

Variability in the Volume of Teaspoons Used to Administer Chloroquine Syrup in Homes in Dar-es-Salaam

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Forty five teaspoons used to administer medicines were collected from homes in Dar-es Salaam and their volumes determined. Teaspoons varied in sizes and so were the volumes of chloroquine syrup administered. The mean volume of the teaspoons was found to be 5.2 ml. However the range was 1.7 - 9.1 ml. Although the sample mean and the standard mean showed no significant difference, the variation is likely to affect treatment of malaria as the clinician always assumes a standard teaspoon of 5 ml is used to administer chloroquine syrup.

Key Words: Chloroquine, syrup, teaspoon.

INTRODUCTION

Malaria remains as much a scourge as ever. Of the four species of Plasmodium which infect man, it is *P. falciparum*, with which we have most problems [1]. In Africa malaria is responsible for 30 - 50% of fever cases, 30% of outpatient consultation and 10 - 15% of hospital admissions. Globally, about 1.5 - 2.7 million persons die from malaria every year [2]. Among the communicable diseases occurring in Tanzania, malaria is by far the commonest and ranks high as a cause of morbidity and mortality. Hospital based data show that 10 - 15% of all outpatient attendance are due to malaria [1]. Malaria is responsible for more than 100,00 deaths in this country per year [3]. Unfortunately it seems very likely that, over the next two decades the trend is likely to worsen under the influence of global warming and we shall, indeed count ourselves lucky if we can hold mortality figures as they are today, let alone reduce them [4].

Resistance to chloroquine although known and documented is generally isolated and probably insignificant. In fact chloroquine resistance is probably greatly over-estimated [5]. Some of the reasons for overestimating resistance are confounding factors such as, non-compliance, inadequate drug administration, drug interaction etc. In one study, 1350 patients suffering from malaria were studied. Of these 96% received chloroquine. The results of this study showed that only 7% received the correct dose of chloroquine, 42% were under-dosed and a 51% were overdosed [6].

A significant proportion of children and adults with symptomatic malaria go on to develop a severe or fatal illness, mostly cerebral malaria, severe anaemia and metabolic acidosis. It is appropriate therefore to concentrate the limited resources trying to serve this group.

The prescribing habits of paediatrician in Muhimbili Medical Centre are based on mg/kg body weight. However the directions given to patients by pharmacists are with reference to a standard 5ml teaspoon as stated

on the labels of chloroquine syrups. The purpose of this investigation was to document how use of non-specific household teaspoons contributes to administration of incorrect chloroquine dose.

MATERIALS AND METHODS

This study was meant to assess the availability of appropriate measuring facilities in people's homes. Two hundred children attending the paediatric clinic in Muhimbili Medical Centre were selected. Of these, 72 children attending the clinic for the same complaint, three times or more in a period of two weeks were short-listed for the study. The purpose of the study was to collect the household teaspoons used to administer medicines. Out of the 72 children, 27 mothers used a standard 5 ml teaspoon, a calibrated 5 ml syringe or a calibrated medicine cup, hence these were excluded from further consideration. The remaining 45 mothers agreed to exchange the teaspoons they used to administer medicines for a standard calibrated 5 ml cup. For each teaspoon, the volume, in ml, was determined. The procedure was simple and involved filling a burette with chloroquine syrups from different manufacturers and noting the initial burette reading. The syrup was then released slowly down into the teaspoon until it was full. The final burette reading was then recorded. The procedure was repeated three times for each teaspoon and the mean volume recorded. The chloroquine base corresponding to the appropriate volumes were calculated and so were the deviations from the standard 5 ml teaspoonful.

RESULTS

Table 1 shows data for 24 teaspoons (54.8% of total) where the determined volume was less than the standard 5ml. Table 2 shows data for 21 teaspoons (45.2%) where the determined volume was more than 5ml. The total volume ($n=45$) was found to be 233 ml, thus giving a mean of 5.27 ml. There was no significant difference between sample mean and standard mean ($p<:0.05$). However, the range was 2.2 to 9.8 ml.

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Considering spoon No.1 as an example (table 1), for age group 7 - 11 years according to the label specification, the treatment regimen is as follows: Day 1: six teaspoonfuls; Day 2: six teaspoonfuls; Day 3: three teaspoonfuls; Day 4: three teaspoonfuls. The chloroquine base deficit for the first and second day is 156 mg, while for the third and fourth day is 78 mg. The total chloroquine base lost during the whole course of treatment amounts to 234 mg. This accounts for 26% loss of chloroquine base.

Similarly considering spoon No.1 (table 2) for age group 7 - 11 years. The total chloroquine base gained in the whole course of treatment is 306 mg. This accounts for 34% over and above the normal dose.

TABLE 1 : Volume of teaspoons measuring below 5ml and corresponding chloroquine base

Spoon No.	Volume (ml)	Chloroquine base (mg)	Deficit mg. CQ. base
1	3.7	37	13
2	4.7	47	3
3	3.7	37	13
4	4.3	43	7
5	4.6	46	4
6	3.9	39	11
7	3.5	35	15
8	1.7	17	23
9	4.0	40	10
10	4.8	48	2
11	4.2	42	8
12	4.6	46	6
13	4.2	42	8
14	4.5	45	5
15	4.7	47	3
16	3.7	37	13
17	4.3	43	7
18	4.5	45	5
19	4.9	49	1
20	3.5	35	15
21	4.9	49	1
22	4.5	45	5
23	4.6	46	4
24	4.0	40	10

TABLE 2 : Volume of teaspoons measuring above 5ml and corresponding chloroquine base

Spoon No.	Volume (ml)	Chloroquine (mg)	Excess mg. CQ base/spoon
1	6.7	67	17
2	9.1	91	41
3	6.2	62	12
4	5.4	54	4
5	6.2	62	12
6	5.3	53	3
7	5.3	53	3
8	6.3	63	13
9	6.9	69	19
10	6.2	62	12
11	5.7	57	7
12	5.2	52	2
13	7.5	75	25
14	5.7	57	7
15	8.0	80	30
16	6.9	69	19
17	5.8	58	8
18	6.8	68	18
19	5.2	52	2
20	5.6	56	6
21	6.7	67	17

DISCUSSION

The results of this study show that there is no significant difference between teaspoons available on the market and those used in the homes. The study also shows that there is no significant difference between sample mean and standard mean of teaspoons available in the homes. This is probably why local manufacturers do not include a standard 5 ml teaspoon. However, the range is 1.7 ml to 9.1 ml. (33 mg less than a standard 5 ml and 41 mg more). None of the 45 teaspoons measured 5 ml which is stated on the label. All of the locally manufactured chloroquine and some of the imported ones did not come with a standard 5ml teaspoon. In another study, Howard reported capacities of household teaspoons to vary from 3 ml to 7 ml. For this reason, for household purposes, an American standard teaspoon has been established by the American National Institute as containing 4.93 + 0.24 ml [7]. There is a great variation in the volumes of teaspoons used in households imported or manufactured in Tanzania. Consequently, teaspoons available in the homes are not suitable for use in measuring volumes of chloroquine syrups and other liquid preparations. The variability in doses increases when a suspension is used due to the effect of air bubbles [8]. This study has established a base for the Pharmacy Board to Institute conditions requiring that all liquid preparations locally made or imported should include a standard 5 ml/2.5 ml teaspoon or measuring cup. Alternatively, the Tanzania bureau of weights and measures should define standards and look for ways to deal with this problem.

REFERENCES

- [1] National Malaria Control Programme, Ministry of Health, (1990) Plan of Operation 1990-1995.
- [2] Africa Health, 19 (1997) 21 - 24.
- [3] WHO - Ministry of Health (Tanzania) Conference on Malaria at the British Council Office, Dar es Salaam, Tanzania, 1997.
- [4] Winstanly P. J. Pharmacol. (Supp 2)49 1997 17 - 19
- [5] Rallason P.V. J. Pharmacol. (Suppl 2) 49 1997 13 - 16.
- [6] Kabati, C.I.A. and Rajan, S. Unpublished observations.
- [7] Mitchell J. Stoklosa and Howard C. Ansel.; (Eds). Pharmaceutical Calculations 10 Ed. Williams and Wilkins pg. 59.
- [8] Steinhausen, K.F., Chambuso, M.H.S., Kabati, C.I.A., Otto, R. and Temu, M.J. Unpublished observation.