

# Household Teaspoon and Oral Liquid Medication: The Present Scenario

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## ABSTRACT

*Objective* To determine the parental dosing errors in administering oral liquid medication to pediatric population.

*Study design* Cross sectional study.

*Place & Duration of study* Department of Pediatric Surgery Civil Hospital and Pediatric Medicine Lyari General Hospital Karachi, from February 2009 to September 2009.

*Methodology* Parents of children admitted were enrolled in the study. They were asked to measure one teaspoonful (5 ml) of paracetamol syrup from the tray containing household spoons of different sizes. The amount filled by the parents was measured by 5 ml syringe. Accurate dose was defined as 5.0 ml while an acceptable dose was 5.0 + 0.5 ml (4.5 ml - 5.5 ml) according to National Formulary and USP Standards of a + or - of 10 % of error dosage range for oral devices.

*Results* A total of 530 parents participated in the study. The age of the participants ranged from 16 year to 55 year (mean= 28.93 ± 6.6 year). Only 118 (22.3%) participants measured accurate dose while 164 (30.9%) measured the acceptable dose and 366 (69.1%) participants measured inaccurate dose. Accuracy in measuring household teaspoon quantity was not associated with parents' age ( $p > .05$ ), education ( $p > .05$ ), cooking experience ( $p > .05$ ) and previous drug administering experience ( $p > .05$ ).

*Conclusions* Household teaspoons were unreliable when measuring and administering liquid medication to pediatric population. Oral syringe is recommended as the best device for both measuring and delivering liquid medication.

*Key words* Teaspoon, Liquid medication, Pediatric population.

## INTRODUCTION:

Oral drugs are presented in the form of capsules/tablets and syrups. Almost all oral drugs for pediatric age group are available in the liquid formulation. However, administration of liquid medications is more difficult than taking a tablet or capsule. The measuring devices commonly used today include teaspoon, droppers, measuring cups,

dosing syringes and even caps of the bottles. Most commonly used device to measure and deliver the drug is teaspoon. The American Pharmaceutical Association in 1902 and American Medical Association in 1903 defined the "standard teaspoonful" as 5 ml.<sup>1</sup> When liquid medicine is not dispensed with teaspoon, 75 – 80% of parents used a household teaspoon as an alternative to standard teaspoon for drug administration.<sup>2,3</sup>

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Different studies have shown that the capacity of household teaspoon is highly variable leading to dosing error.<sup>2-5</sup> In an observational study it was found that amount of acetaminophen administered using household teaspoon was inaccurate 62% of the time

due to both over and under dosing.<sup>6</sup> High proportion of inaccuracy was also reported in a study from Kuwait in which 93.5% of the mothers measured inadequate dose (= 3.7 ml) of drug with household teaspoon.<sup>7</sup> Madlon Kay and Mosch highlighted the inaccuracies of household teaspoon and emphasized that physicians need to be aware that parents continue to use household teaspoon for measuring oral liquid drugs.<sup>8</sup>

Pediatricians in Pakistan still prescribe dosage using the word teaspoon or its abbreviation. As a result families use household teaspoons of different sizes to administer liquid medication to children, especially when drug is not dispensed with standard teaspoon. This observation was also supported by a pilot study conducted by our department which revealed that 95% of parents used household teaspoon to deliver liquid medication when drug was not dispensed with standard teaspoon. This study was conducted to find out the amount of drug measured by parents /caregivers using household teaspoon and association of their age, education, previous cooking and drug administering experience with amount of the drug measured.

#### METHODOLOGY:

This cross sectional study was conducted at the Department of Pediatric Surgery Civil Hospital and Pediatric Medicine Unit IV, Lyari General Hospital Karachi, from February 2009 to September 2009. In order to calculate sample size we considered  $p=62\%$  (proportion of inadequate dose by parents),<sup>6</sup> 95% confidence level and 4.15% margin of error which yielded total sample size of 526~530. The sample size was calculated using OpenEpi software.

The study was approved by the institutional review board (IRB) of DUHS. Parents of the children who were admitted in two departments during the study period consented to participate in the study. Parents who refused to participate, unable to understand, had no previous experience of giving oral liquid medication or physically handicapped due to visual impairment or having hand tremors were excluded from the study.

After verbal consent parents / caregivers were asked to pick up a teaspoon which they think was appropriate (5 ml spoon) from the tray containing household spoons of different sizes. They were asked to measure one teaspoonful (5 ml) of paracetamol syrup. The amount filled by the parents was measured /calibrated by 5 ml disposable syringe (BD company). Accurate dose was defined as 5.0 ml while an acceptable dose was  $5.0 \pm 0.5$  ml (4.5 ml - 5.5 ml) according to National Formulary

and USP Standards of a + or - of 10 % of error dosage range for oral devices. We divided boundaries of measurement into two groups as follows: acceptable dose (4.5 ml - 5.5ml) and inaccurate dose (<4.5 ml or >5.5 ml)

All analyses were performed using SPSS version 16. Mean and standard deviation was calculated for continuous variable like age and the amount of drug filled. Frequencies and percentages were calculated for categorical data like education, cooking and previous experience of giving drug were recorded. Chi-square test was used to find the association of age, education, cooking and previous experience of giving syrup with the amount of dose filled by parents at 5% level of significance.

#### RESULTS:

A total of 530 women participated in the study and their age ranged from 16 year to 55 year with a mean of  $28.9 \pm 6.6$  year. Majority of the participants (n=311, 58.7%) were in the age group of 21-30 year (table I). The mean volume measured by the parents was  $3.7 \pm 1.2$  ml. Only 118 (22.3%) participants measured accurate dose of 5ml while 164 (30.9 %) participants measured acceptable dose (4.5 ml -5.5 ml, mean  $4.99 \pm 1.4$  ml), whereas 366 (69.1%) participants measured inaccurate dose (<4.5 ml or >5.5 ml) with mean= $3.1 \pm 1.1$  ml (table II). Accuracy in measuring drug using household teaspoon was not significantly associated with participants age ( $p>.05$ ), education ( $p>.05$ ), cooking experience ( $p>.05$ ) and previous drug administering experience of the participants ( $p>.05$ ) (table III).

**Table I: Age Distribution of Study Population**

Age (Year)	n	%
Mean± SD: 28.9 ±6.6 year Range = 16 - 55 year		
<20	56	10.6
21-30	311	58.7
>31	163	30.8

**Table II: Dose Administered By Study Population and Volume Measured (n=530)**

Dose	n (%)	Mean ± SD (ml)
Accurate	118 (22.3%)	$5 \pm 0$
Acceptable	164 (30.9%)	$4.99 \pm 1.4$
Incorrect	366 (69.1%)	$3.1 \pm 1.1$

#### DISCUSSION:

Teaspoon is available in almost every house and is being used as an alternative device to measure and

Table III: Tabulation of Drug Administered With Different Variables (n=530)			
Variables	Teaspoon Quantity		P-Value
	Acceptable	Incorrect	
<b>Age (year)</b>			
<20	14 (2.6%)	42 (7.9%)	0.594
21-30	98 (18.5%)	213 (40.2%)	
>31	52 (9.8%)	111 (20.9%)	
<b>Drug administering experience</b>			
1-3	51 (9.6%)	119 (22.5%)	0.08
4-6	46 (8.7%)	73 (13.80%)	
7-9	19 (3.6%)	68 (12.8%)	
>9	48 (9.1%)	106 (20.0%)	
<b>Cooking experience (year)</b>			
1-3	5 (0.9%)	30 (5.7%)	0.129
4-6	18 (3.40%)	38 (7.2%)	
7-9	26 (4.9%)	45 (8.5%)	
>9	115 (21.7%)	253 (47.7%)	
<b>Education</b>			
No Education	111 (20.9%)	277 (52.3%)	0.14
Primary	21 (4.0%)	38 (7.2%)	
Secondary and above	32 (6.0%)	51 (9.6%)	

administer liquid medication in pediatric patients when drug is dispensed without standard teaspoon.<sup>3,9</sup> Household teaspoon, as an effective device for measuring and administering liquid drug has been questioned since the 1970's.<sup>10,11</sup> Despite its inaccuracies in measuring the liquid drug, household teaspoon has been widely used.<sup>3,8</sup> Studies have shown that the amount measured by household teaspoon is highly variable leading to under dose causing treatment failure on one hand while overdose causing serious adverse effects.<sup>13-15</sup> Overdosing of antibiotics due to the use of household teaspoons may result into emergence of antimicrobial resistance.<sup>9</sup>

The results of index study revealed that mean volume measured by parents was on the lower side in comparison to other studies where reported mean volume was  $4.3 \pm 1.7$  ml and  $5.5 \pm 0.7$  ml.<sup>14,16</sup> In present study mean volume filled by parents was lower than the normal accepted range although less serious than overdosing, but may result in ineffective therapy, drug resistance and unnecessary frequent clinical visits as reported by Bayor MT et al.<sup>14</sup> It was found in present study that the amount of liquid drug

filled by parents ranged from 1 to 8 ml which is in accordance with the finding of other studies that reported considerable variability in the measured volume ranged from 2 ml to 9 ml, 2.5 ml to 7.2 ml and 3 ml to 7 ml.<sup>2,17,18</sup>

It was also found that accuracy in measuring teaspoon quantity was not significantly associated with the parents/caregivers age, education, cooking experience and their previous drug administering experience. Our results are consistent with a study by Parisa et al in which parental dosing errors were not statistically related to their age and education.<sup>19</sup> Dosing and administering medication to pediatric population is difficult in comparison to adults. Pediatric dosages need to be adjusted according to age and body weight. As a result children are considered to be more vulnerable to dosing errors. However the issue of administering liquid medication to children is often under estimated or ignored.<sup>8</sup>

Despite the fact that several studies have reported that household teaspoon is inaccurate liquid drug measuring device, it is continued to be popular among parents/caregivers. This is due to the fact

that majority of physicians in Pakistan prescribe oral liquid medication using the word teaspoon or its abbreviation. In addition to inaccuracies of measurement, the spillage of oral liquid during the administration further reduces the reliability of teaspoons.<sup>14</sup> In this regard calibrated devices as dosing cups, oral droppers and oral syringes have been recommended to measure and administer liquid medication to pediatric population.<sup>9,12,18</sup> The oral syringe is found to be the most convenient and most accurate dosing device.

#### CONCLUSIONS:

Household teaspoons are unreliable when measuring and administering liquid medication to pediatric population. Oral syringe is recommended as the best device for both measuring and delivering liquid medication. Considering the consequences of administering inaccurate dose physician should insist on the use of most appropriate dosing device when prescribing oral liquid medication.

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