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Home administration of oral medications to children: Parental challenges and practices in Libya

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Abstract: Administering medication to children at home presents substantial challenges for caregivers. Errors in dosage, timing, or administration method could be harmful. A key contributor to such errors is inadequate knowledge of pediatric medication. The objective of this study was to explore how parents in Libya administer oral medications to their children and the self-care therapies they use for them. A cross-sectional study was conducted using an online self-designed questionnaire consisting of yes/no and multiple-response questions. The sample size was 523 parents with valid questionnaires. Inclusion criteria were being a parent of children aged six months to 10 years and consent to participate. The data were analyzed by the Chi-square test was employed to examine associations between demographic characteristics and parental behaviors and techniques of medication administration. One-third of parents used inappropriate tools to administer liquid medications to their children. When children resisted medication, 49.3% of parents insisted on administering it, 10.7% mixed it with milk or other drink, 5.2% mixed it with food, and 9.2% dissolved solid forms in water or another drink. Additionally, 9.4% of parents admitted to giving doses higher than prescribed, trying to achieve rapid recovery. Furthermore, 82.0% of the parents engaged in self-medication of children, mostly with antipyretics (86.4%) but also with antibiotics (2.5%). We concluded that knowledge of the correct practices for administering oral medication to children was inadequate. It is suggested to develop educational programs for parents on correct practices.

Introduction

Children are often the focus of medical attention due to their need for specialized healthcare. Compared to adults, children are more vulnerable when receiving medication. Due to their developmental characteristics, including the incomplete development of important systems related to drug pharmacokinetics, medication use in children requires careful consideration and close monitoring [1]. Previous studies have shown a high incidence of medication errors in children, which can lead to significant medications-related problems, which puts them at a higher risk of death than older patients, as the medication might be tolerated by adults but cause significant damage in children [1, 2]. It has been reported that children are frequently rushed to emergency rooms or admitted to hospitals due to unintentional medication errors, often resulting from caregivers' lack of knowledge about their

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children's medications. Such errors can occur during home administration, whether due to mistakes in the administration process or incorrect dosing and timing [3, 4]. Parents are dedicated to ensuring their children's well-being, but they often lack the necessary knowledge about prescription medications. Accurate medication delivery requires precise calculations based on the child's weight and age, the use of appropriate measuring tools, and strict adherence to prescribed dosing intervals. Failing to follow these guidelines can result in adverse health consequences [5-7]. For example, ibuprofen is widely recognized as safe for use in children, with the risk of adverse effects generally being lower compared to adults. When adverse reactions do occur, they are typically related to incorrect dosing or pre-existing medical conditions, rather than to the medication itself [8]. Conversely, administering insufficient doses of acetaminophen to children with fever can lead to prolonged symptoms [9]. A child's acceptance of medication can be influenced by various factors, including taste, which in turn impacts the parents' ability to administer the treatment [10]. Parents often attempt various methods to handle the issue, such as mixing the medication with food or drink [11]. The absorption of medications can be affected by certain foods, which may lead to medication failure [12]. Moreover, parents who use a diverse array of self-care therapies for their children often face significant risks. While many self-care methods such as over-the-counter remedies and alternative treatments can offer benefits, their safety and efficacy are not always well-established. Without proper guidance, parents may inadvertently misuse these therapies, leading to potential adverse effects. Additionally, the use of unregulated or poorly understood treatments can interact negatively with prescribed medications, complicating the child's health situation. Misjudgments in dosage or treatment choice can result in harmful side effects, delayed diagnosis of serious conditions, or ineffective management of existing health issues [13-15]. Ensuring that self-care approaches are evidence-based and complement medical advice is crucial to avoid these risks and safeguard the child's health [16]. Parental knowledge plays a crucial role in ensuring medication safety; improving education about proper medication use can significantly reduce incidents of misuse. Thus, reviewing various studies on pediatric medication administration reveals a gap in knowledge of the specific challenges and barriers faced in Libya. Understanding the existing knowledge base is essential for enhancing medication safety. This study aimed to determine parents' administration practices and the challenges they face in administering oral medicines to children in Libya, as well as the self-care therapies they use for their children.

Materials and methods

S*tudy setting and design*: This cross-sectional study was based on an online questionnaire shared via social media platforms using the snowball effect for recruiting participants between February and May 2024 in Libya. The selection criteria were parents with children aged from six months to ten years. *Sample size:* The sample size of 385 was calculated using Raosoft software for a confidence level of 95% and a 5.0% margin of error, using 50% population proportion. However, to increase the accuracy of the results, 653 responses were collected. Only participants who provided informed consent were allowed to complete the questionnaire. Participants who did not meet the inclusion criteria or who did not fully complete the questionnaire were subsequently excluded from the study. The questionnaire included a planted question intended to be skipped, and participants who answered this question were excluded. Ultimately, 523 participants were included in the survey.

Data collection: Data were collected through an online self-administered questionnaire consisting of 20 questions adapted from previous studies [17, 18] and constructed in Google Forms. The five-part questionnaire was divided as follows: **Part I** had questions about sociodemographic information (gender, age, residence, occupational status, educational level, monthly income, and number of children aged between six months and ten years). **Part II** gathered information about medication practices, including who was responsible for administering medication at

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home, what was done when the child resisted taking solid or liquid dosage forms, and the source of information about the medications given to the child. **Part III** focused on the child, with questions about whether the child had difficulties swallowing medication and whether such difficulties were discussed with a physician. **Part IV** collected information about practices, including the tool used for giving the child liquid medications, whether the child was given a dose higher than prescribed in an attempt to treat them more quickly, whether the timing of medication administration was recorded, and what was done with any remaining medicine when the child had recovered. **Part V** gathered information about self-care therapies used by parents for their children, including whether the child was given medications without prescription, the types of medications used, and whether the medications insert was read. All parts of the questionnaire consisted of yes/no or multiple-response questions. Ethically, electronic informed consent was obtained from all the participants at the beginning of the questionnaire, before any survey questions were presented. Participant confidentiality was strictly maintained.

Statistical analysis: The data were coded, categorized, and entered into Statistical Package for the Social Sciences (SPSS version 26). The sociodemographic and clinical data are presented as frequencies. The Chi-square test was used to find the association between demographic characteristics and parental behaviors and techniques for administering oral medication to children. A $p \leq 0.05$ was considered significant.

Results

Sample characteristics: A total of 653 responses were collected, of which 523 were valid with a response rate of 80.0%. **Table 1** shows that 43.2% of the participants were aged 25-34 years. Mothers constituted the majority of parents (95.0%), most of the responses (76.9 %) were from the Eastern region of Libya, and 75.9% of the respondents had university education or higher. 74.6% of the women were unemployed.

Table 1: Demographic information of the parents

Characteristic	Item	Frequency	Percentage
Gender	Male	26	05.0
	Female	497	95.0
Age (years)	<25	170	32.5
	25-34	226	43.2
	35-45	94	18.0
	>45	33	06.3
Residence	Eastern part of Libya	402	76.9
	The Northwestern part of Libya	112	21.4
	The Southwestern part of Libya	09	01.7
Number of children aged between six months and ten years	1	163	31. 2
	2	171	32.7
	≥3	189	36.1
Participants' educational level	Not educated	03	06.0
	Below High School	06	01.1
	High School or Equivalent	82	15.7
	Bachelor's Degree or Equivalent	397	75.9
	Advanced postgraduate degrees	35	06.7
Father's employment	Non employed	34	06.5
	Employed with a medical background	43	08.2
	Employed with a nonmedical background	446	85.3
Mother employment	Not employed	390	74.6
	Employed with a medical background	52	09.9
	Employed with a nonmedical background	81	15.5
Income level of the family	<2000 Libyan dinars	183	35.0
	2000-4000	183	35
	>4000	37	07.1
	Prefer not to answer	120	22.9

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Oral medication administration at home and how children respond: Mothers represented 54.9% of those responsible for medication administration at home (**Table 2**). When asked about their children's acceptance of oral medicines, 52.0% reported that their children refused to take solid dosage forms. To overcome the problem, 9.2% of them resorted to dissolving or dispersing them in water or other drink. Additionally, 98.9% of parents reported that they tried to give their children liquid medications. When the child refused, 49.3% of parents forced them to take it, and 10.7% of them mixed it with milk or other drinks. Moreover, 42.6% of parents obtained information about the medication from their physicians, while 56.6% relied on other sources (**Table 2**).

Table 2: Oral medication administration at home and acceptance behaviors of Libyan children

Variable	Frequency	Percentage
Is the person responsible for medication administration at home?		
Father	10	01.9%
Mother	287	54.9%
Father & mother	213	40.7%
Others	13	02.5%
What did they do when the child refused to take solid dosage forms of medications?		
Dissolve in water or another drink	48	09.2%
Crush capsule	06	01.1%
Open capsule	02	00.4%
Mix with food	10	01.9%
Mix with milk	09	01.7%
Request another form	145	27.7%
Stop medications	06	01.1%
Multiple practices	46	08.8%
NA*	251	48.0%
What did they do when the child refused to take liquid medications?		
Force child	258	49.3%
Mix with milk or another drink	56	10.7%
Mix with food	06	01.1%
Stop medicine	09	01.7%
Multiple practices	188	35.9%
Not applicable	06	01.1%
What is their source of medication information?		
Physician	223	42.6%
Pharmacist	04	00.8%
Others	296	56.6%

*__NA:__ Children do not refuse to take pills or parents have never given them pills before

Swallowing problems during the administration of oral medications: Almost two-thirds of the participants (64.1%) reported that their children have had difficulties swallowing oral medications. Of those who reported swallowing problems, 89.6% discussed the problem with their physicians (**Table 3**).

Table 3: Swallowing problems during the administration of oral medications

Variable	Frequency	Percentage
Have your child ever complained of swallowing difficulty?		
Yes	335	64.1%
Never	188	35.9%
Have you consulted a doctor about swallowing problem?		
Yes	300	89.6%
No	35	10.4%

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Parents' practices during oral medication administration: Almost half of the parents (45.5%) used a syringe to administer oral liquid medications, but other tools were also used. 9.4% of the parents reported that they gave medications in doses higher than prescribed by the doctor to treat their children more quickly. The majority (88.9%) reported that they tracked the time of medication. Less than half (44.2%) said that they disposed of the leftover medicine when the child had recovered, and 39.4% kept it for later use (**Table 4**).

Parents' practices during oral medication administration: Almost half of the parents (45.5%) used a syringe to administer oral liquid medications, but other tools were also used (**Table 4**).

Table 4: Parents' practices during the administration of oral medications

Variable	Frequency	Percentage
What tools do you use when giving your child medication in syrup form?		
Measuring cup accompanying medicine	111	21.2%
Syringe	238	45.5%
Other tools	174	33.3%
Have you ever given your child a dose higher than prescribed by a doctor to hasten their recovery?		
Yes	49	09.4%
No	474	90.6%
Do you keep track of the times you give your child medication?		
Yes	465	88.9%
No	58	11.1%
What do you do with leftover medication after your child's treatment is complete?		
Keep it for later use	206	39.4%
Dispose of it	231	44.2%
Give it to a relative in case they need it	57	10.9%
Other options	29	05.5%

Types of self-care therapies used by parents for their children: Most of the participants (82.0%) had given their children medications without prescription, 86.7% of whom gave antipyretics (**Table 5**). Medication inserts were read by 86.4% of parents before giving their children medications. The Chi-square test was used to find out the association between parental behaviors and techniques for administering oral medication to children and their demographic characteristics (age, gender, educational level, etc.). The analysis revealed no statistically significant association between these variables ($p>0.05$).

Table 5: Self-therapies used by parents for their Libyan children

Variable	Frequency	Percentage
Types of self-care therapies used by parents for their children		
Antipyretics	372	71.1%
Antibiotics	13	02.5%
Antidiarrheal	1	00.2%
Laxatives	1	00.2%
Medications for what parents consider the common cold	13	02.5%
Cough medications	23	04.4%
Colic medications	3	0.6%
Others	3	0.6%
Do not give medication without a prescription	94	18.0%
Do you read the medication leaflet before giving your child medication?		
Yes	452	86.4%
No	71	13.6%

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Discussion

The current study investigated the challenges parents encounter and the errors they make when giving oral medication to their children at home in Libya. This study identified several issues, including the use of unsuitable tools for measuring and administering medicines, improper handling of leftover medication, inappropriate management of swallowing difficulties, and ineffective methods for addressing a child's refusal to take oral medications, such as mixing medications with food or altering tablet forms. Several factors, including the disagreeable taste of medications, can hinder a child's acceptance of oral medicines, which causes difficulties and stress for parents. Half of the parents reported that their children refuse to take solid dosage forms and almost all of them refuse liquid medication. To overcome these problems, parents resort to different strategies, such as mixing the medication with milk or with their children's favorite food or drink. About 10.0% of the parents tried dissolving tablets in water or other drink, and similarly tried mixing liquid medications with milk or other drinks. This mixing could have adverse effects on the absorption, bioavailability, and serum concentrations of some medicines. Interaction of grapefruit juice with some medications, such as erythromycin and clarithromycin, raises their serum concentrations. At high doses, these medicines have severe side effects, so mixing them with grapefruit juice could be harmful [19]. We found that parents were more adept at managing the situation compared to those reported in a Palestinian study [18]. The current study also found that half of the parents obtained information about the medications they used from sources other than healthcare providers. Relying on non-professional sources for information about children's medication poses significant risks. Such sources, including online forums and unofficial websites, may provide inaccurate or outdated advice, leading to potential dosing errors, ineffective treatment, or harmful medication interactions [20, 21]. Two-thirds of the participants reported that their children have had swallowing difficulties during the administration of oral medication, 10.0% of whom did not discuss the problem with their physicians. Swallowing difficulties in children can complicate oral medication administration, leading to issues such as needing alternative medication forms and the potential occurrence of dosing errors. This often results in missed or inconsistent doses and increased stress for parents. The physician's failure to provide important information to the patient can put the patient at risk. Without professional advice, treatment may be ineffective, and health outcomes can be compromised [22]. Dosing errors in children are common because it needs to be assessed individually based on factors such as age and weight [23-26]. In this study, about one-third of the parents used tools such as tablespoons or teaspoons but did not use syringes or medicine cups, which may result in incorrect doses. A previous study advised against using tablespoons and teaspoons for measuring medicine because they are inaccurate [27]. In addition, about 10.0% of the participating parents gave doses greater than prescribed by the physician to treat their children more quickly, which might in most cases lead to minor side effects, or even to hospitalization or fatality. Efforts must be invested in preventing medication overdoses, which have recently become a leading cause of hospitalization [28]. The current study found that about 10.0% of the participants did not track the times they administered medication, which might lead to a range of risks and potential deleterious consequences. Irregular administration disrupts the medication's therapeutic effect, causing fluctuations in medication levels that may exacerbate symptoms or lead to new health issues. Missed doses due to poor tracking can further compromise the child's treatment regimen, resulting in deterioration of their condition and increased risk of complications [29-31]. Over one-third of participants reported that they keep leftover medication after their child's treatment is complete, and about 10.0% give it to a relative if they need it. Keeping leftover medication or giving it to others poses several risks. Misuse is possible if the medication is used incorrectly or administered to someone else, increasing the risk of harmful side effects and interactions [32, 33]. Additionally, children to whom medications are transferred could have a

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different medical history, which could lead to significant risks and adverse outcomes [34, 35]. Despite all that, the current observations show that parents' practices during the administration of oral medications in Libya are more appropriate than those reported in the UAE [17]. However, an important limitation of this study is the regional bias in the sample. Despite distributing the questionnaire across all Libyan cities, the majority of responses were from the Eastern region, which may restrict the generalizability of the findings to the entire country. Development of educational programs for parents should be implanted on proper medication use and self-medication risks, ensure standardized measuring tools and clear medication labels. Moreover, launch public health campaigns on self-medication, and enact legislation requiring a valid prescription for antibiotics.

Conclusion: Use of inappropriate tools to measure or administer oral medications, mixing medications with food or beverages, children's reluctance to take medication, and self-medication of children are common in Libya. Use of antibiotics without prescription is less common but it can still contribute to antibiotic resistance and ineffective treatment.

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