

Medication Dispensing Errors in Liquid Dosage Form in Some Iraqi Governorates

Hussam H. Tizkam*, Sana A.-J. Ali, Ghazwan Alhashem, Maher Darwish

Department of pharmacy, AlSafwa University College, Karbala, Iraq

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ABSTRACT

Domestic measures such as a tea spoon (tsp) and a table spoon (tbsp) may be confusing and result in drug dispensing errors that may eventually lead to adverse consequences, especially with drugs with a small therapeutic window. This study investigates the relationship between the unit of measure used, dispensing errors, and whether household devices mediate this relationship. The results manifested that 95% of error was made by parents when measuring the dose intended by the physician. Moreover, 99.4% made an error in measuring the prescribed dose approved by the standards of USP and BP, and 69% used a nonstandard instrument.

It is best to provide standard measures with each liquid drug and avoid using terms like “tablespoon or teaspoon” in patient education as they are confusing terms.

Keywords: Dispensing errors, Dose, Medication error, Tablespoon, Teaspoon.

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INTRODUCTION

A medicinal product (medication) is a product containing a substance with a known biological activity with excipient(s). The active ingredient is commonly a drug, prodrug, or maybe a cellular derivative.¹

Medication errors (ME), as a definition, are any errors in the prescription, dispensing, or administration step of medicine, whether there are side effects or not. ME is the most preventable cause of patient harm.¹ These errors may happen at any time in the medicine use procedure ranging from prescribing administration to the consumer. The ME occurrence may compromise the confidentiality of the patient in the health career. It increases the cost of health care. Economically, such consequences may happen as the award of patient damages, prolonging the patient's stay in the hospital, and the required potential support for long-term health care for patients suffering from a permanent disease.²

The ME may be generally divided into three types. First, prescribing errors are defined as a wrong medicine choice for a particular patient (the dosing, route of administration, dose strength, indication, and quantity). Second, dispensing errors may occur at any stage during the dispensing procedure ranging from the pharmacist-patient. The third type, errors of administration, may be defined as any errors between the medication therapy received by the consumer and the medical

therapy intended by the physician. Medicine administration is joined with one of the most significant risk areas in the practice of nursing.³

The term ‘failure,’ according to the definition, involves setting particular standards against which failure can be decided. All personnel who deal with drugs should achieve or be common with those standards. They should observe protocols ensuring that failure to meet the standards either does not occur or is unlikely. Everyone involved in the medication process holds responsible for their part of the procedure. The ME caused by parent rates is high, with more than 40% making dosing errors involving liquid oral medications.⁴

Household (domestic) tools are a system of measuring devices used in houses for the measurements of volumes and weights. The devices of household measuring volume include tsp., tbsp., and cups. The measured volumes when using the household devices are less precise than using other devices because the measuring tools may vary in shape and size. Actually, domestic volume tools may also be used in pharmacies when dispensing medicines that will be given in the patient's house since patients may not have other measuring tools at the house as in Table 1

The magnitude of viscosity and surface tension of a certain liquid as well as the method of measuring that liquid can affect the real volume given by a spoon.⁵

*Author for Correspondence: tizgam@alsafwa.edu.iq

The therapeutic drug window is the value of medicine dosage that can heal disease efficiently without causing adverse effects. Drugs with a narrow window should be given with caution and control, and frequently estimated drug blood concentration to prevent their toxicity.⁶ Medicines with a small therapeutic window are those with little variation between their toxic and therapeutic doses, involving that little variation in doses or drug interactions with other medicines that might provoke side effects. A narrow drug therapeutic index has been known to be a principal point of visiting the emergency department. A lot of patients admissions to hospitals are severely ill and have situations that can affect the pharmacodynamics and pharmacokinetics of medicines given.⁷

Based on the above, the objectives of this work were to evaluate household measurements as a dispensing tool for liquid dosage form drugs and to compare the theoretical volume of these household measurements in pharmaceutical textbooks with the actual volume intended by the physician and that measured by caregivers.

MATERIALS AND METHODS

This study was a cross-sectional study achieved in five Iraqi governorates; Baghdad, Karbala, Najaf, Diyala, and Basra. Thirty families from each governorate were enrolled in this study, so a total of 150 families were recruited.

In the study, two liquid drugs dosage forms were used: The powder for oral suspension Zithromax® (Pfizer, France. Composition: azithromycin 200 mg/5 mL of suspension) and Bronquium® elixir (Ferrer, Spain. Composition: anhydrous theophylline 1-g, Glyceril guaiacolate 0.6 g/100 mL). Standardized measuring devices used by researchers were a cylinder of 20 mL, a syringe of 5 mL, and dosing cup of 15 mL supplied by the manufacturers of mentioned liquid drugs used. Domestic measuring devices utilized by the parents were kitchen tsp, cup spoon, and tbsp. Photos for some prescriptions were given with the study results to ensure the volume of the dose required by the drug provider or the physician.

In each home, caregivers or parents have been called to measure the intended amount of the medicine utilizing frequently used wards that are familiar by the pharmacist or physician, e.g., one tsp or tbsp after a meal. The volume of each kitchen device utilized by parents was measured by the standard devices in this study and recorded. The initial criteria used for ME were whether the concentration was given within 20% of the correct dose, chosen depending on other studies investigating dose accuracy.⁸⁻¹⁰ Two-tailed P < 0.05 was considered statistically significant.

Table 1: Domestic devices and the comparable values of metric system conversion.

Volume	Weight
1 tps = 5 mL	1 oz = 30 g**
1 tbsp = 15 mL	1 lb = 454 g**
1 fl oz = 30 mL*	

RESULTS AND DISCUSSION

Two kinds of ME were investigated: error in comparison with the standard measurements required by BP or USP and error in comparison with the prescribed dose by a physician. The mean volume of each kitchen tool in every governorate is recorded in Table 2.

This Table 2 reveals the ME in comparison with the dose prescribed (dose given by the physician). Originally, the physician and drug provider intended that kitchen tablespoon (tbsp) would provide 5 mL of liquid dosage form, as presented in Figures 1 (a and b).

While kitchen cup spoon is intended to provide 3 mL liquid dosage form, as presented in Figure 2.

Kitchen tsp is intended to provide 1.5 mL of the liquid dosage form as presented in Figures 3 (a and b).

The ME compared with the prescribed dosing was evaluated by comparing the dose measured by the caregiver or parents with the actual dose prescribed. The caregivers or parents who deviated by more than 20% were regarded as making a ME—this type of error is presented in Table 3.

In spite that there is a statistically significant difference between the prescribed and measured dose in all kitchen measuring tools (*p*-value < 0.0001) but only tbsp regarded as an error dose because it has been deviated > 20% compared to prescribed dose (41.8%) according to Yin HS. *et al*, Kozer E. *et al*, and Simon HK. *et al* which stated that more than twenty per cent deviation in the dose was regarded as error in the dosing.⁸⁻¹⁰

Nearly one-third (31.7%) of parents use the syringe and the measuring cup provided by the manufacturers to measure the prescribed dose. Compared with others who utilized

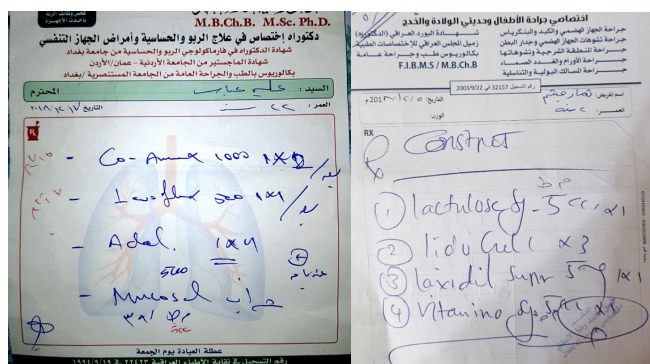


Figure 1: Some prescriptions using tbsp as a dosing tool

Table 2: Volumes recorded by kitchen tools used by caregivers in different Iraqi governorates

Governorate	Kitchen tbsp	Kitchen cup spoon	Kitchen tsp
Baghdad	7.43	3.9	1.59
Karbala	6.88	3.21	1.33
Basra	7.39	2.97	1.45
Diyala	7.3	2.92	1.49
Najaf	6.46	2.89	1.17
Mean ± std.	7.09 ± 0.17	3.18 ± 0.17	1.40 ± 0.02

standardized measures, parents or caregivers which utilized tsp or tbsp were more commonly to make ME in their required dose, which agrees with the fact reported by H. Shonna Yin *et al*,¹¹ who reported also that tsp or tbsp tools may inadvertently endorse the usage of kitchen spoons, which may differ greatly in shape or size, making this more difficult for caregivers or parents to measure the required dosage.

Till now, most individuals find the measurement in tsp and tbsp easier than using measuring tools utilizing milliliters graduates. That is why liquid dosages are supplied with calibrated cups to assist caregivers in equating a Table 3. These results suggest that many caregivers or parents realize how to dose utilizing milliliter tools and that going to a milliliter-preferred system is probably enhances the clarity of dosage instructions, contributing to a decrease in caregiver or parent ME.¹³

When utilizing such a system for dosage measurements, the recommendation is to educate caregivers or patients about the procedure of converting between the household and the metric systems. In many cases, the domestic system will prevail, but in essence, the medicine come measured in either of the other two modes of measurement. That is why the industrial practice insists on telling the variation in milliliters and using a tsp for liquid medications.¹⁴

The second type of error reported is describing the difference between the prescribed dose by the drug provider using domestic measures and that standardized by pharmacopeias, which are presented in Table 4.

As presented in Table 4, there is a 66.6% and 70% deviation in the volume of the two domestic measures evaluated respectively between drug providers and that documented by pharmacopeias. This large deviation may be due to the ignorance of some drug providers by the standard household measures as mentioned by text books¹⁴ or may be due to their previous private evaluation and believes that these domestic measures had not possessed these standard volumes reported in textbooks compared to common social household tools.¹⁵

Table 4 also reveals that the measured tbsp and tsp by the caregiver or parents are far away from the standards by 52 and 72%, respectively. This large deviation is mostly due to the ignorance of most of parents and caregivers in our society in the standard volumes of domestic measures reported by textbooks. In spite of the caregiver or parents may be comfortable utilizing tsp or tbsp tools, caregivers mix up three terms, causing

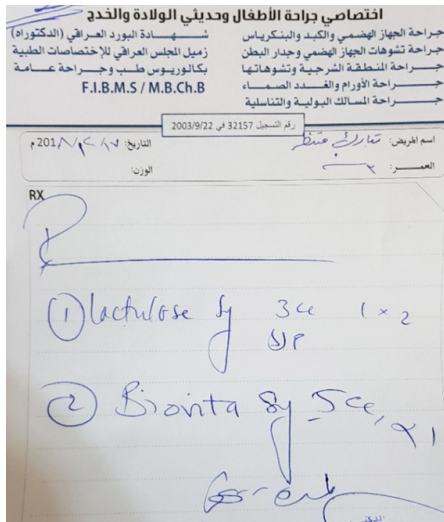


Figure 2: A prescription using a cup spoon as a dosing tool

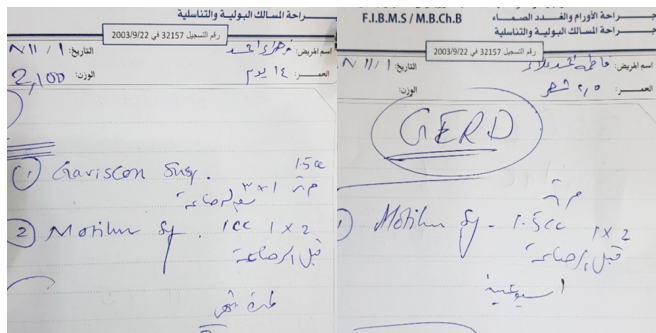


Figure 3: Example of prescriptions utilizing tsp as a dosing measure.

Table 3: Comparisons showing a measured and prescribed doses of liquid dosage form

	tbsp		Cup spoon		Tsp	
	Press. dose	Meas. dose	Press. Dose	Meas. dose	Press. dose	Meas. dose
% Deviation	5 mL	7.09 mL ± 0.17	3 mL	3.18 mL ± 0.17	1.5 ml	1.4 mL ± 0.02
p-value*	41.8%		6%		6.6%	
	<0.0001		<0.0001		<0.0001	

* p-value < 0.05 regarded as significant statistically.

Table 4: The difference between the prescribed dose and measured dose from one side and the standard dose from the other side.

	tbsp			tsp		
	Std.	Press.	Meas.	Std.	Press.	Meas.
%deviation	15 m					L 5 mL 7.1 mL 5 mL 1.5 mL 1.4 mL
		66.6%	52.6%		70%	72%

threefold errors (1 tsp = 5mL, 1 tbsp = 15 mL). One person only who represents 0.6% of the population study measured 15 ml by measuring cup when he was asked to give a Table spoonful liquid dosage form, and then it was reported that he was a physician parent.¹⁵

CONCLUSION

The parent usage of kitchen tsp or tbsp tools was joined with higher ME than when standard measuring units were used solely, especially since the Iraqi houses have many different kitchen spoons.

Travel to a standard measurement tool may enhance the safe usage of pediatric liquid drugs between groups at certain risk for misunderstanding medicine instructions, e.g., those patients with a low level of education.

There is misunderstanding and ignorance of the standard domestic measures reported in pharmacopeias by caregivers and drug providers.

A move to a standard measuring system (such as measuring cups and milliliter units) is probably to enhance the clarity of dose instructions, contributing to a decrease in parent ME.

Support of a growing national initiative to eliminate tsp and tbsp terms would decrease the complexity of calculations of the prescription dose, in addition to decreasing confusion occurred by these terms to the caregivers.

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