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Research Article

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Quality status of brands of chloroquine tablet dosage form from Northern part of Nigeria

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ABSTRACT

Quality of anti-malarial drugs in malaria endemic countries needs more attention than ever before due to increased circulation of substandard drugs in the society. In this study, physicochemical quality parameter test of common brands of chloroquine tablet dosage forms obtained from Northern part of Nigeria was evaluated using appropriate methods. The level of non-compliance with respect to registration with NAFDAC and manufacturer's address, weight variation, friability, hardness and disintegration are 12.5%, 12.5%, 71.43%, 28.57% and 0% respectively. The results indicated gross quality failure of all the quality parameters analyzed, therefore there is urgent need to prompt for action in order to arrest the situation, otherwise the region and the country as whole is at risk. This study serves as a litmus test for drug quality condition for the entire country.

Key words: Anti-malaria, chloroquine, quality, Northern Nigeria.

INTRODUCTION

Malaria is one of the parasitic diseases which have attracted much attention in Nigeria and other countries of the World due to its public health challenges. The escalation of the disease burden has risen to approximately 500 million cases of clinical visit to health care system and over million reported cases of death per annum [1]. The inconsistency of the trends of mortality due to the disease in Nigeria between 1983 to 1990 has led to setting of malaria technical committee by the Federal ministry of health in order to review the situation and come up with suggestion, ideas and initiate moves for the control of the disease in Nigeria [2].

However, various efforts through different approaches has been made as a means of curtailing the disease, one of which is sustenance of quality drugs in the health care system and the society through quality monitoring as a check to sub-standard and counterfeit drug products. This is expedient because several studies of essential drugs obtained from Nigerian market indicated high prevalence of sub-standard products with more than 50% anti-malarial drug identified as non-compliance with respect t o BP specifications [3], [4], [12].

In view of the aforementioned problems, physicochemical and other related quality parameters of the oral dosage form are important to study. The official and unofficial tests used as part of quality control measures includes physical appearance, hardness, friability, weight variation, content uniformity and disintegration time, dissolution and percentage content test [5], [6], [7].

Chloroquine phosphate is a 4-aminoquinoline compound with IUPAC name 7-chloro-4-{[4-(diethyl amino)-1-methylebutyl] amino]} quinoline phosphate (1:2). It is use for oral administration for treatment of acute attack of malarial caused by parasite of *Plasmodium vivax, P.ovale P.malariae* and susceptible strain of *P.falciparum* [8]. The structural formula of the chloroquine base is as shown in the figure A below

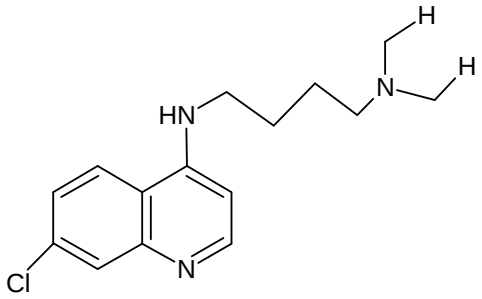

Figure A: chemical structure of chloroquine

In this study, identified brands of chloroquine phosphate tablets were obtained from patent and pharmaceutical medicine stores from northern part of Nigeria and investigated for some quality parameters in order to generate baseline data for the drug brand from the study area.

EXPERIMENTAL SECTION

Materials/reagents

Analytical weighing balance (Shimadzu, Model AUW220), Erweka friabilator (Model 66939), Erweka Hardness Tester (Gmbh Model 65770), Erweka disintegration Apparatus, Spatula, Glass wares of appropriate sizes and ultra-pure distilled water.

Sampling and sample size

Five different brands of chloroquine tablet dosage forms were identified in the three Northern region of Nigeria and sampled randomly by purchasing from both patent medicine stores and pharmaceutical shops. The total number of eight samples was obtained and used for the study.

Weight variation

Twenty (20) tablets from each brand were pooled randomly and weighed together and the average weight was determined. The tablets were weighed individually where the deviation of the weight from the average weight of a tablet were calculated. The percentage deviation of each tablet from the average tablet weight were calculated and compared with the required standards [9], [6], [3]

Friability test

The pre-weighed (Wo) twenty tablets was placed in friabilator (Erweka) and subjected to 100 revolutions for four minutes and re-weighed (W1) where the percentage weight loss was obtained using the relation; Friability,

$$F = 100X\frac{W0-W1}{W0}.$$

Hardness test

The tablets hardness (crushing strength) test was performed on ten tablets using hardness tester (Schleuniger Model 2E) and the values was recorded in kg/cm^3 units [10].

Disintegration test

The disintegration test was performed by agitating six (6) numbers of tablets in a water medium maintained at a temperature of 36 $\pm 2^0$C which was used as the immersion fluid where the disintegration time was recorded. International Pharmacopeia [9] stated that, the accepted disintegration time of tablet in dosage form should not exceed 15 minutes, unless otherwise stated in the individual monograph

RESULTS AND DISCUSSION

Table1: Details of commercial chloroquine tablet samples used in this study

Assigned code:	Location	Dose	man./expiry date	NAFDAC No.	country of origin
FT	Pharm. store	400mg	06/2011-04/2016	registered	Nigeria
QM1	Pharm. store	250mg	10/2011-09/2015	registered	Nigeria
QM2	Pharm. store	250mg	01/2013-12/2015	registered	Nigeria
SA1	Patent store	250mg	09/2012-08/2015	registered	Nigeria
SA2	Patent store	250mg	09/2012-08/2015	registered	Nigeria
EL	Pharm. store	250mg	10/2010-09/2014	registered	Nigeria
CP1	Patent store	250mg	05/2011-05/2014	registered	Nigeria
CP2	Patent store	250mg	05/2013-04/2016	Not registered*	Not indicated*

Table 2: Physical/organoleptic properties

Assigned code:	physical appearance	Taste
FT	whitish capsulated powder	Intensely bitter
QM1	white round tablet	Intensely bitter
QM2	white round tablet	Intensely bitter
SA1	milky white round tablet	lightly bitter
SA2	milky white round tablet	lightly bitter
EL	milky white round tablet	Intensely bitter
CP1	white round tablet	slightly bitter
CP2	white round tablet	slightly bitter

The results of pharmacopoeial and non-pharmacopoeial test of all chloroquine brands involved in the study are presented in Table 1 and 2 and Figure 1 to 4 respectively. Sample identity requirement were met by sample QM1, QM2, SA1, SA2, EL, CP1 and FT while CP2 could not due to lack of indication of manufacturers' address and NAFDAC registration number, this therefore placed CP2 as a suspected counterfeit drug since its identity was not fully given (Table 1). The physical and the organoleptic properties indicated all the samples to possess the properties of chloroquine (Table 2).

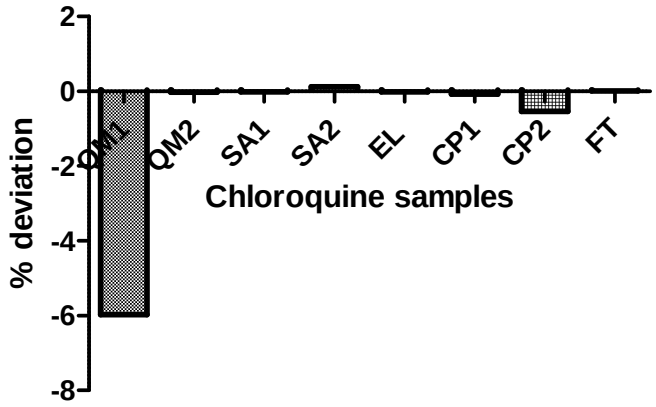

Figure 1: % deviation of tablet weights of the samples

Weight variation is a significant pharmacopoeial test which served as a check to ensure that tablets in each batch are within acceptable size range. In this study, sample QM2, SA1, SA2, EL, CP1, CP2 and FT satisfied requirement for uniformity of weight, while sample QM1 failed BP 1998 specified requirement (>5%) for percentage deviation of tablet weight shown in Figure 1 above.

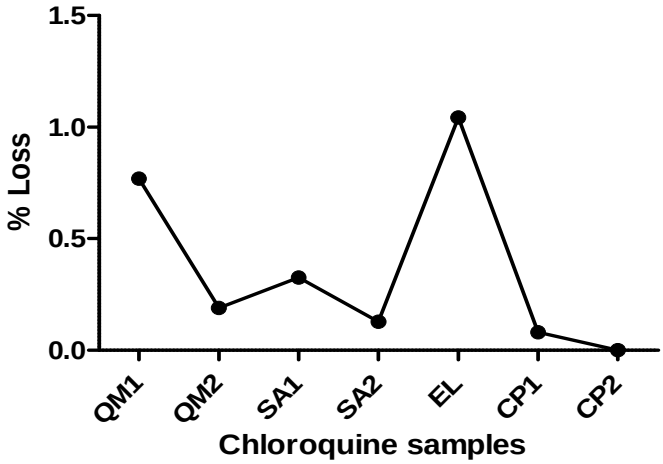

Figure 2: Friability pattern of chloroquine phosphate

Friability is a physical property test which is also related to tablet hardness, the test measure percentage weight loss of tablet as it encounters abrasion during transportation and other handling process. The result of this test is given above in Table 3 and the plot of percentage loss versus the samples' brands is shown in Figure 2. The percentage weight loss obtained from sample QM1, QM2, CP1, CP2, SA1, SA2 and EL ranged from 0 to 1.04%. Sample SA2, QM1 and EL falls outside the specified level of acceptability (0.5-1.0%) therefore they are referred to as noncompliance, while QM2, CP1, CP2 SA1 and SA2 complied with the standard.

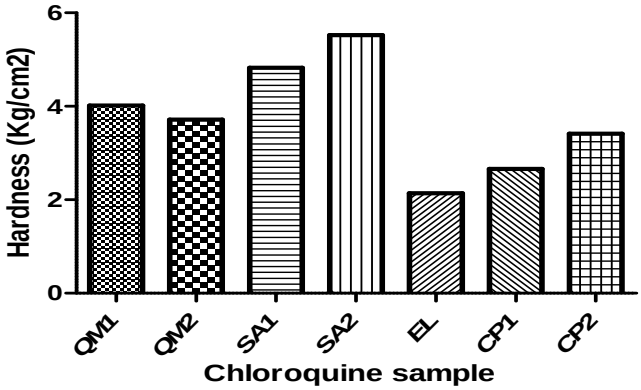

Figure 3: Hardness (Crushing strength)

Tablet hardness test which is also known as crushing strength is a non pharmacopoeial test, but industrial practice generally considers 4kg as minimum [11]. The test evaluates tablets' ability to chipping or breakage during transportation, storage and consumer's handling. Results obtained from the study are QM (3.71-4.02kg/cm^2), SA (4.81-4.52 kg/cm^2), EL (2.14 kg/cm^2) and CP (2.67-3.41 kg/cm^2) which was plotted as Figure 3.The increasing order of crushing strength of the brands are EL <CP <QM <SA. The strength requires for crushing SA was beyond the specified acceptable limit; therefore the brand failed this test and failure due to increase in hardness can alter the drug disintegration/dissolution and absorption rate by the body system. The test was not performed on sample FT because it's in capsule form.

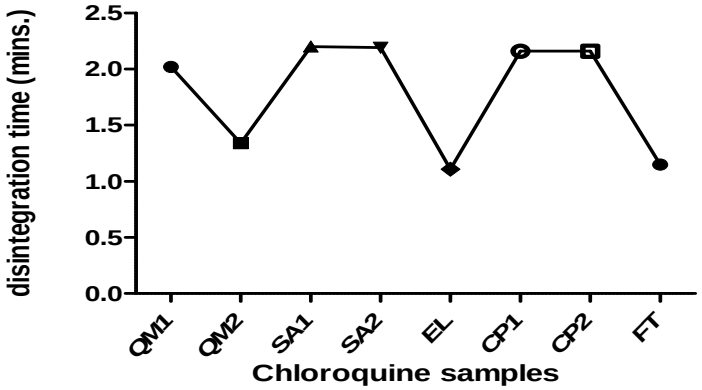

Figure 4: Disintegration profile

Disintegration test is a measure of time required for the tablet to disintegrate into particles. It is a rate-determining step in the process of drug absorption and also a necessary condition for drug dissolution. The results obtained indicated the range of disintegration time for all the chloroquine brands as 1.11 to 2.20 minutes, with 100% compliance with respect to BP 1998 specified pharmacopoeial requirement (≤15minutes). The disintegration of SA and CP follow the similar pattern while QM1, EL and FT follow different pattern. This indicated QM, EL and FT have shorter disintegration time compared to SA and CP brands as shown in Figure 4.

CONCLUSION

The outcome of the study indicated gross quality failure of the various chloroquine brands obtained from the northern part of Nigeria. There is therefore need for Government to intensify efforts in making sure that only quality drugs are in circulation and also devise different strategies of enlightenment programs which can be closer to the people. This is because majority of people still believed that chloroquine can meet their need for malaria treatment. This could be due its cheap cost, familiarity, accessibility, effectiveness or the economic status of most of the users of this drug.

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