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KNOWLEDGE AND ABILITY OF MOTHERS LIVING IN A SEMI-URBAN AREA IN SRI LANKA TO ADMINISTER LIQUID MEDICATIONS TO INFANTS AND PRESCHOOL CHILDREN

Chamari Weeraratne*[1], Dinesh Perera[2] and Anupama Annalingam[3]

[1]Specialist Physician & Senior lecturer, Department of Pharmacology, Faculty of Medicine, University of Colombo, Sri Lanka.
[2]Medical officer, North Colombo Teaching Hospital, Ragama, Sri Lanka.
[3]Medical officer, National Hospital, Sri Lanka.

ABSTRACT
Context: Medication errors are common and associated with significant morbidity and mortality. Poor knowledge and inability of mothers to administer liquid medications to children lead to medication errors and poor health outcomes. Aims: Our aim was to evaluate mother's knowledge and ability to administer liquid medications properly. Methods and Material: A descriptive cross sectional study was done involving 99 mothers living in a semi urban area of Sri Lanka. We studied their ability to understand information given in medicine labels and their knowledge regarding selecting suitable devices to measure liquid medicines. Each participant was also asked to measure a dose of liquid medicine to assess ability to measure it accurately. Statistical analysis used: Descriptive statistics such as frequencies, mean, range, and standard deviation were used to describe data. Chi square test was used to determine whether statistically significant associations were present between possession of essential knowledge and possible influencing factors. Results: Only 39 participants (40.6%) had the basic knowledge required to administer liquid medicine. Out of those 39, only 12 participants (12.5%) measured 5 ml dose within no error range. Conclusions: The majority of participant mothers lacked the basic knowledge and skills necessary to administer liquid medicine to children.

Key words: Medication Errors, Liquid Medication, Dosing Devices, Infants, Small Children.

INTRODUCTION

Medication errors have gained much attention in the recent past due to significant morbidity and mortality associated with it. It has been estimated that at least 1.5 million preventable adverse drug events occur in the United States each year while 44000 to 98000 people die in hospitals each year because of medical errors [1, 2]. No national data is available in this regard in Sri Lanka.

Children, particularly neonates and infants, are more vulnerable to have medication errors because of their physiological and pharmacological differences and their dependence on caregivers for administration of medication [3]. Since medical care of many sick children occurs outside of hospital premises, a significant amount of medication errors occur in outpatient settings [4]. Majority of errors occur during drug administration for which parents are predominantly responsible [5].

Liquid preparations of medicines are often used in paediatric population. Correct use includes correct preparation and storage of medication, calculation of the correct dose based on the weight of the child, accurate measurement and administration of the medicine. Caregiver understanding of the instructions given in medicine and prescription labels and correct interpretation of those are essential for correct use. Errors in administration have been found to be common [6, 7]. In fact Li SF, et al. in 2000 reported that more than 50% of children who presented to the paediatric emergency department were given inaccurate doses of paracetamol or ibuprofen by their caregivers [7].

In Sri Lanka mainly mothers are involved in administering medicines to their children. Sufficient studies have not been conducted in Sri Lanka to develop an understanding in this regard to plan and implement necessary corrective measures. Our primary objective was to study the knowledge and ability of mothers living in a semi-urban area of the country in administering liquid

*Corresponding Author :Chamari Lochana Weeraratne E mail: chamariweera@gmail.com

medication to children. This included study of their ability to understand instructions given in medicine labels of liquid medicines, their knowledge on suitable measuring devices, and their ability to measure liquid medicine accurately.

MATERIALS AND METHODS

Ethics statement

Ethics approval was taken from the ethics review committee of faculty of medicine, university of Colombo.

Study design

We carried out a descriptive cross sectional study.

Study setting

The study was carried out at a well-baby clinic where children are followed up after birth for immunization and health status in Ganemulla, a semi-urban area belonging to Gampaha district of Sri Lanka. Data were collected during July and August months of 2013.

Participants/Study population

Mothers who accompanied their children to the well-baby clinic and gave their voluntary consent were included in our study. Women with psychiatric illness, intellectual impairment or physical disabilities were not included in the study since our objective was to study the average caregivers.

Sample size

To determine the true population proportion of mothers who lack the essential knowledge and skills, approximately 96 participants were needed with an expected proportion of 50%, absolute precision of 10 percentage points and confidence level of 95%. We used convenient sampling method. All women who met the criteria to be included as a participant were included in the study until a sample of 96 was completed.

Study variables

We studied four variables in our study.

a) Socio-demographic factors

b) Ability to understand information and instructions given in medicine and prescription labels.

c) Knowledge on suitable measuring devices to measure liquid medications.

d) Ability to measure a dose of liquid medicine accurately.

Socio-demographic data

An interviewer administered questionnaire was used to collect information. Collected data included age, ethnicity, area of residence, education level, occupation and income.

Ability to understand instructions given in medicine and prescription labels.

We gave the participants an oral suspension of amoxicillin (Decamox; manufactured by Kopran limited, India for Ceylinco pharmaceuticals limited, Sri Lanka) in its original container along with a prescription label mentioning to give 5 ml three times daily for 3 days. We asked each participant to tell the generic name of the drug, how to prepare and store it, how to give it to her child and at what times of the day she would give it. Next we gave each participant a bottle of paracetamol syrup (Panadol; manufactured by Glaxo Welcome Ceylon limited, Sri Lanka) in its original packaging and asked how much she would give to a 18 month old child who weighed 8 kg and what would happen if more than the recommended dose and frequency was used. We also questioned them regarding their next move if fever persisted despite giving paracetamol according to what they mentioned earlier.

Knowledge on suitable measuring devices to measure liquid medications

The participants were shown several types of liquid medication measuring devices (tea spoon, table spoon, oral syringe, dosing cup, dropper, and calibrated cup). They were asked to differentiate tea and table spoon and their volumes, their preferred device to measure 5 ml and 3 ml of a liquid medication and their perceived level of accuracy.

Ability to measure a dose of liquid medicine accurately.

We asked participants to measure 5ml of paracetamol using their preferred measuring device. We measured the weight of the volume they measured using an electronic weighing scale and calculated the volume by multiplying it by density. As described in previous studies we took volumes within 20% error range as no-error, 20 to 40% range as small-error and more than 40% as large error for analysis [8-10].

Data analysis

Data were analysed using the SPSS version 18 statistical software. Descriptive statistics such as frequencies, mean, range, and standard deviation were used to describe data. Chi square test was used to determine whether statistically significant associations were present between possession of essential knowledge and possible influencing factors. Essential knowledge and skills that we studied were ability to understand and interpretation instructions on preparation of powder for suspension, administration and storage information, interpretation of the paediatric dosing chart, and accurate measurement of a dose of liquid medicine using a suitable measuring device.

RESULTS

Demographic data

All participants were from Ganemulla area and were Sinhalese. Ages ranged between 19 and 45 years, with a mean of 30.25 and SD of 5.301. Only 18 participants (18.7%) were employed and remaining 78 participants (81.3%) were house wives. Mean number of children was 1.75 while, maximum and SD were 5 and 0.846 respectively. 86 participants (89.6%) had past experience of administering liquid medicine to a child. Educational level and income data are summarized in table 1.

Ability to understand instructions given in medicine and prescription labels

1. Amoxicillin syrup

Only 4 participants (4.2%) were able to identify the generic name of the medicine. All were able to

understand the instructions given in medicine labels regarding the preparation and storage of medicines. However, confusion occurred with regard to the exact time of administration as "three times daily" was interpreted differently by participants. 16 participants (16.7%) said that they will administer 8 hourly while others mentioned dosing intervals ranging from 3 hours to 8 hours.

2. Paracetamol syrup

Calculated paracetamol dose varied from 2 to 10 ml. Only 57 participants (59.37%) were able to mention the correct paracetamol dose of 5 ml. 77 participants (80.2%) mentioned the correct frequency of 6 hourly dosing. Altogether only 48 participants (50%) mentioned the correct dose and frequency. 77 participants (80.2%) said that dose has to be calculated according to body weight. 18 (18.8%) considered age while only one participant (1%) mentioned that dose has to be based on severity of fever. 5 participants (5.2%) said that they will try the calculated paracetamol dose 4 hourly if fever continued despite giving 6 hourly. Calculated paracetamol dose was 8 ml for 2 of those participants. No one mentioned of increasing the dose. All others (94.8%) mentioned consulting a doctor as their next move. 49 participants (51%) were able to detect the warning that excess paracetamol may result in liver damage. As much as 47 participants (49%) didn't pay attention to the warning box.

Knowledge and skills in using suitable measuring devices

Spoon identification

89 participants (92.7%) were able to identify tea spoon and table spoon correctly. Out of those only 41 and 26 participants knew the usual volumes of a tea spoon and table spoon respectively. 10 participants came up with incorrect tea spoon volumes ranging from 2 to 6 ml. Rest accepted that they were not aware.

Preferred device to measure liquid medicines

Participants preferred devices to measure 3 ml and 5 ml of liquid medication are summarized in figure 3. Majority preferred dosing cup to measure both 5 and 3 ml. Out of 79 participants (82.29%) who preferred dosing cup to measure 5 ml, 37 participants (46.83%) mentioned its ease of use as the reason for their preference while 34 (43.03%) mentioned its accuracy in measuring. All 9 participants who preferred tea spoon to measure 5 ml mentioned its ease of use as the reason for their selection.

Perceived accuracy of devices

74 participants (77.1%) considered dosing cup to be the most accurate device to measure 5 ml of a liquid medication. 14 (14.6%), 3 (3.1%) and 5 (5.2%) participants considered oral syringe, tea spoon and dropper to be the most accurate device to measure 5 ml respectively. Altogether 86 participants (89.6%) considered the household spoons (both tea and table spoons) to be the least accurate devices to measure 5 ml of liquid medication.

Liquid medicine measurement

Mean volume measured was 5.92 ml. Minimum volume measured was 3.99 ml and maximum was 7.34 ml. Volume measured with regard to device used is summarized table 2.

Table 1. Education level and Income data of study population

Population	Frequency	Percent
Educational level		
Up to grade 5	2	2.1
Up to GCE ordinary level (Grade 5 to 11)	41	42.7
Up to GCE advance level (Grade 11 to 13)	35	36.5
Higher education	18	18.8
Income (In SLR)		
Less than 10000	1	1.0
10000 – 20000	34	35.4
20000 – 30000	30	31.3
30000 – 50000	24	25.0
More than 50000	7	7.3

Table 2. Actual volume of liquid medicine measured by participants when they were asked to measure 5 ml

Device	Measured Volume, ml			Error category n (%)		
	n	Range	Mean (SD)	No error	Small error	Large error
Dosing cup	79	4.86 – 7.34	6.13 (0.52)	27 (34.18)	48 (60.76)	4 (5.06)
Oral syringe	8	5.29 – 5.70	5.54 (0.17)	8 (100)	0 (0)	0 (0)
Tea spoon	9	3.99 – 5.07	4.42 (0.34)	7 (77.78)	2 (22.22)	0 (0)
Total	96	3.99 – 7.34	5.92 (0.70)	42 (43.75)	50 (52.08)	4 (4.17)

Altogether 42 participants measured 5 ml of liquid medication within a 20% plus or minus range which was accepted to be adequate. 50 participants measured with a small error (20 – 40% range deviation). 4 participants measured with a large error (more than 40% deviation).

Figure 1. Paracetamol dose calculated as suitable for a child weighing 8 Kg by the participants. Correct dose was 5 ml

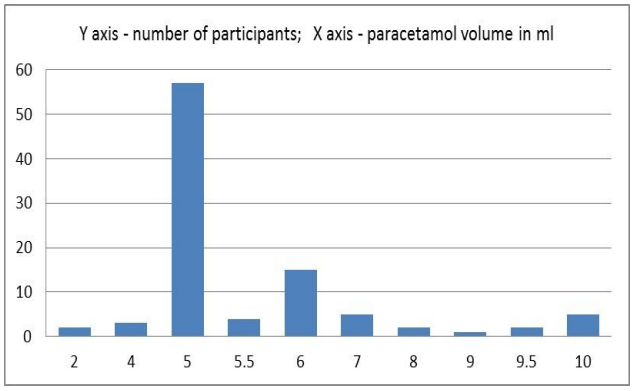


Figure 2. Mentioned frequency of paracetamol administration by mothers

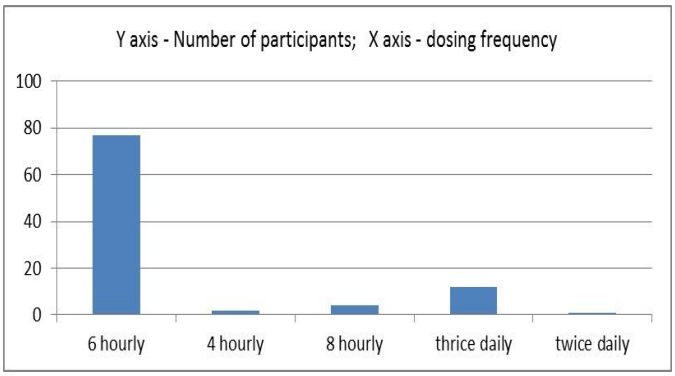
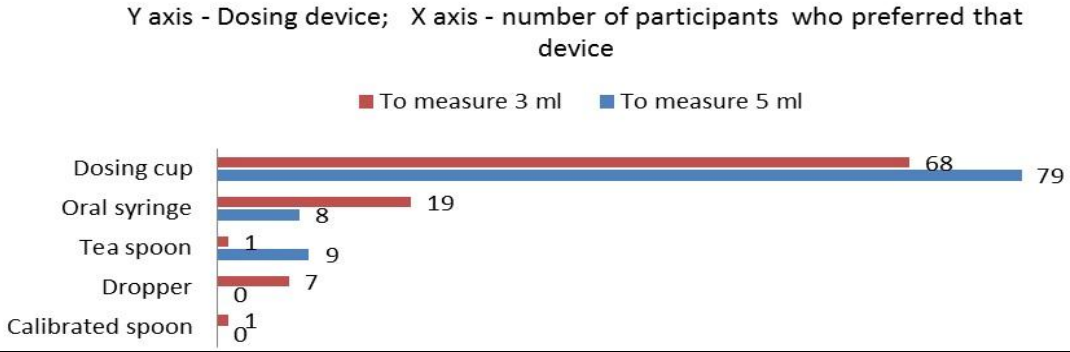


Figure 3. Participants preferred device to measure a dose of liquid medication



Essential knowledge and skills

Altogether only 39 participants (40.6%, 95% CI: 30.87% – 51.15%) had the essential knowledge required to administer liquid medicine avoiding a medication error. Out of those 39, only 12 participants (12.5%, 95 CI: 6.91% – 21.2%) measured 5 ml dose within no error range. Possession of essential knowledge and skills did not significantly differ with level of education, occupation, family income, number of children or past experience of administering liquid medication.

DISCUSSION

Our study findings show that the majority of participants lacked the basic knowledge and skills necessary to administer liquid medicine to children. Only very few of the participants knew the generic name. Even though all participants were able to understand drug preparation and storage instructions, this is of limited value when it comes to local market where majority of the medicine labels and information sheets contain instructions only in English language. It is important for caregivers to understand the instructions given to avoid wrong procedures involved in drug preparation and storage which will result in poor quality drugs with potential harm to the child.

Confusion with regard to exact time of administration has been a known problem [11,12]. We asked them to interpret what was meant by three times a day administration since many practitioners are known to indicate the dosage frequency in this manner even though it is highly inappropriate especially in the case of antibiotics where the frequency of administration should be stated in an unambiguous manner. Clear mentioning of the exact time of administration has been suggested as a possible measure to overcome this [11].

Regarding paracetamol syrup, only 59.37% of participants were able to interpret the paediatric dosing chart accurately and state the correct dose. This became more difficult for our participants as the weight and age of the child we mentioned for that purpose were discordant. Our findings are much better than what Simon HK, et al. found in 1997 [7]. In their study only 40% of caretakers were able to mention the correct dose when child's weight and all package labeling were given. But again in 2000 Diane J, et al. reported that as much as 87% of participants were able to interpret a paediatric dosing chart accurately in their study [13]. Not paying attention to warning boxes was significant. Over the counter medicines such as paracetamol pose a greater risk as they can be purchased without supervision of any healthcare provider. This emphasizes the role of pharmacist and other health care workers role in educating caretakers wherever possible. Accurate measurement of the required dose is essential to prevent both drug under dosage and over dosage since under dosing can lead to therapeutic failure and overdosing can lead to drug toxicity with possible harm to the child. This is more applicable to drugs with narrow therapeutic indexes such as carbamazepine.

In 1975 American academy of paediatrics emphasized the necessity of avoiding teaspoon to measure liquid medicine due to significant dosing errors associated with it and recommended the usage of standardized

measuring devices [14]. However, use of tea spoons and other non-standardized devices to measure liquid medication is still practiced by care givers and this was shown in our study also [13]. This practice has been encouraged by doctors and pharmacists indicating the teaspoon as the measuring unit at times when instructing caregivers.

Studies done in western part of the world have shown oral syringe and dropper to be more accurate in measuring liquid medication [8,13,15]. This was also supported by our study findings in contrast to a recent study done in India which has shown better dosing with the use of dosing cups [10]. Dosing cups have shown to be associated frequently with dosing errors [8, 16]. This was seen in our study too. This is of more importance to our population as majority preferred dosing cup to measure liquid medicine and most of the liquid medicines available in local market come with dosing cups. Even though our study failed to demonstrate a significant association between possession of essential knowledge and skills to administer liquid medication to children and level of education, previous studies have shown liquid medication errors to be associated with care giver level of education and health literacy [8, 10, 13]. There are several limitations to our study. Our study was carried out in a semi urban area where most were with low education and income levels. Results may not be generalizable to the other parts of the country. Secondly our sample was not a random sample and it could have been better if we were able to assess a larger sample. Finally we only assessed the volume measured by the participant. This volume may differ significantly from the actual volume of medicine that child receives.

In Sri Lankan setting it is essential that mothers are equipped with the necessary knowledge and skills to administer liquid medicines accurately to their children. Previous studies have shown the effectiveness of education on decreasing liquid medicine dosing errors [17]. We hope that our study findings will help to increase awareness of health care workers regarding these issues and responsible authorities to plan and implement necessary measures to overcome those.

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