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Assessment of Cadmium, Chromium and Lead in Some Common Anti-Malaria Drugs in Ibadan North Local Government Area, Ibadan, Oyo State, Nigeria.

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Abstract: *Elemental impurities levels in drug products should be controlled within acceptable limits since they do not have any therapeutic use. Concentration of cadmium, chromium, and lead was determined in ten(10) common anti-malaria drugs in Ibadan North local government area of Ibadan, Oyo state, Nigeria, using Atomic Absorption Spectroscopy. It was discovered that chromium was highest in the drugs in the range 0.011ppm and 0.025 ppm followed by lead which was found to be between 0.004 ppm and 0.018 ppm, cadmium concentration was least, and it was between 0.001 ppm and0.013 ppm. The result obtained showed that, these drugs are safe for use as regards their trace metals levels since the concentration of each metal determined was below 1ts permisible level.*

Keywords: *Anti-malaria, Drugs, Heavy metal, Diseases, Atomic absorption spectroscopy*

I. Introduction

Malaria infection is an important tropical mosquito borne infectious disease that kills approximately three million per year (Ogbonna et al., 2008). The emergence and spread across sub-Saharan Africa of *plasmodium falciparum* resistance among others to the inexpensive anti-malaria chloroquine and sultadoxine-perimethanine have worsen the pandemic and hampered the socioeconomic development of affected countries (Simba et al., 2004). The four major drug classes currently used to treat malaria include quinoline-related compounds, antifolates, artemisinin derivatives, and antimicrobials. No single drug that can eradicate all forms of the parasite's life cycle has been discovered or manufactured yet. Therefore, 1 or more classes of drugs often are given at the same time to combat malarial infection synergistically. Treatment regimens are dependent on the geographic location of infection, the likely *Plasmodium* species, and the severity of disease presentation(Thomas, 2015).

Impurities in pharmaceutical products are of great concern not only due to the inherent toxicity of certain contaminants, but also due to the adverse effect that contaminants may have on drug stability and shelf-life (Grégory, 2015). Elemental impurities in drug products may arise from several sources; they may be residual catalysts that were added intentionally in synthesis or may be present as impurities (e.g., through interactions with processing equipment or container/closure systems or by being present in components of the drug product). Because elemental impurities do not provide any therapeutic benefit to the patient, their levels in the drug product should be controlled within acceptable limits (ICH, 2015). So, it is critical to ascertain the level of metal impurities in drugs and keep them within the permissible level.

Heavy metals such as iron, copper, chromium and zinc are essential for metabolic activities, but become toxic at higher concentrations. Heavy metals such as lead (Pb), cadmium (Cd) and mercury (Hg) are natural constituents of the environment like air, water, and soil. They are produced from anthropogenic activities and have gained importance as contaminants. They have no beneficial role in living organisms, but are very toxic to humans. They are only tolerated at extremely low concentrations and excesses are associated with many adverse health effects (Rai et al., 2001; Emami *et al*., 2005; ATSDR, 2007; Castro-González and Méndez-Armenta, 2008).

Cadmium has shown to be genotoxic, but not mutagenic and has been acknowledged as a human carcinogen (IARC, 2012). Cadmium and cadmium compounds cause cancer of the lung. Also, positive associations have been observed between exposure to cadmium and cadmium compounds and cancer of the kidney and of the prostate (ICH,2015). Evidence from numerous epidemiologic studies assessing inhalation exposures to cadmium via both occupational and environmental routes has demonstrated an increased risk of developing cancer (primarily lung) that correlates with inhalation exposure to cadmium (ICH, 2015; NTP, 1995). In humans and animals, exposure to lead may cause neurological, reproductive, developmental, immune, cardiovascular and renal health effects. In general, sensitivity to lead toxicity is greater when there is exposure in utero and in children compared to adults (ICH, 2015). Adverse neurobehavioral effects are considered to be the most sensitive and most relevant endpoint in humans after oral exposure. Data from

epidemiological studies show that blood lead levels <5 μg/dL may be associated with neurobehavioral deficits in children (NTP, 2012). Thus, cadmium, chromium and lead concentration in ten different anti-malaria drugs commonly used for the treatment of malaria in Ibadan north local government area of Ibadan, Oyo state, Nigeria was determined. This is important to know the safety level of these drugs for human use.

II. Materials and Methods

2.1 Sample collection

The drugs samples (labelled A to J) used were purchased from local pharmacy in Ibadan north local government area of Ibadan, Oyo State, Nigeria. The drugs were carefully selected to give a good representation of each of the drug samples.

2.2 Sample preparation

Each of the drug samples was ground into fine powdery form using mortar and pestle. 1g of each powdered drug was weighed and dissolved in 10 ml of distilled water in which none of the metals analyzed was detected in a digestion flask. 5ml each of concentrated hydrochloric and concentrated nitric acid was measured and added to the dissolved solution in the digestion flask and boiled until a clear solution was obtained. It was allowed to cool and then filtered into a 100ml standard volumetric flask. The filtrate was made up to the volume with the distilled water.

2.3 Heavy Metal Analysis

Perkin Elmer A Analyst 200 Atomic Absorption Spectrophotometer was used for the analysis

III. Result

The result of the heavy metal analysis in the anti-malaria drugs is presented in the table below.

Table 3. 1: Heavy Metal Concentration In The Anti-Malaria Drugs Analyzed.

Drug ID	Cd (ppm)	Cr(ppm)	Pb(ppm)
A	0.004	0.018	0.011
B	0.008	0.025	0.018
C	0.003	0.013	0.004
D	0.006	0.016	0.014
E	0.001	0.015	0.005
F	0.004	0.011	0.007
G	0.009	0.025	0.009
H	0.011	0.022	0.016
I	0.002	0.013	0.009
J	0.013	0.021	0.012

IV. Discussion

The anti-malaria drug samples analysed showed different heavy metal compositions. Cadmium level was between 0.01 and 0.013mg/kg in all. Chromium was found to be between 0.11 and 0.025mg/kg, while lead concentration in all the samples falls within 0.004 and 0.018mg/kg. The result of this study reveals that the concentration of the metal analysed were within the permissible level for each of the metals, 0.5ppm for both lead and cadmium, and 30ppm for chromium, even though ATSDR says; there is no save limit for lead. The result was close to that of the work done by Bilal *et al.,* 2015, who estimated toxic heavy metals in Unani drug Majoon-e-Dabeed-ul-Ward, which has strong anti-oxidant, anti- inflammatory and hepatoprotective effects. Lead was not detected and cadmium concentration(0.006ppm) was below the permissible limit. Muhammad *et al.,* 2013, also evaluated essential trace and toxic heavy metals in 31 crude drugs commonly used in Khyber Pukhtonkhawa and found lead to be in excess in four of the samples and twelve out of thirty one was within the permissible limit of chromium.

V. Conclusion

This study revealed that the level of heavy metals contained in the anti-malaria drugs analyzed cannot disrupt the metabolism of human body system. It can thus be concluded that these anti-malaria drugs analysed are safe for human use. In view of the findings, regulatory bodies in Nigeria (NAFDAC) should make standardization and quality control of drugs a matter of utmost priority and also intensify effort on pharmaco-vigilance activities.

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