHAWAHNA, R., KOSKI, A., MALKKI, J., OJALA, K. & YLIPERTTULA, M. 2010. **Very rapid dissolution is not needed to guarantee bioequivalence for biopharmaceutics classification system (BCS) I drugs**. *J Pharm Sci,* 99**,** 621-625.

- KOZIOLEK, M., SCHNEIDER, F., GRIMM, M., MODEBETA, C., SEEKAMP, A., ROUSTOM, T., SIEGMUND, W. & WEITSCHIES, W. 2015. **Intragastric pH and pressure profiles after intake of the high-caloric, high-fat meal as used for food effect studies**. *J Control Release,* 220**,** 71-78.

- KRUER, R. M., JARRELL, A. S. & LATIF, A. 2014. **Reducing medication errors in critical care: a multimodal approach**. *Clin Pharmacol,* 6**,** 117-126.

- LAU, E. T. L., STEADMAN, K. J., MAK, M., CICHERO, J. A. Y. & NISSEN, L. M. 2015. **Prevalence of swallowing difficulties and medication modification in customers of community pharmacists**. *J Pharm Pract Res,* 45**,** 18-23.

- LI, T., EISENHART, A. & COSTELLO, J. 2017. **Development of a medication review service for patients with enteral tubes in a community teaching hospital**. *Am J Health Syst Pharm,* 74**,** S47-S51.

- LIU, F., GHAFFUR, A., BAINS, J. & HAMDY, S. 2016. **Acceptability of oral solid medicines in older adults with and without dysphagia: A nested pilot validation questionnaire based observational study**. *Int J Pharm,* 512**,** 374-381.

- LIU, F., RANMAL, S., BATCHELOR, H. K., ORLU-GUL, M., ERNEST, T. B., THOMAS, I. W., FLANAGAN, T. & TULEU, C. 2014. **Patient-centred pharmaceutical design to improve**

acceptability of medicines: similarities and differences in paediatric and geriatric populations. *Drugs*, 74**,** 1871-1889.

- MAFIANA, R. N., TAQI, A. & AL-ZAKWANI, I. 2014. **Evaluation of nurses' knowledge of oral solid dosage forms that should not be crushed at a university hospital in Oman**. *J Pharm Health Serv Res,* 5**,** 49-53.

- MANRIQUE, Y. J., LEE, D. J., ISLAM, F., NISSEN, L. M., CICHERO, J. A., STOKES, J. R. & STEADMAN, K. J. 2014. **Crushed tablets: does the administration of food vehicles and thickened fluids to aid medication swallowing alter drug release?** *J Pharm Pharm Sci,* 17**,** 207-219.

- MARQUIS, J., SCHNEIDER, M. P., PAYOT, V., CORDONIER, A. C., BUGNON, O., HERSBERGER, K. E. & ARNET, I. 2013. **Swallowing difficulties with oral drugs among polypharmacy patients attending community pharmacies**. *Int J Clin Pharm,* 35**,** 1130-1136.

- MARTIR, J., FLANAGAN, T., MANN, J. & FOTAKI, N. 2020. **Co-administration of Paediatric Medicines with Food and Drinks in the Context of Their Physicochemical Properties-a Global Perspective on Practices and Recommendations**. *AAPS J,* 22**,** 54.

- MAYO, A. M. & DUNCAN, D. 2004. **Nurse perceptions of medication errors: what we need to know for patient safety**. *J Nurs Care Qual,* 19**,** 209-217.

- MC GILLICUDDY, A., CREAN, A. M., KELLY, M. & SAHM, L. 2017. **Oral medicine modification for older adults: a qualitative study of nurses**. *BMJ open,* 7**,** e018151.

- MC GILLICUDDY, A., KELLY, M., CREAN, A. M. & SAHM, L. J. 2019. **Understanding the knowledge, attitudes and beliefs of community-dwelling older adults and their carers about the modification of oral medicines: A qualitative interview study to inform healthcare professional practice**. *Res Social Adm Pharm,* 15**,** 1425-1435.

- MELTZER, E. O., WELCH, M. J. & OSTROM, N. K. 2006. **Pill swallowing ability and training in children 6 to 11 years of age**. *Clin Pediatr (Phila),* 45**,** 725-733.

- MERCOVICH, N., KYLE, G. J. & NAUNTON, M. 2014. **Safe to crush? A pilot study into solid dosage form modification in aged care**. *Australas J Ageing,* 33**,** 180-184.

- MINISTRY OF HEALTH & PALESTINIAN HEALTH INFORMATION CENTER (PHIC). 2017. **Health Annual Report-Palestine 2016** [Online]. Available: http://www.site.moh.ps/Content/Books/ZxRcynmiUofNqt66u4CrHRg

mJR6Uv7z77srjjIEAho6xnz5V3rgLTu_RhO7xf2j2VusNiIvWkjwp84yXHLdGleB97gKrHHI5iZ9oPJ25owGEN.pdf [Accessed December 17 2020].

- MITCHELL, J. F. 2014. **Oral dosage forms that should not be crushed** [Online]. Available: https://kormanhealthcare.com/wp-content/uploads/2020/03/Do-Not-Crush-Medications.pdf [Accessed December 17 2020].

- NISSEN, L. M. 2012. **Australian don't rush to crush handbook**, Collingwood, Australia, The Society of Hospital Pharmacists of Australia.

- NISSEN, L. M., HAYWOOD, A. & STEADMAN, K. J. 2009. **Solid Medication Dosage Form Modification at the Bedside and in the Pharmacy of Queensland Hospitals**. *J Pharm Pract Res,* 39**,** 129-134.

- NOURAEI, S. A. R., MURRAY, I. A., HEATHCOTE, K. J. & DALTON, H. R. 2018. **Oesophageal causes of dysphagia localised only to the pharynx: Implications for the suspected head and neck cancer pathway**. *Clin Otolaryngol,* 43**,** 1088-1096.

- PAPARELLA, S. 2010. **Identified safety risks with splitting and crushing oral medications**. *J Emerg Nurs,* 36**,** 156-158.

- PARADISO, L. M., ROUGHEAD, E. E., GILBERT, A. L., COSH, D., NATION, R. L., BARNES, L., CHEEK, J. & BALLANTYNE, A.

2002. **Crushing or altering medications: what's happening in residential aged-care facilities?** *Australas J Ageing,* 21**,** 123-127.

- RADWAN, A., ZAID, A. N., JARADAT, N. & ODEH, Y. 2017. **Food effect: The combined effect of media pH and viscosity on the gastrointestinal absorption of ciprofloxacin tablet**. *Eur J Pharm Sci,* 101**,** 100-106.

- RAOSOFT INC. 2004. **Raosoft Sample Size Calculator** [Online]. Available: http://www.raosoft.com/samplesize.html [Accessed April 10 2015].

- SALMON, D., PONT, E., CHEVALLARD, H., DIOUF, E., TALL, M. L., PIVOT, C. & PIROT, F. 2013. **Pharmaceutical and safety considerations of tablet crushing in patients undergoing enteral intubation**. *Int J Pharm,* 443**,** 146-153.

- SAXENA, S. & JAIN, S. 2019. **A review on biopharmaceutical classification system**. *Asian Journal of Pharmacy and Technology,* 9.

- SEFIDANI FOROUGH, A., LAU, E. T. L., STEADMAN, K. J., KYLE, G. J., CICHERO, J. A. Y., SERRANO SANTOS, J. M. & NISSEN, L. M. 2020. **Appropriateness of oral dosage form modification for aged care residents: a video-recorded observational study**. *Int J Clin Pharm,* 42**,** 938-947.

- SHAH, T., TSE, A., GILL, H., WONG, I., SUTCLIFFE, A., GRINGRAS, P., APPLETON, R. & TULEU, C. 2008. **Administration of melatonin mixed with soft food and liquids for children with neurodevelopmental difficulties**. *Dev Med Child Neurol,* 50**,** 845-849.

- SHAWAHNA, R. 2016. **Pediatric Biopharmaceutical Classification System: Using Age-Appropriate Initial Gastric Volume**. *AAPS J,* 18**,** 728-736.

- SHAWAHNA, R. & RAHMAN, N. 2011. **Evaluation of the use of partition coefficients and molecular surface properties as predictors of drug absorption: a provisional biopharmaceutical classification of the list of national essential medicines of Pakistan**. *Daru,* 19**,** 83-99.

- SHAWAHNA, R., ZYOUD, A., HAJ-YAHIA, A. & TAYA, R. 2021. **Evaluating Solubility of Celecoxib in Age-Appropriate Fasted- and Fed-State Gastric and Intestinal Biorelevant Media Representative of Adult and Pediatric Patients: Implications on Future Pediatric Biopharmaceutical Classification System**. *AAPS PharmSciTech,* 22**,** 84.

- SOHREVARDI, S. M., JARAHZADEH, M. H., MIRZAEI, E., MIRJALILI, M., TAFTI, A. D. & HEYDARI, B. 2017. **Medication Errors in Patients with Enteral Feeding Tubes in the Intensive Care Unit**. *J Res Pharm Pract,* 6**,** 100-105.

- STANDING, J. F. & TULEU, C. 2005. **Paediatric formulations--getting to the heart of the problem**. *Int J Pharm,* 300**,** 56-66.

- STOJKOVIC, A., PAROJCIC, J., DJURIC, Z. & CORRIGAN, O. I. 2014. **A case study of in silico modelling of ciprofloxacin hydrochloride/metallic compound interactions**. *Aaps Pharmscitech,* 15**,** 270-278.

- STUBBS, J., HAW, C. & DICKENS, G. 2008. **Dose form modification - a common but potentially hazardous practice. A literature review and study of medication administration to older psychiatric inpatients**. *Int Psychogeriatr,* 20**,** 616-627.

- SURA, L., MADHAVAN, A., CARNABY, G. & CRARY, M. A. 2012. **Dysphagia in the elderly: management and nutritional considerations**. *Clin Interv Aging,* 7**,** 287-298.

- TAHAINEH, L. & WAZAIFY, M. 2017. **Difficulties in swallowing oral medications in Jordan**. *Int J Clin Pharm,* 39**,** 373-379.

- TAYLOR, S. & GLASS, B. D. 2018. **Altering dosage forms for older adults**. *Aust Prescr,* 41**,** 191-193.

- TEDER, K., RESNJAK, O. & KULL, K. 2018. **INT-006 Administrating oral medications to patients with dysphagia**. *Eur J Hosp Pharm,* 25**,** A247-A249.

- TERNIK, R., LIU, F., BARTLETT, J. A., KHONG, Y. M., THIAM TAN, D. C., DIXIT, T., WANG, S., GALELLA, E. A., GAO, Z. & KLEIN, S. 2018. **Assessment of swallowability and palatability of oral dosage forms in children: Report from an M-CERSI pediatric formulation workshop**. *Int J Pharm,* 536**,** 570-581.

- TRELOAR, A., BEATS, B. & PHILPOT, M. 2000. **A pill in the sandwich: covert medication in food and drink**. *J R Soc Med,* 93**,** 408-411.

- VAN RIET-NALES, D. A., FERREIRA, J. A., SCHOBBEN, A. F., DE NEEF, B. J., EGBERTS, T. C. & RADEMAKER, C. M. 2015. **Methods of administering oral formulations and child acceptability**. *Int J Pharm,* 491**,** 261-267.

- VERMA, S. & KUMAR, V. L. 2018. **Artesunate affords protection against aspirin-induced gastric injury by targeting oxidative stress and proinflammatory signaling**. *Pharmacol Rep,* 70**,** 390-397.

- VIRILI, C., TRIMBOLI, P., ROMANELLI, F. & CENTANNI, M. 2016. **Liquid and softgel levothyroxine use in clinical practice: state of the art**. *Endocrine,* 54**,** 3-14.

- WENZLER, E., SPRANDEL-HARRIS, K. & RODVOLD, K. A. 2018. Drug-Food Interactions. *Drug Interactions in Infectious Diseases: Mechanisms and Models of Drug Interactions.* Springer.

- WILCZYNSKI, S., KOPROWSKI, R., DUDA, P., BANYS, A. & BLONSKA-FAJFROWSKA, B. 2016. **Microtomographic studies of subdivision of modified-release tablets**. *Int J Pharm,* 511**,** 899-912.

- WILLIAMS, H. D., FORD, L., LIM, S., HAN, S., BAUMANN, J., SULLIVAN, H., VODAK, D., IGONIN, A., BENAMEUR, H. & POUTON, C. W. 2018. **Transformation of biopharmaceutical classification system class I and III drugs into ionic liquids and lipophilic salts for enhanced developability using lipid formulations**. *Journal of pharmaceutical sciences,* 107**,** 203-216.

- WRIGHT, D. 2002. **Medication administration in nursing homes**. *Nurs Stand,* 16**,** 33-38.

- WRIGHT, D. J., SMITHARD, D. G. & GRIFFITH, R. 2020. **Optimising Medicines Administration for Patients with Dysphagia in Hospital: Medical or Nursing Responsibility?** *Geriatrics (Basel),* 5**,** 9.

- ZAID, A., ABDALLAH, Y. & ZYOUD, S. 2019. **Knowledge, Attitudes, and Practices of Pharmacists Toward Splitting or Crushing Oral Solid Dosage Forms in Palestine: Safety and Therapeutic Implications**. *Pal Med Pharm J,* 4**,** 11-26.

- ZAID, A. N., AL-RAMAHI, R. J., GHOUSH, A. A., QADDUMI, A. & ZAAROR, Y. A. 2013. **Weight and content uniformity of lorazepam**

half-tablets: A study of correlation of a low drug content product. *Saudi Pharm J*, 21**,** 71-75.

- ZAJICEK, A., FOSSLER, M. J., BARRETT, J. S., WORTHINGTON, J. H., TERNIK, R., CHARKOFTAKI, G., LUM, S., BREITKREUTZ, J., BALTEZOR, M., MACHERAS, P., KHAN, M., AGHARKAR, S. & MACLAREN, D. D. 2013. **A report from the pediatric formulations task force: perspectives on the state of child-friendly oral dosage forms**. *AAPS J*, 15**,** 1072-1081.

Appendices

Appendix 1

Data Collection Form

استبيان حول معرفة و ممارسه الممرضين حول خلط الدواء مع المواد الغذائية

الجزء الأول : البيانات الديموغرافي

العمر ..... **الحالة الاجتماعية .....**

الجنس:

- ☐ **ذكر**
- ☐ **أنثى**

اسم المستشفى .....

الجامعة التي تخرجت/ي منها.....

سنه التخرج .....

مكان العمل:

- ☐ قسم الأطفال
- ☐ قسم الباطني
- ☐ قسم العناية المكثفه
- ☐ قسم عظام
- ☐ قسم الكلى
- ☐ قسم طوارئ
- ☐ جراحة
- ☐ غير ذلك .....

الدرجة العلمية

☐ دبلوم	☐ بكالوريوس	☐ ماجستير

التخصص

☐ باطني	☐ العناية المكثفة	☐ أطفال	☐ غير ذلك.....

سنوات الخبرة

☐ اقل من ثلاث سنوات	☐ من خمسة إلى عشرة سنوات	☐ أكثر من عشرة سنوات

الجزء الثاني: إليه خلط الدواء بالطعام وطبيعة الطعام المستخدم

	Yes نعم	Noلا
Have you ever modified an oral dosage form prior to administration ? هل سبق وقمت بتعديل الشكل الدوائي للدواء فبل إعطائه للمريض عن طريق الفم	□	□
Have you crushed or opened the tablet/capsule and given the medicine as a powder? هل سبق وقمت بطحن حبوب أو فتح كبسولات الدواء وإعطاءها على شكل بودرة	□	□
Have you crushed or opened the tablet/capsule and mixed the medicine into juice (drink)? هل سبق وقمت بطحن حبوب أو فتح كبسولات الدواء و مزجها مع العصير	□	□
Have you crushed or opened the tablet/capsule and mixed the medicine into food (e.g. yoghurt)? هل سبق وقمت بطحن حبوب أو فتح كبسولات الدواء و مزجها مع الطعام (مثال: لبنه الفواكه)	□	□
Have you added juice to a spoonful of liquid medicine? هل سبق وقمت بإضافة العصير إلى معلقه من الدواء السائل	□	□
Have you added some soft food (i.e. yoghurt) to a spoonful of liquid medicine? هل سبق وقمت بإضافة الطعام إلى معلقه من الدواء السائل	□	□
have you open an ampoule and mix it with drink هل سبق وقمت بفتح أمبولة دواء وخلطها مع العصير	□	□

Foodstuff used to mix with medicine أطعمه تستخدم للخلط مع الدواء	Never إطلاقا	Rarely نادرا	Sometime بعض الأحيان	Often غالبا	Vary often دائما
Milk حليب	□	□	□	□	□
orange juice عصير البرتقال	□	□	□	□	□
Yoghourt لبنه الفواكه	□	□	□	□	□
Banana موز	□	□	□	□	□
Strawberry juice عصير الفراولة	□	□	□	□	□
Cholet شوكولاتة	□	□	□	□	□
Water ماء	□	□	□	□	□
Others (mention) أخرى (اذكرها)	□	□	□	□	□

هل سبق وقمت بطحن أو تعديل الشكل الدوائي للأدوية التالية وخلطها مع الطعام ؟

- Omeprazol capsule
- Atrovastatin tablet
- Azithromycin capsule
- Aspirin tablet
- Ciprofloxacin tablet
- Ampicillin
- Amoxicillin tablet
- Doxacyclin tablet
- Furesemide tablet
- Bisoprolol tablet
- Analapril tablet
- Clopidogrel tablet
- Ratidine tablet
- Famotidine tablet
- Azithromycin suspention
- Ibuprofen suspention
- Paracetamol suspention
- Dexamethason ampule
- Diclofenac ampule
- Amoxicillin/clavulanic acid suspention
- ibuprofen tablet
- paracetamol tablet
- amlodipine tablet
-
- اذكر أدويه أخرى
- .....
- .....

الجزء الثالث : الأسباب التي تؤدي إلي خلط الدواء مع الطعام

أسباب محتملة					
	Never ابدآ	Rarely نادرا	Some time بعض الأحيان	Often غالبا	Very often دائما
The tablet/capsule is too large for the patient to swallow whole الحبة أو الكبسولة كبيرة جدا على مريض ليقوم ببلعها كاملة	□	□	□	□	□
To disguise the sour or bitter taste of the medicine لإخفاء الطعم المر أو الحامض للدواء	□	□	□	□	□
The patient will not accept the medicine as a whole tablet/capsule مريض لم يتقبل الدواء بشكله الحالي	□	□	□	□	□
To disguise/conceal the medicine from the patient لإخفاء الدواء عن المريض	□	□	□	□	□
To give medication to patient on naso-gastric (NG) tube لإعطاء الدواء للمريض عن طريق الأنبوب الأنفي المعوي	□	□	□	□	□

الجزء الرابع : مدى معرفه الممرضين عن تأثيرات خلط الدواء مع الطعام ومدى تدريبهم للقيام بهذه العملية.

	Yes نعم	No لا	I DON'T KNOW لا اعلم
Do you feel sufficiently trained to carry out these procedures? هل تشعر انك مدرب جيدا لإجراء هذه العملية	☐	☐	☐
Do you feel sufficiently knowledgeable in the area of drug stability? هل تشعر بمعرفه كافيه حول موضوع ثباتية الأدوية	☐	☐	☐
Do you feel sufficiently supported by your colleagues when administering medication as a co-mixture? هل تشعر بدعم زملائك في العمل عند القيام بخلط الدواء مع الطعام	☐	☐	☐
Do you feel sufficiently supported by your management when administering medication as a co-mixture هل تشعر بدهم مديرك بالعمل عند قيامك بخلط الدواء بالطعام	☐	☐	☐
Did you report every time you mix medicine with foodstuff in the nursing note هل تقوم بتدوين كل مره تقوم فيها بتعديل الشكل الدوائي في دفتر ملاحظات التمريض	☐	☐	☐
Do you think modifying the dosage form is part of the nurse's role or responsibility هل تعتقد أن تعديل الشكل الدوائي للمريض من ضمن وظيفة الممرض و صلاحياته	☐	☐	☐
Did you take training courses about drug stability هل أخذت دورات تدريبيه أو مواد خلال دراستك الجامعية حول الثباتيه الدواثيه	☐	☐	☐
Did you take training courses about mixing drug into food هل أخذت دورات تدريبيه أو مواد خلال دراستك الجامعية حول خلط الدواء مع الطعام	☐	☐	☐
Did you take training courses about drug –food interaction هل أخذت دورات تدريبيه أو مواد خلال دراستك الجامعية حول تفاعلات الدواء مع الطعام	☐	☐	☐
Did you chick the dosage form before church the drug هل تقوم بتفحص الشكل الدوائي للأدوية فبل طحنها	☐	☐	☐
Did you ask the clinical pharmacist before modify the dosage form هل تقوم بسؤال الصيدلاني السريري فبل عمليه تعديل الشكل الدوائي	☐	☐	☐
Sometimes I am not sure whether tablets are Suitable for splitting or crushing. أحيانا لا أكون متأكدا أن الحبوب الدوائية مناسبة لعمليه الطحن	☐	☐	☐
If tablets are not suitable for splitting or crushing I expect to find this information in the package leaflet. إذا كانت الحبوب الدوائية غير معدة للطحن فمن المفروض أن يكون ذلك مكتوبا بالنشرة الدوائية الخاصة بالدواء	☐	☐	☐

Are you certain that the patient take the all amount of drug when mix with food هل أنت متأكد أن المريض قام بأخذ الجرعة كاملة بعد خلط الدواء بالطعام	□	□	□
Did you feel worry about inhale or take some amount of drug will churching it هل تشعر بالقلق من أن تكون قد استنشقت أو ابتلعت جزء من الدواء خلال طحنه	□	□	□
Did you crush an Extended release tablet هل قمت بطحن حبوب الدواء مطولة مدة الخروج الدوائي	□	□	□
Did you crush an Enteric coated tablet هل قمت بطحن الحبوب المغلفة معويا	□	□	□
Did you chick the dosage form before crushing the tablet هل تتفقد الشكل الدوائي قبل طحن الحبوب	□	□	□

Your sources of information about splitting or crushing medications is/are

المراجع التي تستخدمها للبحث حول موضوع طحن أو قسم أو تعديل الشكل الدوائي

(you can choose more than one answer)

	□ **Medical book** **كتب طبية**	□ **Other Nurse** **ممرضين آخرين**	□ **Publication of M.O.H** **منشورات وزارة الصحة**
□ Doctors الأطباء	□ **Pharmacist** **الصيادلة**	□ **Leaflet for drug** **كتيب الدواء**	□ **Publication of Association** **منشورات**
□ Journal مجلات علمية	□ **Internet مواقع** **الويب (النت)**	□ **Media(newspaper,T.V)** **وسائل الإعلام (تلفاز أو صحف....)**	□ **Others…….** **أخرى.....**

الجزء الخامس: شفافية العملية و طلب الإذن

	Never	Rarely	Sometimes	Often	Always
is the patient aware that their medicine is mixed into the foodstuff? هل يكون المريض على علم أن الدواء ممزوج مع الدواء الذي يتناوله	□	□	□	□	□
Is the procedure of mixing medicine into the foodstuff 'care planned' in the nursing notes? هل تعليمات خلط الدواء تكون مدونه في دفتر الملاحظات الخاص بالتمريض	□	□	□	□	□
Is the requirement of mixing the medicine into the foodstuff explicitly mentioned in the prescription هو شرط خلط الدواء في المواد الغذائية يكون مكتوبا في وصفة طبية	□	□	□	□	□
Did you take the approval of the patient guardians before mixing drug into food هل تأخذ إذن ولي أمر المريض فبل خلط الدواء بالطعام	□	□	□	□	□
Did you ask the patient guardians about food he preferred to mix with drug هل تقوم بسؤال ولي أمر المريض عن الطعام الذي بفضل أن يخلط مع الدواء	□	□	□	□	□
Did you take the approval of the patient before mixing drug into food هل تأخذ إذن المريض فبل خلط الدواء بالطعام	□	□	□	□	□
Did you ask the patient about food he preferred to mix with drug هل تقوم بسؤال المريض عن الطعام الذي بفضل أن يخلط مع الدواء	□	□	□	□	□

Appendix 2

Ministry of Health Approval Letter

State of Palestine
Ministry of Health - Nablus
General Directorate of Education in Health

دولة فلسطين
وزارة الصحة- نابلس
الإدارة العامة للتعليم الصحي

Ref.: .....
Date:.....

الرقم: عمد/ ١٧١٥ / ٢٠١٨
التاريخ: ٢٥/ ٠٦/ ٢٠١٨

الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،

تحية واحترام،،،

الموضوع: تسهيل مهمة طلاب – جامعة النجاح

يرجى تسهيل مهمة **الطالبة: مرح عطاالله يوسف دعيبس– ماجستير صيدلة سريرية/ جامعة النجاح**، في عمل بحث بعنوان "**معرفة وممارسة الممرضين لخلط الأدوية مع المواد الغذائية: دراسة مقطعية من فلسطين**"، من خلال السماح للطالبة بجمع معلومات من خلال مقابلة الممرضين في اقسام المستشفيات لتعبئة استبانه تتعلق بالبحث، وذلك في:

- **مستشفى الوطني – مستشفى رفيديا – مستشفى طولكرم**
- **مستشفى قلقيلية – مستشفى جنين**

علما ان البحث تحت اشراف د. سائد زيود و د. سماح الجابي. كما انه سيتم الالتزام بمعايير البحث العلمي والحفاظ على سرية المعلومات.

مع الاحترام،،،

د. أمل ابو عوض
مدير عام التعليم الصحي

نسخة: عميد كلية الدراسات العليا المحترم/ جامعة النجاح

P.O .Box: 14
Tel.:09-2333901

ص.ب. 14
تلفون: 09-2333901

Appendix 3

Ministry of Health Approval Letter

State of Palestine
Ministry of Health - Nablus
General Directorate of Education in Health

دولة فلسطين
وزارة الصحة- نابلس
الإدارة العامة للتعليم الصحي

Ref.: .....
Date:.....

الرقم: ع ت/١٧٤٦/٢٠١٨
التاريخ: ٢٨/١٠/٢٠١٨

الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،

تحية واحترام،،،

الموضوع: تسهيل مهمة طلاب – جامعة النجاح

يرجى تسهيل مهمة **الطالبة: مرح عطاالله يوسف دعيبس– ماجستير صيدلة سريرية/ جامعة النجاح**، في عمل بحث بعنوان "**معرفة وممارسة الممرضين لخلط الأدوية مع المواد الغذائية: دراسة مقطعية من فلسطين**"، من خلال السماح للطالبة بجمع معلومات من خلال مقابلة الممرضين في اقسام المستشفيات لتعبئة استبانه تتعلق بالبحث، وذلك في:

- **مستشفى طوباس التركي الحكومي**

علما ان البحث تحت اشراف د. سائد زيود و د. سماح الجابي. كما انه سيتم الالتزام بمعايير البحث العلمي والحفاظ على سرية المعلومات.

مع الاحترام،،،

د. أمل ابو عوض
مدير عام التعليم الصحي

نسخة: عميد كلية الدراسات العليا المحترم/ جامعة النجاح

P.O .Box: 14
Tel.:09-2333901

ص.ب. 14
تلفون: 09-2333901

Appendix 4

IRB Approval Letter

An-Najah
National University
Faculty of medicine
&Health Sciences
Department of Graduate
Studies

جامعة النجاح
الوطنية
كلية الطب وعلوم الصحة
دائرة الدراسات العليا

IRB Approval Letter

Study Title:

"Nurses' knowledge and practice of mixing medications with foodstuff : a cross - sectional study from Palestine"

Submitted by:

Marah Daibes , Dr. Sa'ed Zyoud , Dr.Samah Al-Jabi

Date Reviewed:

6th June 2018

Date Approved:

27th June 2018

Your Study titled: "Nurses' knowledge and practice of mixing medications with foodstuff : a cross - sectional study from Palestine" with archived number (1) June ,2018 was reviewed by An-Najah National University IRB committee and was approved on 27th June 2018.

Hasan Fitian, MD

IRB Committee Chairman
An-Najah National University

نابلس - ص.ب 7 أو 707 || هاتف 14/8/7/4/2902(09)(970) || فاكسميل 2342910 (09) (970)

Nablus - P.O Box :7 or 707 | Tel (970) (09) 2342902/4/7/8/14 | Faximile (970) (09) 2342910 | E-mail : hgs@najah.edu

جامعة النجاح الوطنية

كلية الدراسات العليا

معرفة وممارسة الممرضين لخلط الأدوية مع المواد الغذائية:

دراسة مقطعية من فلسطين

اعداد

مرح عطاالله دعيبس

اشراف

الدكتور سائد زيود

الدكتورة سماح الجابي

قدمت هذه الاطروحة استكمالا لمتطلبات الحصول على درجة الماجستير في الصيدلة السريرية في جامعة النجاح الوطنية، نابلس – فلسطين.

2021

معرفة و ممارسة الممرضين لخلط الأدوية مع المواد الغذائية: دراسة مقطعية من فلسطين

اعداد

مرح عطاالله دعيبس

اشراف

د. سائد زيود

د. سماح الجابي

الملخص

الخلفية : الخصائص الصيدلانية المختلفة للشكل الدوائي (DF) لها تأثير مباشر على مدى سهولة ابتلاع الدواء الصلب فمويا. يعاني غالبية كبار السن من درجة معينة من عسر البلع، اضافة الى ذلك صعوبة البلع هي عائق علاجي شائع بين الأطفال. غالبًا ما يتم تعديل تركيبات الأدوية عن طريق سحق الأقراص أو فتح كبسولات (CT / OC) لتسهيل تناول الدواء، ولكن هذا التعديل يؤثر على سلامة وفعالية الدواء وقد يتسبب في آثار جانبية ضارة. أيضًا يجب سحق الأدوية الخاصة بالمرضى الذين يعانون من أنبوب أنفي معدوي (NGT) أو فتحها قبل الإعطاء. يمكن أن يتسبب تناول الأدوية مع الطعام في حدوث تغييرات في امتصاص الدواء ويؤدي إلى تغيير في حركية الجهاز الهضمي، مما قد يؤدي إلى تأثير غير متوقع على انحلال الدواء وامتصاصه. لذلك هدفت هذه الدراسة إلى معرفة معرفة وممارسات الممرضين بخصوص خلط الأدوية مع الطعام أو الشراب في فلسطين.

المنهجية : شملت هذه الدراسة المقطعية الممرضين في المستشفيات الحكومية في مناطق مختلفة من فلسطين. تم جمع البيانات عن طريق استبيان مقابلة وجهاً لوجه.

النتائج : شارك ما مجموعه 200 ممرض/ة في الدراسة. تظهر البيانات فرق معنوي بين المشاركين حسب قسم العمل ($p < 0.001$). تم العثور على أعلى درجة متوسطة [بين الشرائح الربعية] 15 [12–15] للممرضين العامين في وحدة العناية المركزة لحديثي الولادة. أيضًا ، حصل الممرضين في جناح الأطفال وجناح الرجال على درجات عالية من 13 [11.5–15] و 13 [11–14]، على التوالي. أظهرت النتائج أن 88٪ من الممرضين قاموا بتعديل DF عن طريق الفم قبل الإعطاء للمرضى. طحن الحبوب الدوائية او فتح لكبسولات وخلطها مع العصير أكثر

الإجراءات شيوعًا من قبل الممرضين (حوالي 84٪) ؛ 35٪ من الممرضين استخدموا عصير البرتقال لخلطه مع الدواء. كان السبب الأكثر شيوعًا لطحن الدواء هو إعطاء الأدوية لمرضى عن طريق النبوب الفموي المعوي (41.5%) . بالإضافة إلى ذلك ، يطلب 58٪ من الممرضين عادة من الصيادلة معلومات حول الأدوية. كان الأسبرين أكثر الأدوية التي تم سحقها من قبل الممرضين (44٪) ؛ ومع ذلك، لم يشعر 35.5٪ من الممرضين بتدريب كافٍ للقيام بهذه الممارسة.

الخلاصة: أظهرت نتائج هذه الدراسة أن سحق الأدوية وخلطها مع الطعام أمر شائع بين الممرضين، كما أن غالبية الممرضين غير مدركين للتأثير الخطير لهذه الممارسة على صحة المريض. يجب على الصيادلة تثقيف الممرضين بشكل فعال حول حالات طحن الدواء غير الضرورية أو عندما يجب تجنب الطحن ومحاولة إيجاد بديل، عند توفره .