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Research Article
The Awareness and Knowledge of Pharmacists about Pediatric Doses

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Abstract

Background and Objective: Pediatric patients are at high risk of medication errors. Thus, pediatric prescriptions are often a source of anxiety for community pharmacists. The doses of pediatric drugs cannot be estimated directly from the adult doses. Children and infants present challenges with the drug doses and they have to be highly taken care of. This study aimed to measure the awareness role of Palestinian Pharmacists and their knowledge about pediatric doses. **Materials and Methods:** This was a cross-sectional study that targeted Palestinian Pharmacists from different cities. This study used an online questionnaire (Arabic version) for data collection. Two hundred sixty-seven pharmacists completed the questionnaire and the majority (34.1%, n = 91 out of 267) were from the Hebron Governorate. Different types of questions were used to measure the pharmacists' awareness and knowledge about paediatrics drug doses. Statistical Package for the Social Sciences (SPSS) version 25 was used to analyze the data collected. **Results:** Two hundred sixty-seven pharmacists filled and completed the questionnaire. Less than half of the participants (47.9%, n = 128) were working in the community pharmacies. Pediatric doses of certain drugs were evaluated in this study. The results were varied and depended mainly on the pharmacists' experience. The knowledge resources about pediatric doses for most of the pharmacists who participated in this study were gained through self-study courses. The participants were agreed that additional pharmaceutical training and paediatrics drug doses related courses in the pharmacy colleges are beneficial in increasing the awareness and knowledge of pharmacists which makes the pediatric drug doses more accurate and safer. **Conclusion:** This study recommends raising awareness and knowledge either by continuous education and/or the pharmacy colleges should develop their curriculums and academic plans to include numbers of such courses and training.

Key words: Pediatric, doses, pharmacists, awareness, knowledge, Palestinian

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Medicines mistakes are any action that might harm the patient and are more serious in paediatrics than in adults. There are several reseasons for medicines' mistakes which include, medicine description, compounding, distributing, delivery, transportation, training, follow-up and application. Sometimes adverse effects or complications and death in the pediatric community and adult people, might occur due to medical mistakes. Most studies of medicine mistakes were carried out in adults[1-3]. The issue of pediatric drug doses is controversial in many countries including Palestine and thus many types of research have been found related to this topic. Previous surveys have shown the need for additional training to improve pharmacists' perceived knowledge and comfort level when providing care for children. A survey on community hospital and homecare pharmacists determined pharmacists' perceived knowledge and expertise required to make recommendations regarding selected pediatric topics. It has been reported that the community pharmacists have been more comfortable with conditions such as cough and cold, diaper rash, head lice, analgesics and antipyretics conditions but less comfortable with less common conditions such as enuresis, poisoning, cancer and terminal illness[4]. In another survey on the community, pharmacists were also carried out to determine community pharmacists' comfort level and confidence in providing care for children. A substantial percentage of respondents are not comfortable when dealing with pediatric prescriptions likely seen following hospital discharge as morphine prescriptions and has identified a need for more education. Ensuring that community pharmacists have the skills and confidence to provide safe and effective care to a wide range of patient populations remains a challenge for the profession[5]. In addition, paediatrics is not a major focus in many Pharmacy education programs. Students learn about various medical conditions, appropriate dosages and monitoring parameters to assess improvement in adults. Paediatrics training is provided only in the form of elective courses or as a limited number of lectures throughout the university.

Dosing errors are the most common medication error. Paediatrics have a different response to drugs compared to adults. Therefore it is very important to health care providers to ensure that the appropriate drug and doses are prescribed to paediatrics, especially neonates. The rapid and varying physiologic development which occurs during childhood contributes to changing the pharmacokinetics and pharmacodynamics of paediatrics. That causes complications in these patients' doses calculation, this will make efficacy and safety less accurate. Pharmacists can help prevent medication errors by checking dosing calculations, drug-drug interactions and counselling caregivers for proper administration and medication storage safety tips[6-9]. Pediatric patients require patient-specific dosing calculations because they have different ages, weights and different body surface areas, thus determining appropriate medication use in children frequently places health care providers in a quandary[10]. Accordingly, there is the need for accurate doses calculation. Thus, this study was conducted to measure the pharmacists' knowledge and their experiences in determining pediatric doses. The study of the awareness role of Palestinian Pharmacists and their knowledge about "paediatrics doses" was measured due to the necessity of calculating the doses accurately and the importance of obtaining a successful collaboration between Pediatricians and community pharmacists for the lives of children. A self-administered, online-based questionnaire of pharmacists in Palestine was conducted. The questionnaire was easy to understand, the format was too simple to use and was distributed *via* social media applications. The questionnaire contains questions that are necessary for practice.

MATERIALS AND METHODS

Research protocol: A cross-sectional study was conducted using an online questionnaire (Arabic Version). The survey was designed to measure the awareness and knowledge of Palestinian Pharmacists about pediatric doses. Data were collected using a self-administered online-based questionnaire as a cross-sectional web-based survey. The questionnaire consists of three parts, part one contains the demographic data of participants, which includes their academic degrees, years of experience, places of residence, workplaces, the resources that pharmacists use when they estimate the children's drugs doses and the ones which they use to learn about children's drugs doses. Part two contains 16 questions related to children's medications, the answers to the questions of this part were either yes or no or multiple choices. Part three contains specific questions related to the children's drug doses. The questions are about the drugs commonly used in community-based practice and are supposed to be familiar to most pharmacists. For each question, participants were invited to choose from a list of pre-specified answers including 'No answer' (multiple-choices design). The questions were easy to understand, the format of the questionnaire was easy to use and the questionnaire

contains knowledge areas that are necessary for pharmacy practice. Additionally, participants were asked to add comments at the end of the questionnaire if they felt that some questions were too difficult to understand or unclear or the questionnaire format was not easy to deal with.

After the questionnaire was evaluated, it was formatted on Google form, placed online and kept for about one month. Participation was voluntary and confidential. All the data were collected in February, 2020. Multiple methods were used to reach the target population. The questionnaire link was also distributed online to pharmacists groups by Facebook, Messenger and WhatsApp. The total number of participants was 267 pharmacists. Data were downloaded and entered into Microsoft Excel (Microsoft Corp., Redmond, WA).

Statistical analysis: Descriptive statistics were computed for all variables using Statistical Package for the Social Sciences (SPSS) Software. Chi-square analyses were performed to see if there's a relation between the year of experience and different variables. In addition, chi-square analysis was used to compare the pharmacists' academic degrees with the same variables. Statistical analysis were performed using SPSS software, version 25. The data were presented using frequency counts and percentages. Results were analyzed to determine the awareness role of Palestinian Pharmacists and their knowledge about pediatric doses. Subsequent comparisons were made between the four pharmacists groups and the years of their experience.

RESULTS

At the end of the mentioned period of the study, a total of 267 Palestinian Pharmacists filled and completed the questionnaire. Overall, 85.4% (n = 228) of the pharmacists hold a Bachelor's degrees, 11.6% (n = 31) hold Master's degrees, 1.1% (n = 3) hold Ph.D. degrees and 1.9% (n = 5) hold diploma degrees. The majority of the participants 34.1% (n = 91) are from the Hebron governorate, 16.5% (n = 44) are from Nablus, 10.9% (n = 29) are from Ramallah and Al Berih, 9% (n = 24) are from Bethlehem and others are from the different governorates. Most of the participants (36.7%, n = 98) have 1-5 years of experience, 36% (n = 96) have <1 year experience, only 10.5% (n= 28) of the participants have 6-10 years and 16.9% (n = 45) have >10 years of experiences. Less than half of the participants (47.9%, n = 128) are working in community pharmacies, 18% (n = 48) are unemployed, 10.5% (n = 28) are working in their pharmacy shops, 6% (n = 16) are working in government jobs and the remaining are working in different jobs (e.g., medical representatives, Pharmaceutical Companies, University, Insurance Companies). Only a few of them (n = 1, 0.4%) are working in a drugs warehouse and (0.4%, n = 1) in private businesses. Some students (5.2%, n = 14) also participated and filled out the questionnaire.

It was found that most of the pharmacists (39.7%, n = 106) use the applications of the drugs as resources to estimate the children drugs doses, while 22.1% (n = 59) uses websites, 16.9% (n = 45) uses books and 21.3% (n = 57) do not use any references and they instead rely on their previous experiences. The majority of the participants (53.2%, n = 142) took self-study courses to learn about children's drugs doses, some of them (26.2%, n = 70) took courses in pharmacy colleges and a few of them (20.6%, n = 55) rely on their experiences. One hundred eighty-one (67.8%) knowns that the basis for calculating children's drugs doses is the age and weight of the child, others answered either age or weight alone needs for calculating the doses and only 2 participants need Body Mass Index (BMI) for calculating the doses. Most of the pharmacists who participated in this study (76.78%, n = 205) calculated the dose based on the weight and age of the child when they receive a prescription that the doses not specified, 14.23% (n = 38) call the physician for the doses and 24 pharmacists (9%) estimate the doses based on their experience in Table 1.

In the case that one of the participants' children or children of their relatives needs medications, about half of the participants (48.3%, n = 129) give the drug based on their diagnosis and calculate the dose accordingly, 8.6% (n = 23) of them estimate the dose and 43.1% (n = 115) prefer to ask a physician. Table 2 summarized the pharmacists' answers to the questions about the attitude, awareness and knowledge of children's doses and medications. The majority of the pharmacists (86.9%, n = 232) know the age group of neonates (i.e., from birth to 28 days old), 77.53% (n = 207) also knows the age group of infants (i.e., from 29 days to 12 months), 64.8% (n = 173) also knows the age group of children (i.e., 1-12 years old) as shown in Table 2. Three selected types of drugs (Clarithromycin, Budesonide, Decongestants) were given to measure the knowledge of the pharmacists about which of these drugs is not given to children who are under 6 years old, 45% (n = 122) of participants answered decongestants which is correct. Based on the selection of the drug in the previous question, specific adverse effects are given which include anaphylactic shock, Attention-Deficit Hyperactivity Disorder (ADHD) and Crohn's Disease, only 20.6% (n = 55) of the participants answered it correctly, i.e., ADHD (Table 2). Most of the pharmacists (n = 239, 89.51%) know due to the cause of Reye's Syndrome Aspirin is not given

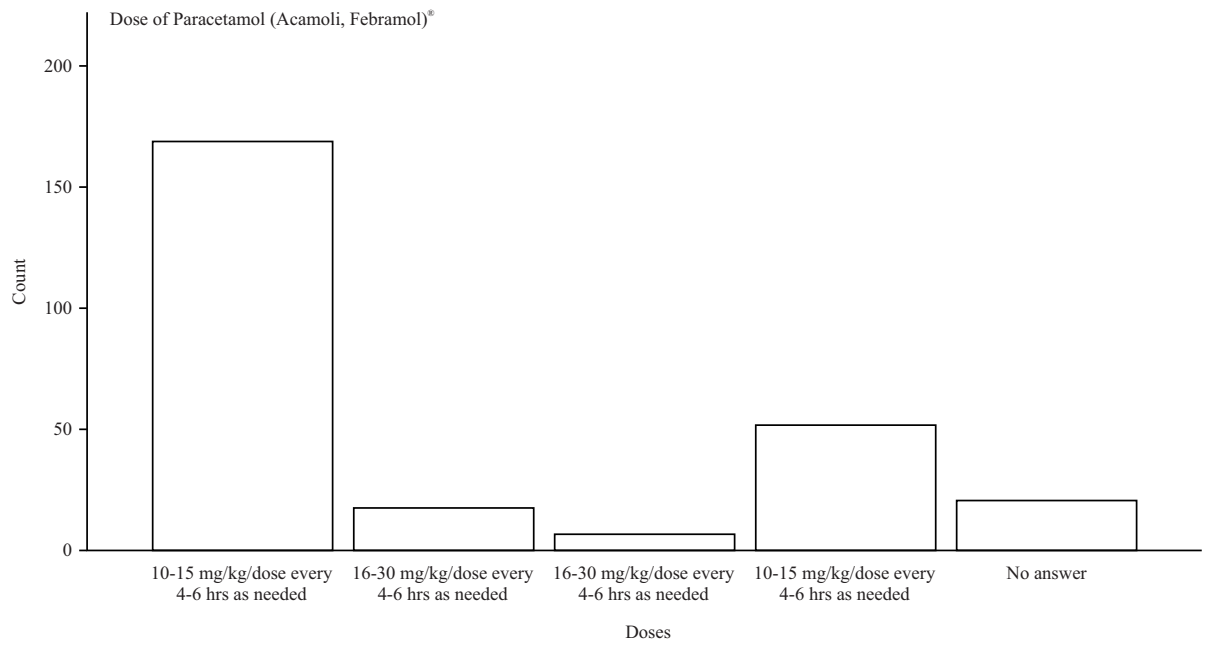

Fig. 1: Dose of Paracetamol

Table 1: Resources of pharmacists about the children's drugs doses

Resources use	Frequency	Percentage
Resources of pharmacists to estimate the children's drugs doses		
Drug applications	106	39.7
Websites	59	22.1
Books	45	16.9
Do not use any references	57	21.3
Resources of pharmacists to learn about children's drugs doses		
Self-study courses	142	53.2
Courses in pharmacy colleges	70	26.2
Experiences	55	20.6
Basis for calculating children's drugs doses		
Age and weight	181	67.8
Weigh	80	29.96
Age	4	1.5
Body Mass Index (BMI)	2	0.75
Deal with a children prescription, the required dosage not specified		
Calculate the dose based on weight and age	205	76.78
Call the physician to ask about the dose	38	14.23
Estimate the dose based on the experience	24	9

to children even though it is called baby's Aspirin, 229 (85.77%) pharmacists knows that chloramphenicol cause grey baby syndrome and thus not given to newborn babies and 141 (52.8%) of them also knows that due to the cause fatal respiratory depression by Promethazine, it is not given to children under 2 years of age (Table 2).

Regarding the questions about children's drug dosages, when we asked the participants about the dose of Paracetamol (Acamoli, Febramol etc.)®, 169 responders (63.3%) answered it correctly, that the dose is 10-15 mg/kg/dose every 4-6 hrs as needed, while 51 pharmacists (19.1%) answered it is 10-15 mg/kg/dose every 4-6 hrs as needed, 20 pharmacists (7.5%) answered the paracetamol dose is 16-30 mg/kg/dose every 4-6 hrs as needed, 6 (2.25%) only selected the dose of paracetamol is 16-30 mg/kg/day every 4-6 hrs as needed and 7.87% (n = 21) of them didn't answer the question in Fig. 1. Sixty-three out of 169 (37.28%) of the pharmacists who answered it correctly have 1-5 years of experience.

When we asked the participants about the dose of Ibuprofen (Nurofen, Trufen)®, 130 pharmacists (48.7%) out of 267 participants answered it correctly and 10.9% of them

Table 2: Attitude, awareness and knowledge of pharmacists about the children's doses

Questions	Answers	Frequency	Percentage
Are you able to prescribe and dosing medicines for children?	Yes	205	76.8
	No	62	23.2
Do you recalculate the dose written by the physician in the children prescription?	Yes	150	56.18
	No	117	43.82
Have you ever adjusted the dose of a children's medicine in a prescription?	Yes	185	69.29
	No	82	30.71
Do you think that the role of the pharmacist is limited only to dispensing prescriptions without intervention if he believes that there is an error in the prescribed medications or their doses?	Yes	2	0.75
	No	265	99.25
Have you ever found medical errors in children's prescriptions?	Yes	219	82.02
	No	48	17.98
What is the age group of neonates?	From birth to 28 days old	232	86.9
	From birth to 8 weeks old	19	7.11
	From birth to 12 months old	7	2.62
	No answer	9	3.37
What is the age group of infants?	From birth to 28 days old	5	1.87
	From 29 days to 12 months	207	77.53
	From 29 days to 24 months	47	17.6
	No answer	8	3
What is the age group of children?	1-12 years old	173	64.8
	1-14 years old	38	14.23
	1-18 years old	52	19.48
	No answer	4	1.5
Which of the following medicines should not be given to children under 6 years of age?	Clarithromycin	49	18.35
	Budesonide	29	10.86
	Decongestants	122	45.7
	No answer	67	25.1
What does the medicine you chose in the previous question Do; if it is given to children under 6 years of age?	Anaphylactic shock	67	25.1
	Attention Deficit Hyperactivity Disorder (ADHD)	55	20.6
	Crohn's disease	29	10.86
	No answer	116	43.44
Why is aspirin not given to children even though it is called baby's aspirin?	May cause severe bleeding to children	15	5.62
	Reye's syndrome	239	89.51
	May cause low acidity in the blood	4	1.5
	No answer	9	3.37
Why is chloramphenicol not given to newborn babies?	Gray baby syndrome	229	85.77
	Ulcerative colitis	10	3.75
	May cause chronic diarrhea	9	3.37
	No answer	19	7.11
Why is promethazine not given to children under two years of age?	Cause severe dehydration	22	8.24
	May cause heart palpitation	56	20.97
	Cause fatal respiratory depression	141	52.8
	No answer	48	18

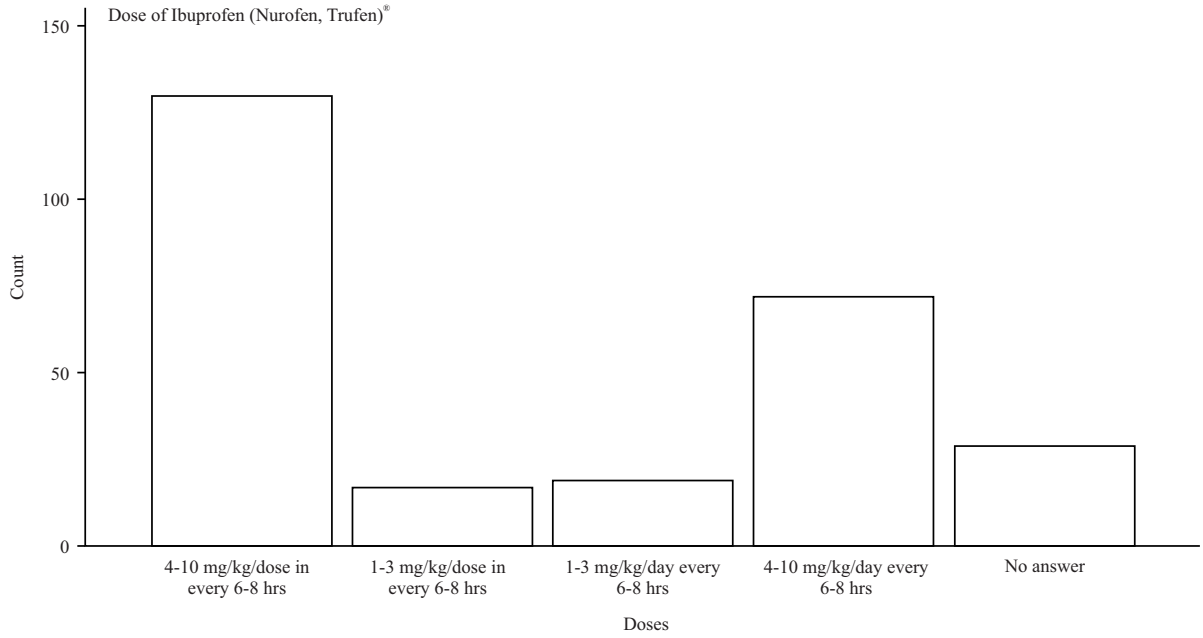

Fig. 2: Dose of Ibuprofen

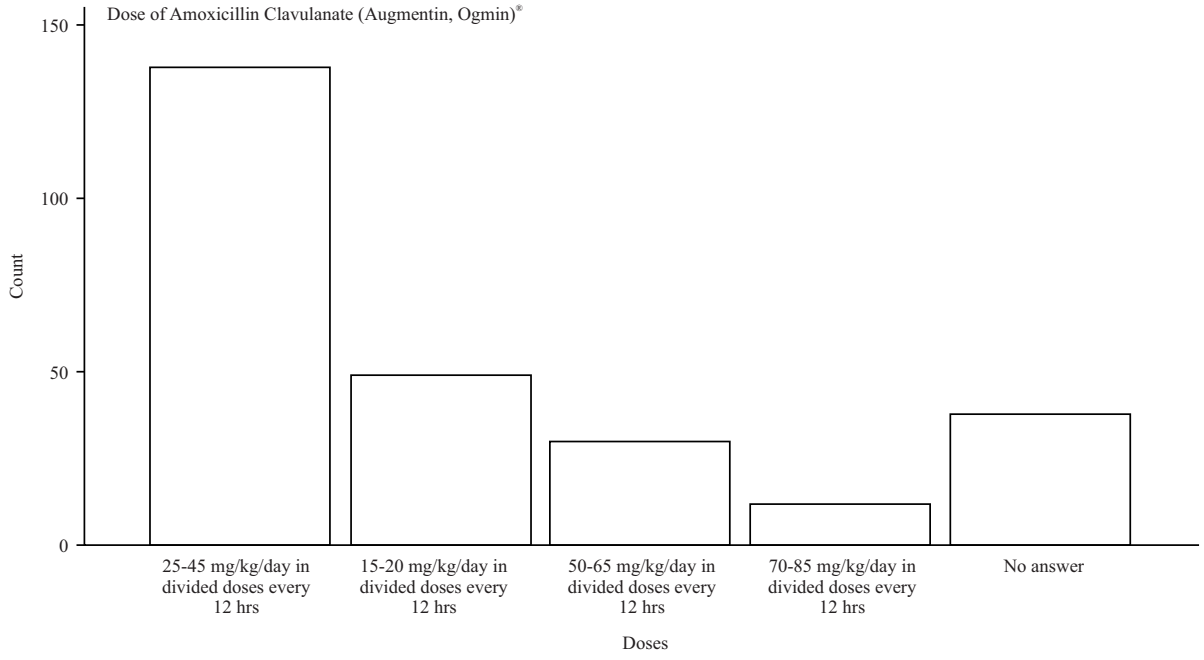

Fig. 3: Dose of Amoxicillin Clavulanate

chose not to answer the question, 36.9% (48/130) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 2.

One hundred thirty-eight pharmacists (51.7%) answered the dose of Amoxicillin Clavulanate (Augmentin, Ogmin)® correctly and 14.2% of them chose not to answer the question, 36.2% (50/138) of the pharmacists who answered it correctly have <1 year of experience. The percentage of the ones who answered it wrongly is shown in Fig. 3.

When the participants answered the question about the dose of Azithromycin (Azytra, Azicare)®, 57.7% (154/267) of participants answered it correctly and 13.5% of them chose not to answer the question, 40.2% (62/154) of the pharmacists

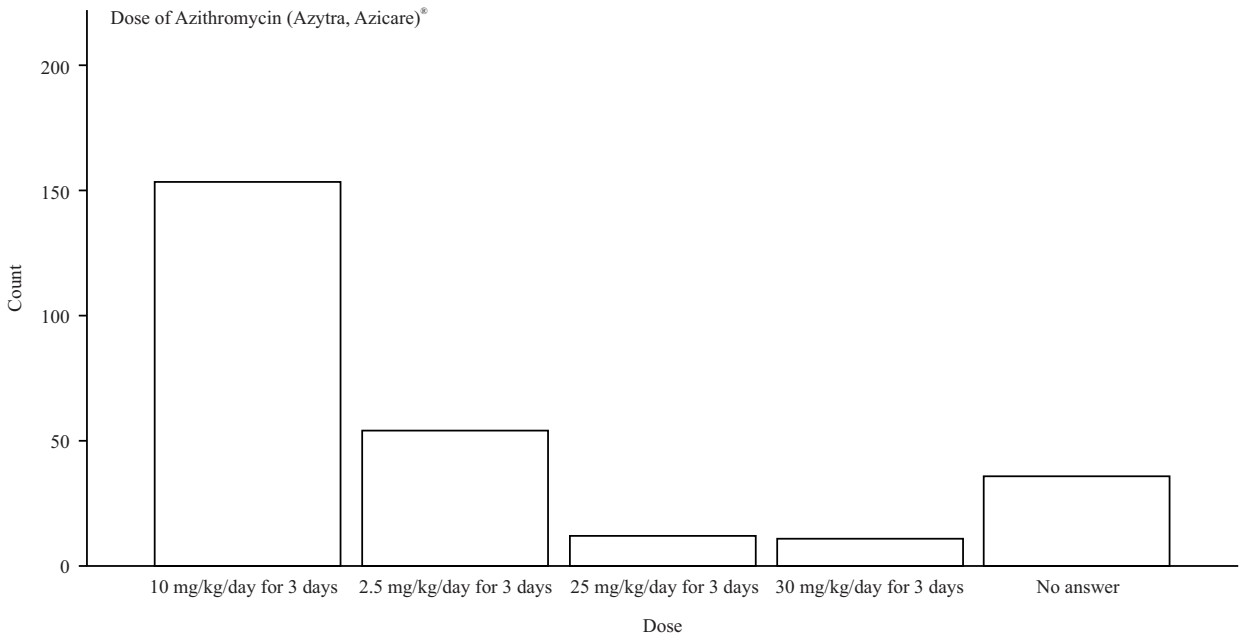

Fig. 4: Dose of Azithromycin

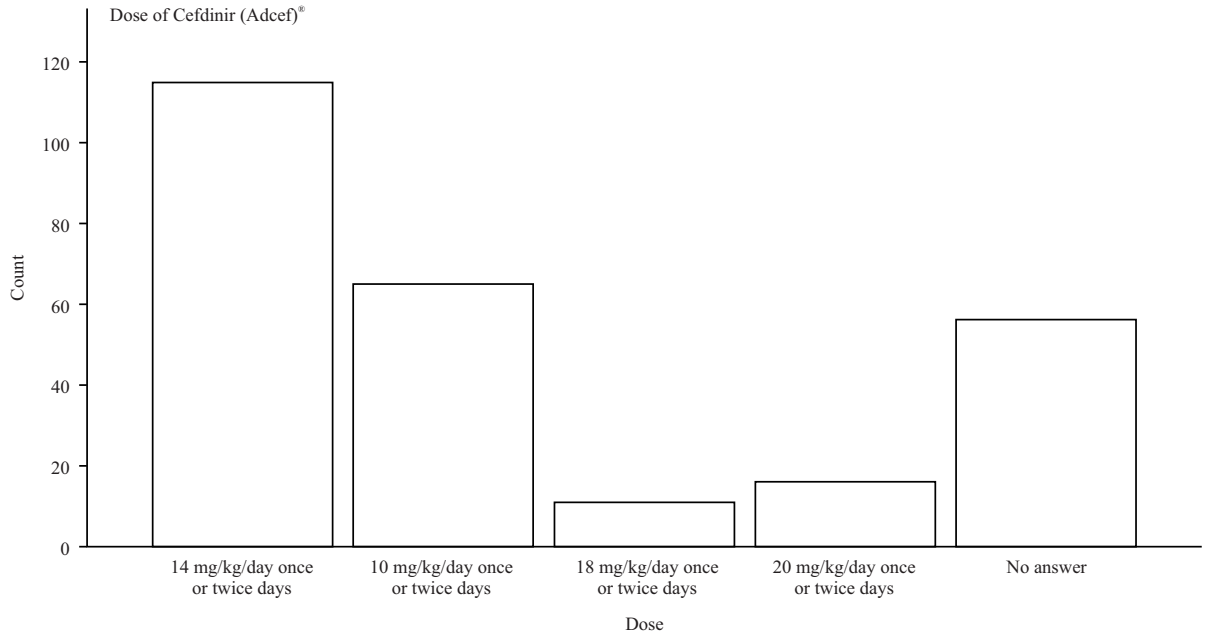

Fig. 5: Dose of Cefdinir

who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 4.

Cefdinir (Adcef)® is used to treat a wide variety of bacterial infections only and it is a third-generation cephalosporin antibiotic. One hundred fifteen (41.1%) of the participants answered its dose correctly and 21% of them chose not to answer the question, 45.2% (52/115) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 5.

Prednisolone is a steroidal medication, corticosteroid hormone secreted by the adrenal gland and is used to treat a variety of different inflammatory conditions and a wide range

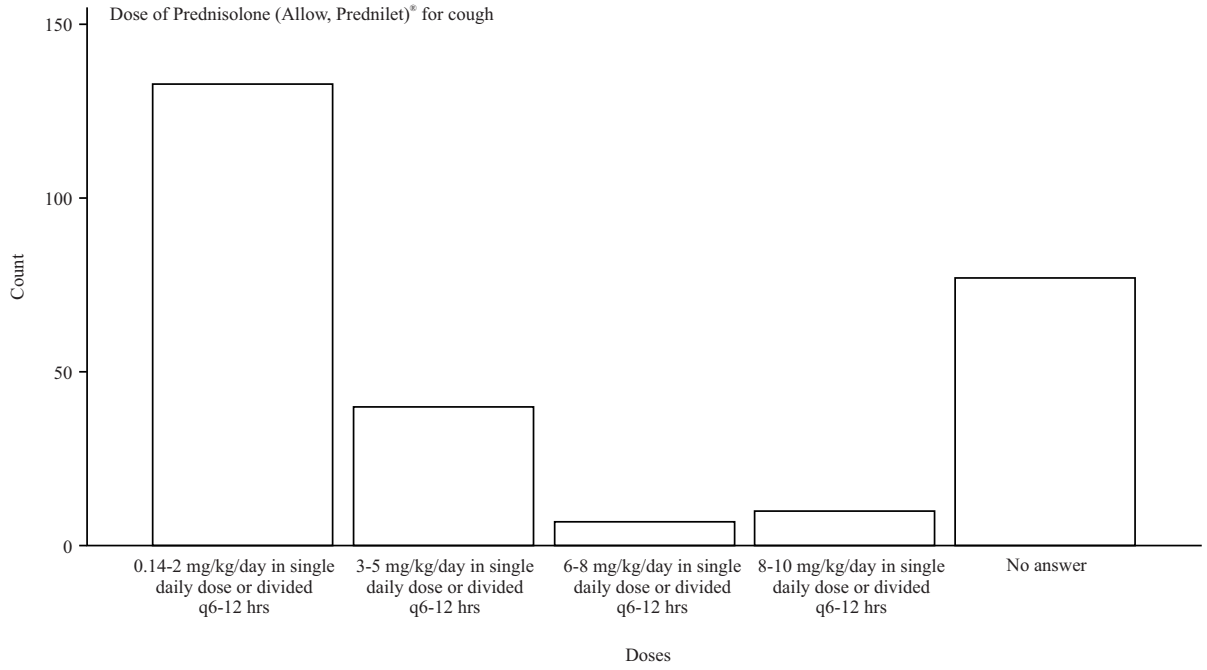

Fig. 6: Dose of Prednisolone for cough

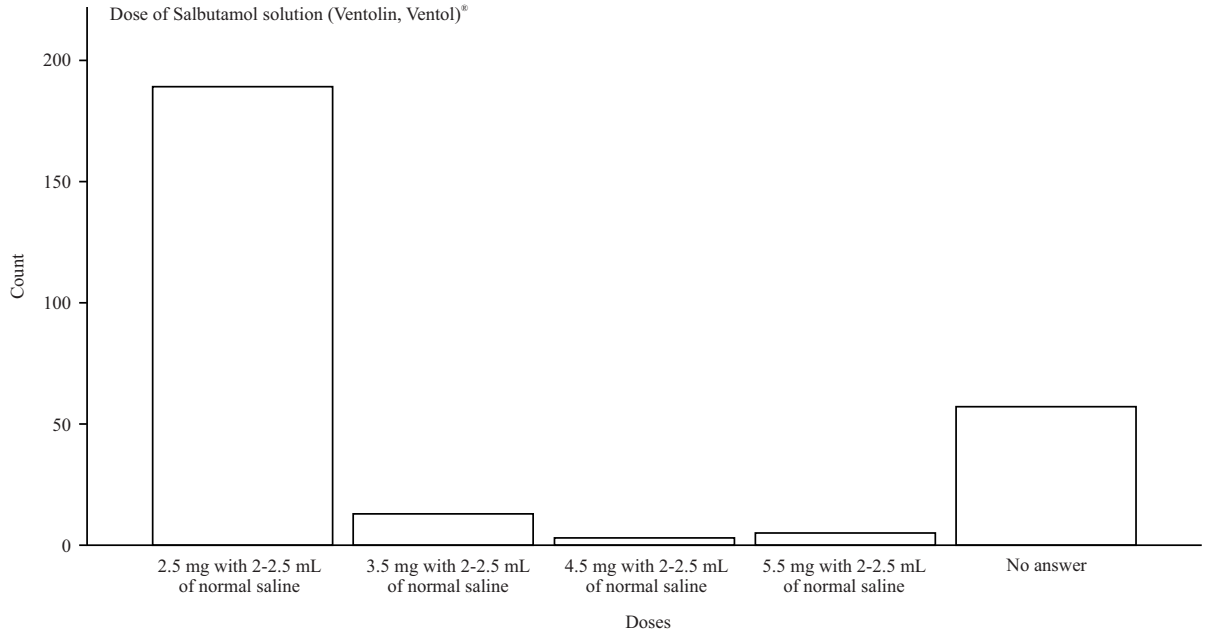

Fig. 7: Dose of Salbutamol

of disorders including allergies, skin diseases, arthritis, immune system disorders, blood problems, psoriasis, infections, lupus, ulcerative colitis, certain cancers and to prevent organ rejection. When the pediatric dose of prednisolone (Allow, Prednilet)® for cough was asked to participants pharmacists, 49.8% (133/267) of participants answered it correctly and 28.8% of them chose not to answer the question, 39.8% (53/133) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 6.

When asked the participants about the dose of Salbutamol solution (Ventolin, Ventol)®, 70.8% (189/267) of

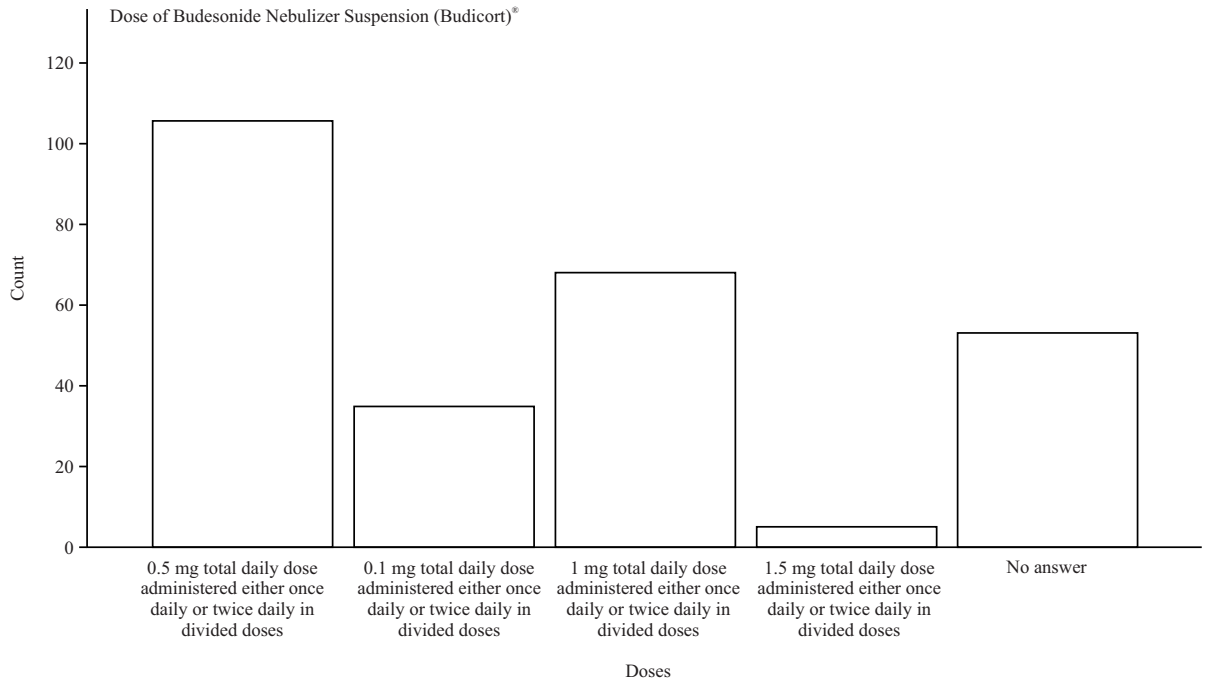

Fig. 8: Dose of Budesonide Nebulizer Suspension

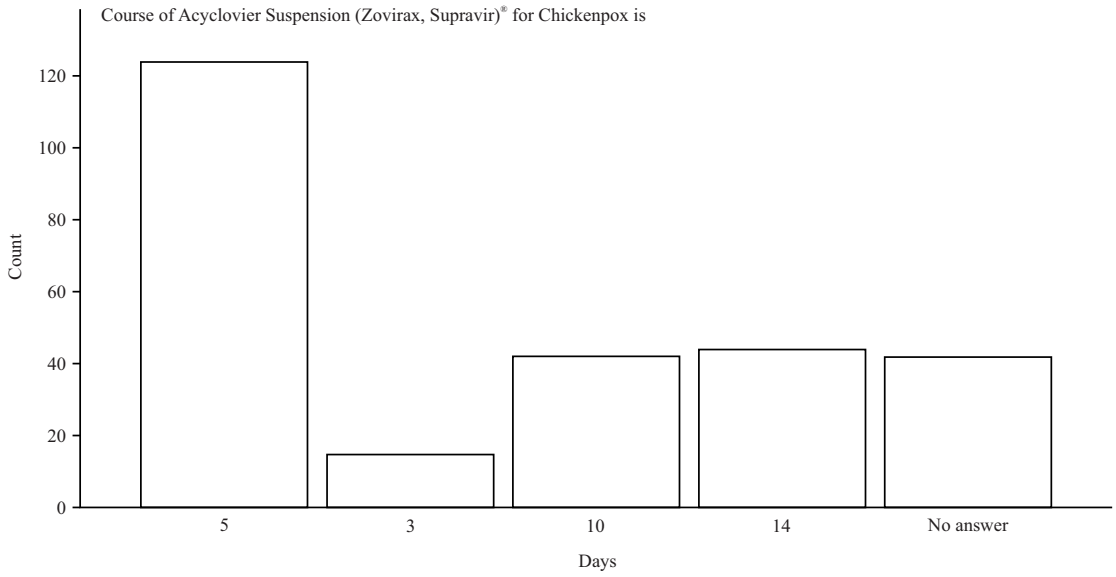

Fig. 9: Dose of Acyclovir Suspension

participants answered it correctly and 21.3% of them chose not to answer the question, 36.5% (69/189) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 7.

The answers of the participants' pharmacists about the dose of Budesonide nebulizer suspension (Budicort)® were as follows, 39.7% (106/267) of participants answered it correctly and 19.9% of them chose not to answer the question, 42.4% (45/106) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 8. Budesonide corticosteroid medication is available as an inhaler, nebulization solution, nasal spray, rectal form and pills and is used in chronic obstructive pulmonary disease and management of long-term asthma.

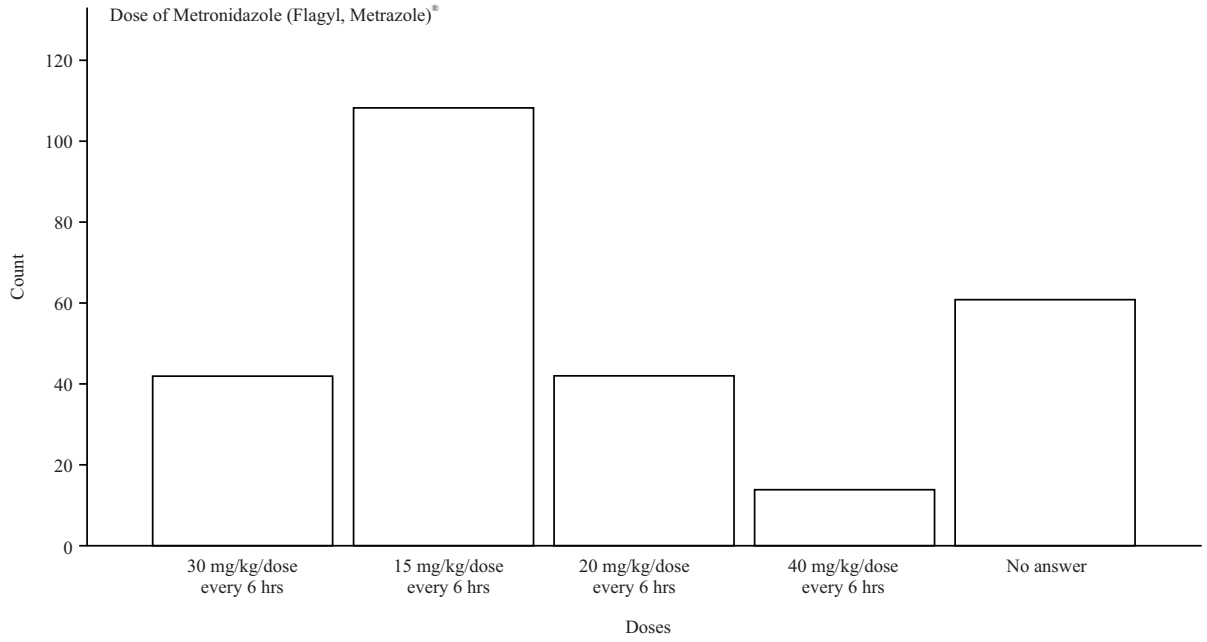

Fig. 10: Dose of Metronidazole

The antiviral Acyclovir drug is used mainly for the treatment of chickenpox, shingles and herpes simplex virus infections. This drug is available in different dosage forms. When we asked the participants pharmacists about the pediatric dose of Acyclovir suspension (Zovirax, Supravir)® for Chickenpox, 46.4% (124/267) of participants answered it correctly and 15.7% of them chose not to answer the question, 38.7% (48/124) of the pharmacists who answered it correctly have <1 year of experience. The percentage of the ones who answered it wrongly is shown in Fig. 9.

The participants pharmacists answered about the pediatric dose of Metronidazole (Flagyl, Metrazole)® as the following, 15.7% (42/267) of participants answered it correctly and 22.8% of them chose not to answer the question, 50% (21/42) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 10.

The cephalosporin antibiotic Ceftriaxone is a third-generation and is used to treat various bacterial infections which include meningitis, pneumonia, skin infections, endocarditis, middle ear infections, pelvic inflammatory disease. urinary tract infections, intra-abdominal infections, bone and joint infections and gonorrhoea. It is also sometimes used before surgery and following a bite wound to prevent infection. Ceftriaxone can be given by injection into a vein or a muscle. One hundred three (38.6%) of participants answered the dose of Ceftriaxone (Rocephin, Tixon)® for acute bacterial otitis media correctly and 25.5% of them chose not to answer the question, 44.6% (46/103) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 11.

About forty-eight percent (127/267) of the participants answered the dose of vitamin D (Dee Dense)® for the infant correctly and 12.4% of them chose not to answer the question, 38.5% (49/127) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 12.

The participants' pharmacists answered the dose of Paracetamol suppositories for infants as the following, 64% (171/267) of participants answered it correctly and 9.4% of them chose not to answer the question, 38% (65/171) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 13.

Dimetindene is an anticholinergic. It is a selective H1 antagonist (antihistamine). When we asked the participants pharmacists about the dose of Dimethindene drop (Fenistil, Dimestil)® for infants, 44.9% (120/267) of the participants answered it correctly and 11.2% of them chose not to answer the question, 40% (48/120) of the pharmacists who answered it correctly have 1-5 years of experience. The percentage of the ones who answered it wrongly is shown in Fig. 14.

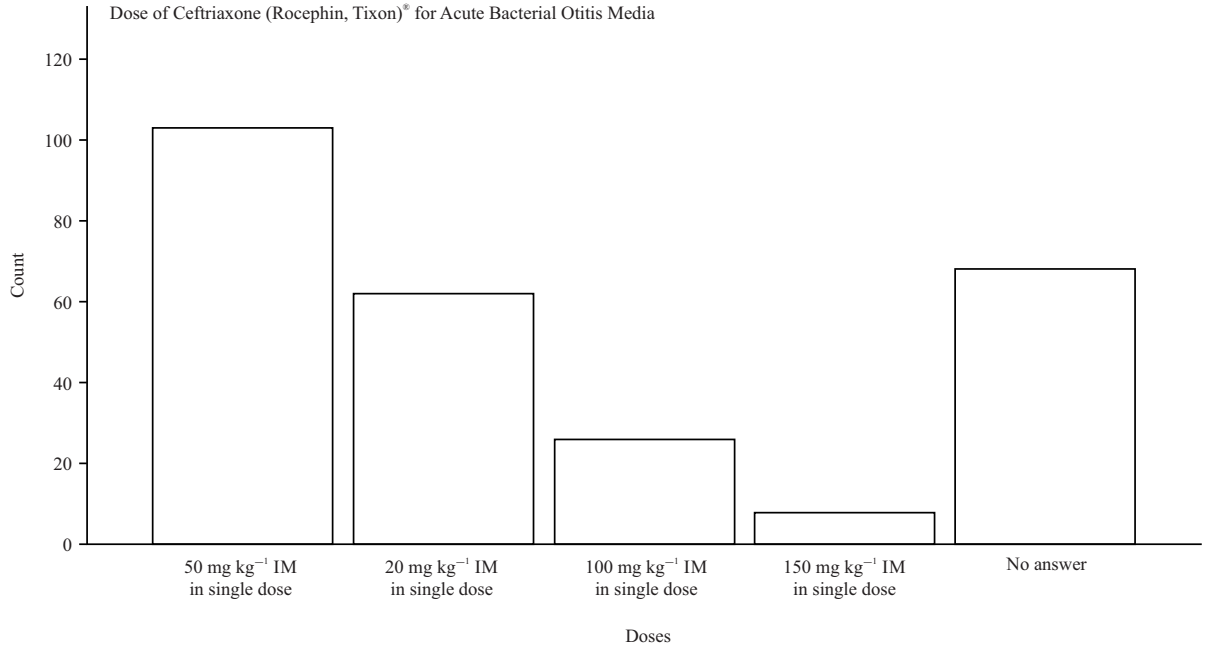

Fig. 11: Dose of Ceftriaxone for acute bacterial Otitis media

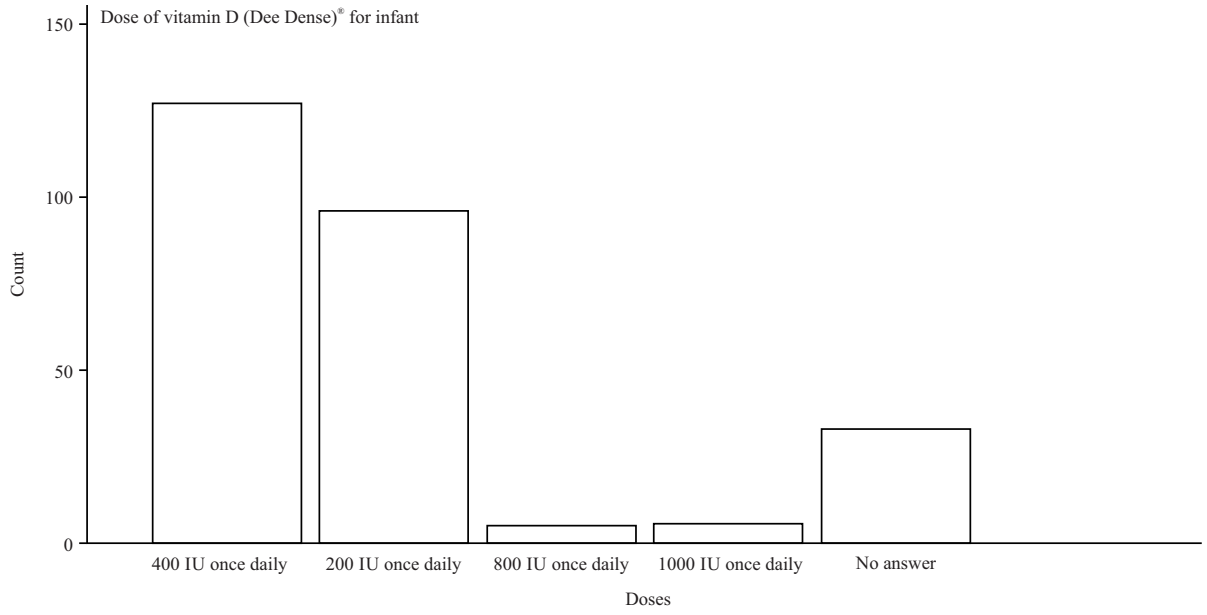

Fig. 12: Dose of vitamin D (Dee Dense)® for the infant

DISCUSSION

In the present study, it was found that the majority of the participants were from Hebron city, because the questionnaire was distributed via Facebook messenger and pharmacy groups and the Facebook policy usually suggests to you the residents who are near to your area. More than half of the participants 53.2% took online self-study courses to learn about children's drug doses. This means that some colleges of Pharmacy in Palestinian universities do not teach courses related to children's doses. The study found that most pharmacists are interested in learning about children's drug doses that is why they take self-study courses. Most pharmacists responded “No” to the question, "Do pharmacists

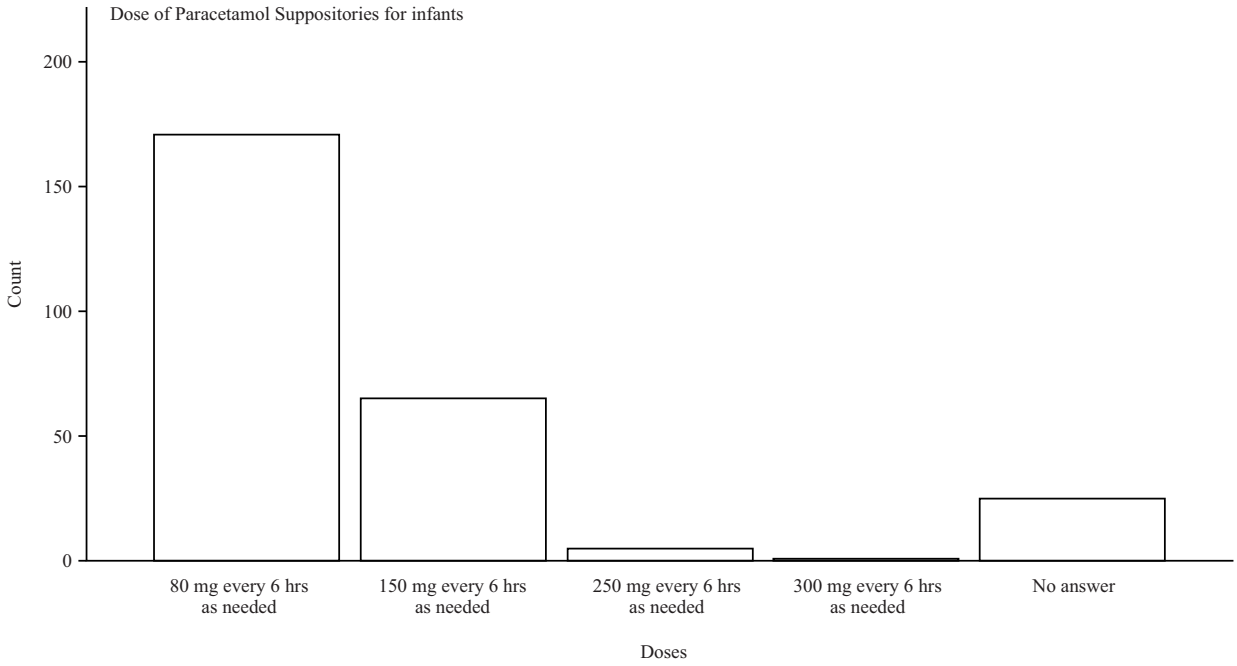

Fig. 13: Dose of Paracetamol Suppositories for infants

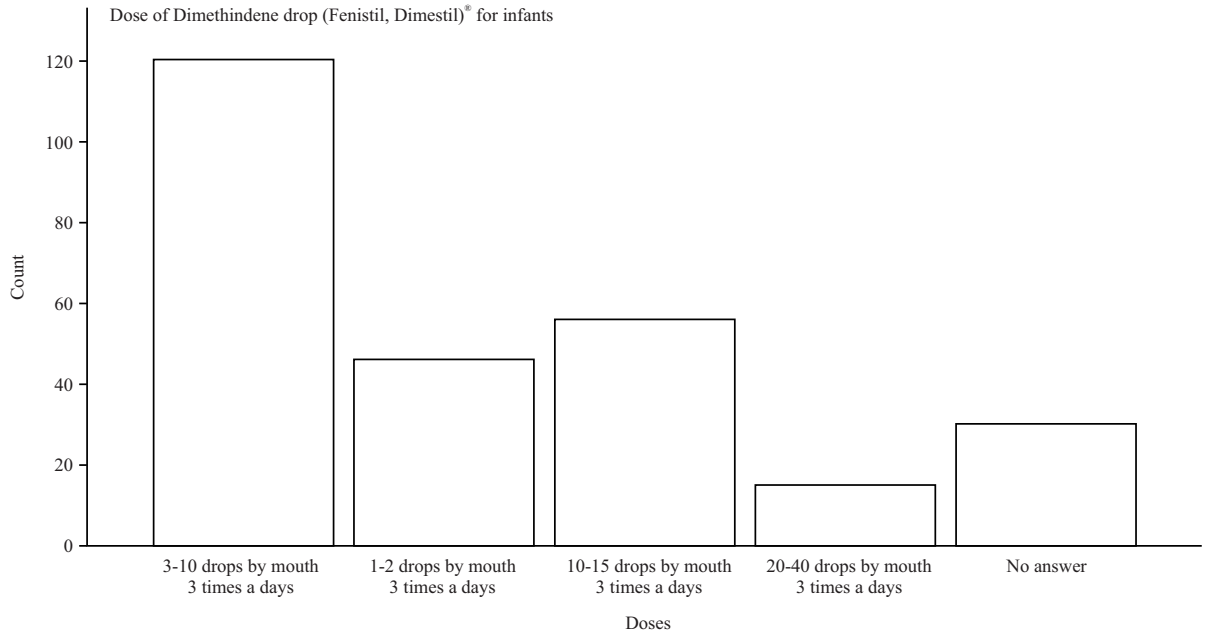

Fig. 14: Dose of Dimethindene drops

think that their only job is to sell the drug whether the dose is correct or wrong?" while, 67.85% of them can able to deal with a children's prescription that does not include the dose by calculating it based on weight and age. However, the results of the third section were not fully satisfactory. For the question "What would pharmacists do in case one of their family members needs a drug?" Nearly half of the respondents will give or have given the family member patient the drug on his/her responsibility, the other half prefer to ask a physician and this indicates that those pharmacists have little confidence in themselves.

The questionnaire includes some general questions like children's age groups and most of the participants' answers were correct. The research study contains some questions to figure out the pharmacists' knowledge about different issues, for example, if the drugs are contraindicated in some age groups and most of the participants' answers were correct. This indicates that most pharmacists can deal with prescriptions that contain such kinds of contraindicated drugs. The third section of the questionnaire is the most important one in this research study because it contains specific questions about children's drug doses that include most drug classes. Most of the participants answered the doses of Paracetamol and Ibuprofen correctly. This might be these drugs are very commonly known and used (Fig. 1, 2). Half of the answers on the antibiotics and Prednisolone are also correct, this might be the pharmacists dispense many prescriptions of these drugs. Surprisingly and unexpected, most of the participants pharmacists answered the doses of Metronidazole and vitamin D wrongly, this most likely they think that children should take a small dose of these medications. They also got the Ceftrixone dose wrong because the question was about the injection, which not all of the community pharmacists are familiar with this antibiotics. Pharmacists, therefore, do not know the doses of the drugs often used in hospitals (Fig. 6, 10-12). Their highest knowledge was for Salbutamol dose as 70.8% of participants got the dose of it correct, this is because this drug is very in common use. On the other hand, 39.7% only got the dose of Budesonide correct although this medicine is prescribed widely. Less than half of the participants also answered the dose of Dimethindene and the course of Acyclovir correctly. Generally, Palestinian pharmacists lack knowledge about paediatrics medication doses and their calculations.

Knowing and giving the correct dose of the drug is important for achieving the desired therapeutic efficacy and avoiding undesired effects as drug dose accuracy is critical for drugs therapeutics and monitoring. However, the dose delivered to an individual patient should be always the desired and correct dose. Delivering inaccurate dose due to human error or lack of knowledge about the dose or its calculation lead to serious harm to the patients especially for narrow therapeutic index or paediatrics. Serious harmful results of a medication dose may include death, life-threatening situation, hospitalization, disability and birth defect. Medication errors remain one of the most common causes of unintended harm to patients and have led to many deaths. Some categories of medication errors include, medications administered to the wrong person, medications administered at the wrong time, through the wrong route, administration of the wrong medication and/or dose and the omission of medications[11-14]. Therefore, doses calculation knowledge is very important to avoid such serious conditions caused by lack of knowledge and/ or calculation errors in all patients including the doses for paediatrics. Based on these facts about does accuracy/ medication errors and the results obtained in this study, it would be necessary to implement educational campaigns to increase the awareness and knowledge of Palestinian Pharmacists about Pediatric doses, additional training is also beneficial in increasing the perceived knowledge, awareness and comfort of pharmacists regarding pediatric patients. In addition, a significant association was noted between the educational level/years of experience and the awareness and knowledge of Palestinian Pharmacists towards pediatric doses. Certainly, dose checking, collaborative practice, complete counselling and appropriate compounding practices of pediatric doses are expectations of all pharmacists and are included in the standards of practice for pharmacists in most countries. Medication errors in pediatric patients and the risks associated occur when required standards of practise are not followed. Pharmacists who specialize in caring for children play an important role in optimizing pediatric pharmaceutical care. From this study, have somehow gained a broad range of practical advice and suggested activities that pharmacists can use across the spectrum of practice. The information presented in this study may help pharmacists develop greater comfort in caring for pediatric patients and may guide the development of a practical pediatric pharmacy curriculum that will support both adult and pediatric medication use.

Generally, there are no previous studies that exactly measure the awareness and knowledge of pharmacists about pediatric doses. But, some studies examine the knowledge of pharmacists about certain drugs[15-19]. Comparing current findings with these related studies, in one study in the USA about medication error prevention by clinical pharmacists in pediatric hospitals, It was found that the most common type of error in the study was incorrect dosage and the most prevalent type of error was over dosage and the error rate was greatest among physicians with the least training. Reviewing drug orders by pharmacists significantly decreased the potential harm resulting from errant medication orders. In another study about clinical pharmacists in the medical care of paediatrics, it was found that participation of pharmacists in the pharmacotherapy of pediatric patients gives many advantages including improved patient compliance rate and reduced the drugs' side effects[15]. Thus the knowledge and awareness of pharmacists about pediatric doses are very important to avoid medication errors. A study on the

knowledge of community pharmacists about appropriate dosing of antibiotics among paediatrics was conducted in Jordan[16], it was found most Jordanian community pharmacists were non-knowledgeable about appropriate dosing of antibiotics in pediatrics[17]. On the other hand, Brown *et al.*[18]. found that community pharmacists did not consistently identify appropriate doses. It was reported that the main issue for the community pharmacists that may lead to inappropriate dosing of antibiotics was poor scientific knowledge about dose calculation[19]. Current findings are consistent with these previous studies[15-19] and this supports our finding that pharmacists, in the current study, poor knowledge have about dosing and calculation skills.

In general, the number of responses (n = 267) in this study was few compared to the total number of total pharmacists in Palestine and it is often because the questionnaire was conducted online and for a short period (1 month). Thus, a small number of pharmacists, who have more than 10 years of experience, have responded to the questionnaire. Significantly, the more years of experience, the fewer respondents. Another reason for such a few numbers of responses is that the questionnaire was sent to the pharmacists via social media applications and most likely was found in messages requests so that not all of them have seen or read it. This was the first study in Palestine to assess the awareness and knowledge of pharmacists about pediatric doses. The study covered the topic of Pediatric doses from different angles, including drug applications, calculation of children's drugs doses, dealing with children's prescriptions and dose-related knowledge. In general, Palestinian pharmacists lack knowledge about paediatrics medication doses. Thus, it is recommended to enhance the pharmacists' knowledge about dosing and calculation skills through implementing adequate and appropriate educational programs among community pharmacists.

On the other hand, this study had some limitations. First, used a convenient sampling for participants' selection. Moreover, most of the study subjects are from the Hebron Governorate and some of them are students. Because most of the participants are only from one area and some are students, our findings may not accurately reflect all pharmacists in Palestine. Furthermore, the cross-sectional design that was adopted in the current study did not allow for testing between variables accurately. Finally, the recall bias and language level of complexity could not be eliminated due to limitations in such studies as it is an online survey and not a face-to-face study.

CONCLUSION

The results fulfilled the aim of the research, which is studying the awareness role of Palestinian Pharmacists and their knowledge about pediatric doses. The majority of the pharmacists answered most of the questions correctly has 1-5 years of experience. This indicates that this group of pharmacists has enough knowledge and experience which makes them fully capable of providing care for children. However, the largest number of those who answered most of the questions wrongly is either the pharmacists who have <1 year of experience, the students and who have >10 years of experience. Some pharmacists have <1 year of experience and the students chose not to answer some of the questions, which means that universities have a significant role in providing courses which in turn enable the students to be aware of the correct drug doses of children. Accordingly, the study demonstrated that some Palestinian universities do not have such courses in their academic plans. Consequently, this study suggests that Palestinian Universities should increase the number of such courses and the training in their curriculum. Additionally, it's preferable if the pharmacists, who have a long experience, take courses frequently related to the pediatric drug doses to refresh their knowledge. These courses could be virtual or face-to-face classes in the Palestinian Pharmacists Association. Lastly, we also recommend that Drug Companies take part in continuous education regarding drug doses.

SIGNIFICANCE STATEMENT

This study discovered the lack of awareness and knowledge regarding pediatric dosing among Palestinian Pharmacists that can be beneficial to the ministry of health and Pharmacy colleges for raising awareness and knowledge by either continuous education and/or by developing the curriculums and academic plans of the pharmacy colleges to include numbers of courses and training about pediatric doses. This study will help the researchers to uncover the critical areas of awareness and knowledge about Pediatric doses and medication errors that many researchers were not able to explore. Thus a new theory on awareness and knowledge of pediatric doses may be arrived at.

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REFERENCES

1. Sandlin, D., 2008. Pediatric medication error prevention. J. Perianesthesia Nurs., 23: 279-281.
2. Montesi, G. and A. Lechi, 2009. Prevention of medication errors: Detection and audit. Br. J. Clin. Pharmacol., 67: 651-655.
3. Holdsworth, M.T., R.E. Fichtl, M. Behta, D.W. Raisch and E. Mendez-Rico *et al*., 2003. Incidence and impact of adverse drug events in pediatric inpatients. Arch. Pediatr. Adolesc. Med., 157: 60-65.
4. Prot-Labarthe, S., J. Stil-Baudry, M. Fahd, F. Brion and O. Bourdon, 2013. The role of community pharmacists in the management of hematopoietic stem cell transplant recipients: Knowledge and training. J. Pediatr. Hematol. Oncol., 35: 188-192.
5. Rashid, A.R. and M. Duffett, 2016. Medications for children: A survey of community pharmacists. J. Pediatr. Pharmacol. Ther., 21: 213-223.
6. Dorothy, A., T.M. Yadesa and E. Atukunda, 2021. Prevalence of medication errors and the associated factors: A prospective observational study among cancer patients at Mbarara regional referral hospital. Cancer Manage. Res., 13: 3739-3748.
7. Batchelor, H.K. and J.F. Marriott, 2015. Paediatric pharmacokinetics: Key considerations. Br. J. Clin. Pharmacol., 79: 395-404.
8. Lu, H. and S. Rosenbaum, 2014. Developmental pharmacokinetics in pediatric populations. J. Pediatr. Pharmacol. Ther., 19: 262-276.
9. Kennedy, A.R. and L.R. Massey, 2019. Pediatric medication safety considerations for pharmacists in an adult hospital setting. Am. J. Health Syst. Pharm., 76: 1481-1491.
10. Benavides, S., D. Huynh, J. Morgan and L. Briars, 2011. Approach to the pediatric prescription in a community pharmacy. J. Pediatr. Pharmacol. Ther., 16: 298-307.
11. Ogden, S.J. and L. Fluharty, 2015. Calculation of Drug Dosages. 10th Edn., Elsevier Mosby, United States, ISBN-13: 978-0-323-39366-9, Pages: 624.
12. Pickar, G.D. and A. Pickar-Abernethy, 2012. Dosage Calculations. 9th Edn., Cengage Learning, United States, ISBN-13: 978-1439058473, Pages: 592.
13. Munzenberger, P.J., R.L. Thomas, S.B. Edwin and V. Tutag-Lehr, 2011. Pharmacists' perceived knowledge and expertise in selected pediatric topics. J. Pediatr. Pharmacol. Ther., 16: 47-54.
14. Weant, K.A., A. Bailey and S. Baker, 2014. Strategies for reducing medication errors in the emergency department. Open Access Emergency Med., 6: 45-55.
15. Fernández-Llamazares, C.M., M.A. Calleja-Hernandez, S. Manrique-Rodriguez, C. Pérez-Sanz, E. Duran-García and M. Sanjurjo-Saez, 2012. Impact of clinical pharmacist interventions in reducing paediatric prescribing errors. Arch. Dis. Child., 97: 564-568.
16. Zhang, C., L. Zhang, L. Huang, R. Luo and J. Wen, 2012. Clinical pharmacists on medical care of pediatric inpatients: A single-center randomized controlled trial. PLoS ONE, Vol. 7. 10.1371/journal.pone.0030856.
17. Keewan, N., N.A. Al-Sawalha and B.A. Almomani, 2021. The knowledge of community pharmacists about appropriate dosing of antibiotics among paediatrics: A national study from Jordan. Int. J. Clin. Pract., Vol. 75. 10.1111/ijcp.14652.
18. Brown, S.W., L.M. Oliveri, K.H. Ohler and L. Briars, 2019. Identification of errors in pediatric prescriptions and interventions to prevent errors: A survey of community pharmacists. J. Pediatr. Pharmacol. Ther., 24: 304-311.
19. Bassoum, O., A. Ba-Diallo, N.M. Sougou, M.M.M. Lèye and M. Diongue *et al*. 2019. Community pharmacists' knowledge, practices and perceptions on antibiotic use and resistance: A cross-sectional, self-administered questionnaire survey, in Guediawaye and Pikine, Senegal. Open J. Epidemiol., 9: 289-308.