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RESEARCH PAPER

HISTOLOGICAL CHANGES IN THE HEART OF RATS FED DIET CONTAINING MONDIA WHITEI

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ABSTRACT

This study investigates the effects of *Mondia Whitei* on the heart of rats. Sixteen adult Wistar rats (151.67 ± 2.89 grams) were involved. They were divided into four groups: a control (A) and three test groups (B, C and D). For 3 weeks, group A (control) received normal feed (growers mash), while test groups B, C, and D, received graded doses of *Mondia Whitei* (4.5; 9.0; and 13.5g respectively) in feed daily. Histological investigations revealed that *Mondia Whitei* induced severe fibrillolytic changes with pale staining hypertrophic myofibres, extensive myocardial necrosis, inflamatory cell infiltration, and oedema, in a dosage-duration-dependent manner. These results suggest therefore, that *Mondia Whitei* has cardio-toxicity potentials and as such, there is a need to regulate the inclusion of *Mondia Whitei* in consumable products.

Keywords: Mondia whitei, cardiac infarction, cardio-toxicity, myocardial necrosis.

INTRODUCTION

Mondia whitei is medicinally used throughout the regions of its distribution in tropical Africa (Agea et al., 2008). It is an aromatic plant of the *Periplocaceae* family (Watcho et al., 2005), and commonly known as *Isirigun* among the Yoruba ethnic group of Nigeria. The roots have a pronounced vanilla-like odour and tastes like a mixture of liquorice and ginger (Burkill et al., 1997; Mlangeni*et al*., 2006). Phytochemically, *Mondia whitei* contains steroids, teriterpenes (a mixture of α-amyrine and β-acetate, lupeol, idβ-sitosterol, and β—sitosterol glucosldehydeide) and aromatic compounds (2-hydroxyl-4methoxybenzaldehyde, 3-hydroxy-4-methoxy benza, and 4-hydroxy-3-methoxy-benzaldehyde), glucose, and polyholosides (Watcho et al., 2006). Other constituents include Zinc, Iron, Calcium, Magnesium and Vitamins (A, D and K) (Patnam*et al*., 2005).

Of interest, is the fact that several scientific studies have documented the use of *Mondia whitei* in the treatment of malaria, sexual weakness, premature ejaculation and increased sperm production (Asthenia) (Noumi et al., 1998; Burkill et al., 1997; Watcho et al., 2004; 2006; Lampioa et al., 2008; Venter et al., 2009; Sumalatha et al., 2010); as well as the treatment of urinary tract infection, jaundice, headache and diarrhea (Adjanohoun et al., 1996; Noumi et al., 1998). It has also been reported that *Mondia whitei* is traditionally used as an aphrodisiac, for appetite stimulation and in the treatment of stomach pain, body pain, indigestion, gastrointestinal disorders, gonorrhea, post-partum bleeding, pediatric asthma and vomiting (Gundidza et al., 2009).

However, there is paucity of information on the effect of *Mondia whitei* on several other biological and/or physiological parameters. Judging by the potentials of its active components therefore, this histological study investigates the effects of *Mondia Whitei* on the heart of rats.

MATERIALS AND METHODS

Experimental animals and grouping: Sixteen adult male Wister rats of comparable weight (151.67 ± 2.89 grams) and sizes were used for this study. They were procured from the animal farm of the Department of Physiology, College of Medicine, Ambrose Alli University, Ekpoma, and moved to the experimental site where they were housed in well ventilated wooden cages.

They were assigned into four groups; a control group (A) and three test groups (B, C and D). The rats were allowed to acclimatize for two weeks, during which they were fed *ad libitum* with water and Feed (growers mash from Bendel Feeds and Flour Mills, Ewu, Edo State, Nigeria.

Study duration: This study lasted for five weeks (2weeks for animal-acclimatization and 3 weeks for animal-treatment). During the 5-week period, the animals were fed and monitored between the hours of 8:00am – 12:00 pm.

Substance of study: The roots of *Mondia whitei* were obtained from a local market in Alimosho, Lagos – Nigeria, and authenticated at the Department of Botany, Faculty of Natural Sciences, Ambrose Alli University, Ekpoma, Edo-Nigeria.

Substance preparation and administration: The roots of *Mondia whitei* were sun-dried for seven days after cutting the roots into pieces to increase its surface area. The dried roots were subsequently pounded in local mortar and finally grinded into fine powder using an electric blending machine. Measurement of the fine powder was carried out using an electric balance (Denver Company USA 200398. 1REV. CXP-3000) in the diagnostic Laboratory of the Department of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Nigeria. The measured quantities were packed in small plastic bags and stored separately in a dry glass containers pending usage.

For the purpose of this study, feed-pellets were produced by sprinkling water into specific quantities of feed and *Mondia whitei* powder (in grams) to form a semi-solid paste. The resultant paste was then split into bits and allowed to dry under the sun.

Substance Administration: After acclimatization, each of the experimental groups received as follows: Group A (Control) received 100g of feed (growers mash) only. Group B received 95.5g of feed plus 4.5g of *Mondia whitei*. Group C received 91.0g of feed plus 9.0g of *Mondia whitei*, while group D received 86.5g of the feed plus 13.5g of *Mondia whitei*.

Sample collection: At the end of each week, 4 rats from each of the groups were sacrificed using chloroform administered via the nasal cavity as an anaesthetic. Dissection was performed to harvest the heart which was immediately fixed in 10% formal saline.

For descriptive purposes, the test group animals sacrificed at the end of week one designated as B1-D1 rats, while B2-D2 and B3 - D3 represents rats sacrificed at the end of week two and three respectively.

RESULTS

Acute toxicity evaluation: No animal death occurred during treatment with *Mondia Whitei indicating* no toxicity. There were no differences in appearance, fur discoloration, diarrhea, bloody stool, constipation, anorexia, dehydration, and environmentally related changes in the rats.

The results obtained on the effect of graded doses of *Mondia whitei* on the histology of the heart are presented in a summarized table as shown in table 1.

Table 1.0: Summarized result table, showing histological findings and microscopic observations.

Group	Treatment	Duration	Histological findings
A; Control	Normal feed		Normal
B	(B1) 4.5 mg test material + normal feeds	Week 1	Interstitial haemorrhage/oedema and infarction.
	(B2) 9.0 mg test material + normal feeds		Pale staining hypertrophic fibres.
	(B3) 13.0 mg test material + normal feeds		Haemorrhage, extensive myocardial necrosis and inflamatory cell infiltration
C	(C1) 4.5 mg test material + normal feeds	Week 2	Pale staining myocardium with the presence of sparse inflamatory cells and focal edema
	(C2) 9.0 mg test material + normal feeds		Haemorrhage/oedema with severe parenchymal damage.
	(C3) 13.0 mg test material + normal feeds		Severe fibrillolysis, oedema and severe parenchyma damage.
D	(D1) 4.5 mg test material + normal feeds	Week 3	Hypertrophy (H), cellular infiltrates (C) and fibrous necrosis (FN).
	(D2) 9.0 mg test material + normal feeds		Oedematous fibrillolysis with infarctions (I).
	(D3) 13.0 mg test material + normal feeds		Oedematous fibrillolysis (OC) with parenchyma erosion (PE).

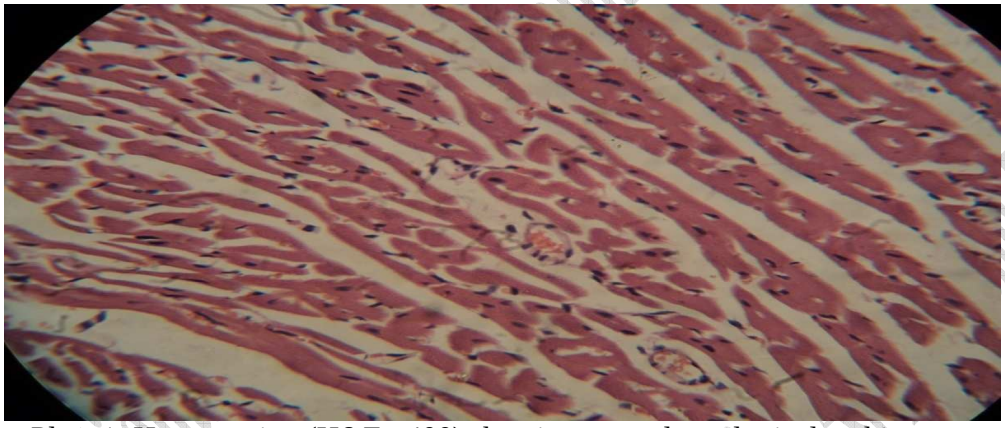

Plate 1: Heart section (H&E x400) showing normal cytological architecture

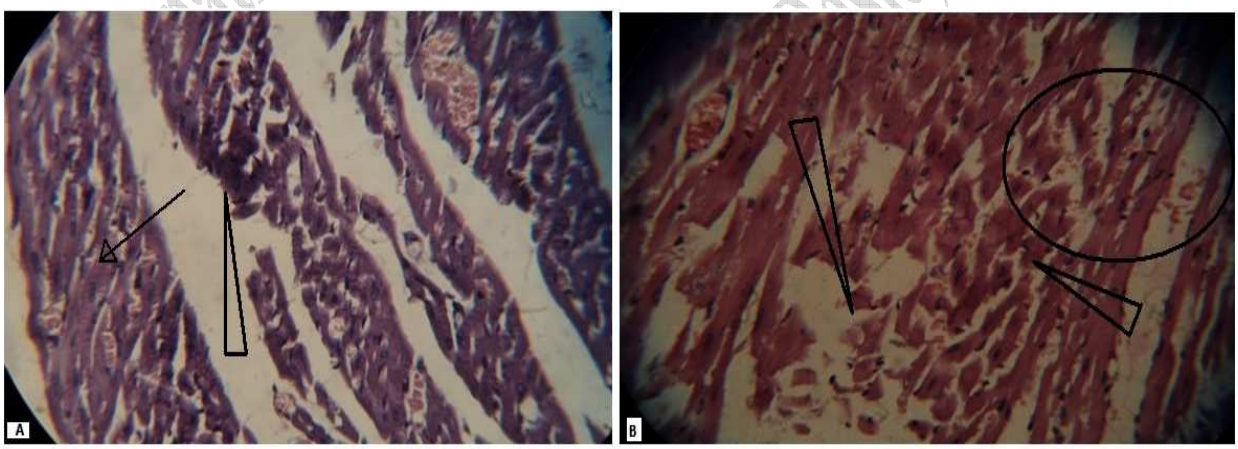

Plate 2 (A & B): Heart section (H&E x400) showing pale staining hypertrophic fibres (A; line arrow) as well as haemorrhage (B; encircled), extensive myocardial necrosis (A&B; triangular tips) and inflamatory cell infiltrations (B)

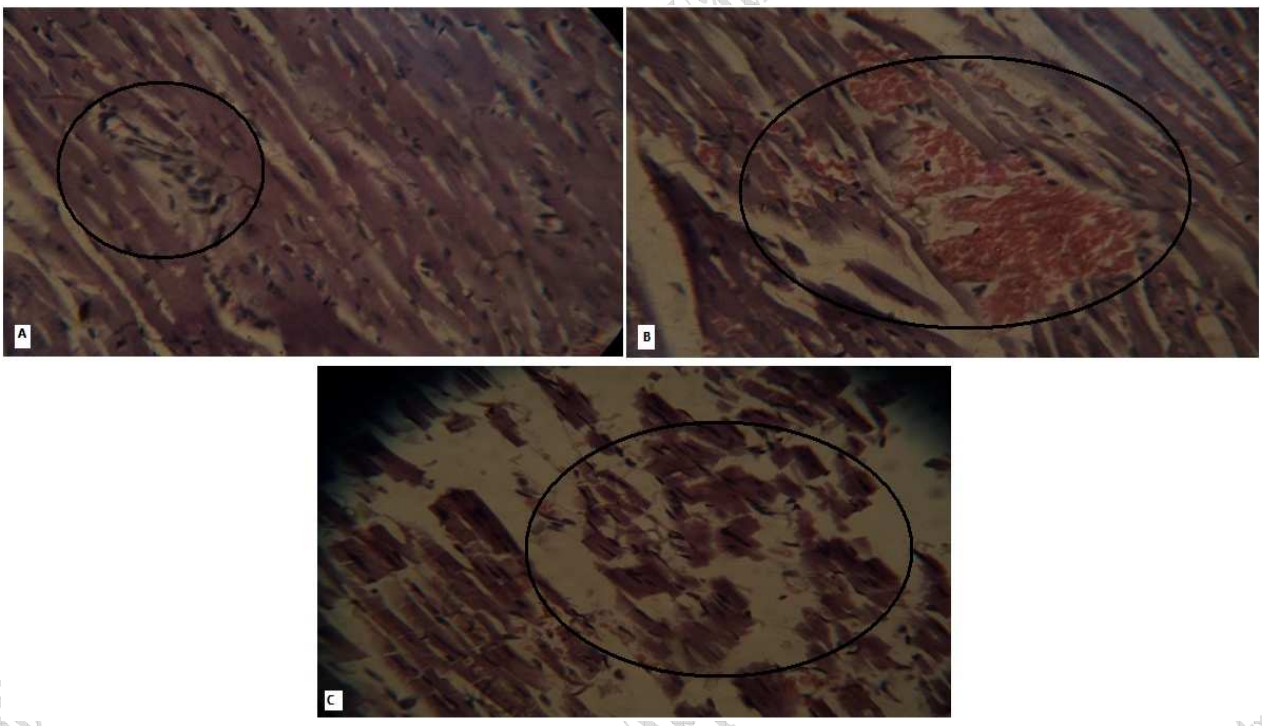

Plate 2 (A, B, & C): Heart section (H &E x 400) showing pale staining myocardium with the presence of sparse inflamatory cells and focal edema (A; encircled); haemorrhage and oedema (B; encircled), and severe fibrillolysis with oedema and severe parenchyma damage (C; encircled).

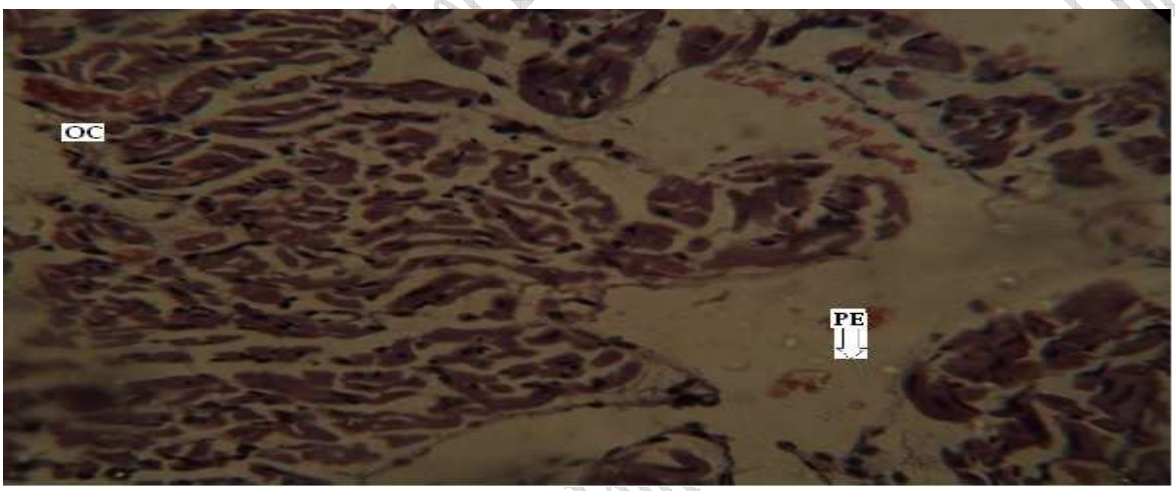

Plate D3: Heart section (H and E X 400) showing oedematous fibrillolysis (OC) with parenchyma erosion (PE).

DISCUSSION

Judging by the results of this study, it could be inferred that the observed pathological changes implicates the active chemical components of *Mondia whitei*. In fact, the volatile oil of the roots has been reported to cause inflammation and reddening of the skin as well as mucous membranes irritation (Patnam*et al*., 2005). Also, the pharmacologically active glycosides in *Mondia whitei*, has been reported to cause hallucinations, allergic reactions and an irregular heart beat (Wisegeek, 2012) especially in higher doses. These reports gives insight into what might have caused the observed extensive severe parenchymal tissue changes that included cardiac muscle hypertrophy, myocardial necrosis, inflamatory cell infiltration and oedema, in the *Mondia whitei* treated rat tissue sections.

Although the mechanism of action for *Mondia whitei* as regards the observed changes remains uncertain, there are however, known mechanisms for cardiotoxic substances and these includes free radical induced myocardial injury, lipid peroxidization (Myers et al., 1977), mitochondria damage (Bier and Jaenke, 1976), decreased activity of Na^+ K^+ATPase (Geetha and Devi, 1992), vasoactive amine release (Bristow et al., 1980), impairment in myocardial adrenergic signalling/regulation, increase in serum total cholesterol, tryglyceride, and low density lipoproteins (Ilskowic and Singal, 1997). The associated generation of reactive oxygen species like superoxide anion and hydrogen peroxide has been reported to cause impairment of cell functioning and cytolysis (Daoud, 1992), and due to the presence of less developed antioxidant defence mechanisms, heart is particularly vulnerable to reactive oxygen specie-induced injury. Moreover, the liberation of free has been reported to be central to the mechanism of action for substances inducing cardiac damage (Poternsky et al., 2006) for instance, cardio-myopathy and heart failure (Hanaa, 2005).

Our findings therefore suggest that *Mondia whitei* has cardiotoxic potentials particularly in higher doses and that the observed effects become more pronounced as the dosage and duration of treatment increases. As such, there is a need to regulate the inclusion of *Mondia Whitei* in consumable products.

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AUTHOR(S) CONTRIBUTION

Okon AU, Bankole JK, Eneasato, AP., Ezeah, GA. and Bankole SO., actively took part in the daily animal care and substance administration. Bankole JK, provided necessary assistance for the histological processing.