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Haematological Effects of Aqueous Extracts of *Geigeria alata* in Male Albino Rats

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Abstract: The indigenous medicinal plants in Sudan form an important component of the natural wealth of the country. The effects of oral administration of *Geigeria alata* aqueous extract at doses 500, 1000, and 1500 mg/kg body weight on haematological profiles in male albino rats was investigated in this research work. Albino rat animals were divided into four groups of 6 animals each. Group1: control, Group 2, 3 and 4 were administrated orally by 500, 1000 and 1500 mg/kg body weight, plant extracts respectively, throughout the experiment which contained for consecutive 14 days. The blood parameters measured were: haemoglobin (Hb), Packed Cell Volume (PCV), Red Blood Cells (RBC), White Blood Cells (WBC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC), Lymphocytes and Neutrophils, Lymphocytes and Neutrophils, plant extract after 14 days did not produce any significant change ($P < 0.05$) on haemotological parameters tested, relative to their respective control. Significant changes were noted in body weights of rats treated with 1500 mg/kg body weight after 14 days, relative to Control Group. Sub-acute toxicity studies in rats showed that no mortality was recorded in any of the groups even at 1500 mg/kg body weight dose.

K**eywords:** *Geigeria alata,* Haematology, Aqueous Extracts, Albino Rats

Introduction:

Medicinal plants have a long history of use by human beings for cure of various ailments. Since the advent of modern allopathic medicine, the use of traditional medicine declined to a

considerable extent. However, in recent years, traditional medicine has made a comeback for a variety of reasons including side-effects and toxicity of modern synthetic drugs, evolution of multi-drug resistance microorganisms and the inability of modern medicine to find effective cures for a number of diseases, important drugs introduced from plants include the anti-cancer drugs vinblastine and taxon, as well as the anti-malarial drug artemisinin (Mohammed *et al*., 2010).

Geigeria alata (DC.) Oliv. etHiern. (syn. *Diplostemma alatum* DC.) Local name: Gud-gad is an herbaceous, dicotyledonous, aromatic plant belonging to the Asteraceae family, distributed in northern and central Sudan in sandy lowland plains. *G. alata* is a glabrous, erect, branched, annual herb, up to 1 m high with stems three-winged. The leaves opposite, sessile and lanceolate. The inflorescence heads are clustered at the fork of branches. The fruits are pale-green cypsela (EL-Kamali, 2001). *G. alata* has been widely used by many localities in Central Sudan in diabetes, cough, epilepsy and intestinal complaints, antispasmodic and as anti-hypertensive (El-Kamali, 2001, *Dimitrina et al., 2016), antispasmodic and as antihypertensive (EL-Kamali, 2001, EL-Ghazali et al., 1994, 1997).*

Trans-3,5-dicaffeoylquinic acid (3,5-diCQA) was isolated from *G. alata* roots and its anti-hypeglycemic, antioxidant and antihypertensive effects on chemically-induced diabetic spontaneously hypertensive rats (SHRs) supported the traditional use of *G. alata* for the management of diabetes (Bozhanaet *et al*., 2019). The oil shows moderate in vitro cytotoxicity and weak anti-HIV activity (Elegami *et al*., 2006, Ross *et al.*, 1997). *G. alata* also showed strong antioxidant and α-glycosidase inhibitory activities. (Ahmed *et al*., 2018). GC/ms chromatogram of ethanol extract of *G. alata* showed the presence of 29 compounds (Yousef, 2019). The anti-diabetic activity of *G. alata*is is due to enhanced insulin secretion, modulation of β-cell function, and improvement of antioxidant status (Hafizur *et al*., 2012). The plant rich in tannins, this plant is highly promising to be used in cancer therapy and antioxidant treatments (EL-Shikh, 2020).

The objectives of this research work is to assess the Haemotological haemoglobin (Hb), packed cell volume (PCV), Red Blood Cell (RBC), White Blood Cell (WBC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC), Lymphocytes and

Neutrophils) of aqueous extract of *Geigeria alata* whole plant at concentrations 500, 1000 and 1500 mg/kg body weight in albino rats when administrated for 14 days.

Materials and Methods:

Plant material:

Gegeria alata herb was obtained from North Kordufan (Umruwaba) Sudan, in March 2019. The plant herb cleaned, shade dried and powered by grinder.

Experimental Design:

Twenty four male albino rats were housed in the premises of the Department of Microbiology, Faculty of Veterinary Medicine, Khartoum University, with feed and water provided ad libitum. The rats were taken random on four groups, each of 6 rats, group one continued to be fed the normal diet and used as control, group two, three and four were given at 500mg/Kg/day, 1000mg/Kg/day and 1500mg/Kg/day via the oral route respectively. All rats were dosed their designated experimental oral doses for 2 weeks. Average, body weight and body weight gain for each group were recorded after two weeks. Blood samples were collected at slaughter.

Hematological parameters:

Haemoglobin (Hb), packed cell (PCV), Red Blood cell (RBC), White Blood cell (WBC), differential WBC counts, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) were determined.

Methods

Preparation of plant extracts

These methods were performed as described by (Geulei, 1982). 100g, of the powdered plant were extracted with petroleum ether (60-80 °C for 2 hrs) in a soxhlet apparatus. The petroleum ether extract was evaporated by a Buchi Rotary evaporator under reduced pressure. The air-dried plant extract material was, repacked in soxhlet and then extracted with distilled water for 2hr. The extract was similarly evaporated exhaustively, air dried and yield was recorded in a cover flask for about 18 hours. In a conical flask, the plant residues were further extracted with distilled water over night at room temperature (25-30 °C), filtered and freeze dried.

Hematological methods

These techniques were preformed according an Automated Hematology Analyzer (Human GambH, max-planck-Ring21, D-65205 wiesbaden). The Human GambH processes approximately 60 samples/hour and are displayed on LCD screen, the particle distribution

curves of WBC, RBC, differential WBC counts and platelets count along with data of other parameters.

CD Analyzer detection method

Blood sample is aspirated, measured to determine volume, diluted at specified ratio, with transducer use. The transducer chamber has minute hole called the aperture, on both sides of it, there are electrodes between which direct current flows. Blood cell suspended and diluted sample passes through the aperture causing direct current resistant to change between the electrodes as direct resistance changes, the blood size is detected as electric pulses. The parameters measured were Hb, PCV, RBC, WBC, differential WBC counts and erythrocyte series, MCV, MCH and MCHC.

Results and Discussion

Results:

Body Weight Changes

Table (1) shows body weight and body weight gain of rats given daily oral doses of aqueous extract of *G. alata* herb at 500 mg/kg/day, 1000 mg/kg/day and 1500 mg/kg/day for group 2, 3 and 4 respectively for two weeks. The value of body weight analysis in (Group 4) was changed in weight compared to the control and other Groups.

Hematological parameters

The hematological effects of aqueous extract of *G. alata* was evaluated in male albino rats during 14 days administration of plant extract at 500 mg/kg/day body weight, 1000 mg/kg/day body weight and 1500 mg/kg/day body weight. Parameters evaluated include Hb, RBC, PCV, MCV, MCH, MCHC, WBC, Lymphocytes and neutrophils. The results of hematological Parameters are reported in table 2. Treatment of rats (Group2) with 500mg/kg/day body weight of plant extract after 14 days did not produce any significant change ($P<0.05$) on all hematological Parameters tested, relative to their respective control. Administration of 1000 mg/kg/day body weight of plant extract after 14 days did not produce any significant change ($P<0.05$) on all blood parameters tested except (PCV) value relative to their respective control. The effect of *G. alata* extract (1500 mg/kg/day body weight) on hematological parameters in male albino rats shows no significant difference ($P<0.05$) between the control group of the treated group for HB, RBC, PCV, MCV, MCH, MCHC, WBC, Lymphocytes and Neutrophils on 14 days, relative to their respective control.

Changes on blood parameters according to treated albino rats with *G. alata* extract

Hb in experimental groups 2, 3 and 4 after 14 days were decreased to 2.13, 8.51 and 8.51%, respectively. RBC in groups 2, 3 and 4 after 14 days were decreased to 4.35, 8.70 and 24%, respectively. PCV in group2 and 4 after 14 days were increased to 0.52 and 8.42%, respectively while in group3 was decreased to 10.70% of than in Control Group (group1). MCV in groups 2, 3 and 4 were increased to 18.60, 12.67 and 15.26%, respectively. MCH in groups 2, 3 and 4 were increased to 11.76, 33.33% and 19.61%, respectively. MCHC in groups 2 and 4 were increased to 2.5% and 3.33%, respectively. Lymphocytes in group 2 was increased to 1.64% of Control Group. Neutrphils in groups 2, 3 and 4 were decreased to 7.69, 19.23 and 3.85%, respectively.

Discussion:

Assessment of hematological parameters can be used to determine the extract of deleterious effect of foreign compound including plant extract on the blood. It can also be used to explain blood relating functions of chemical compound plant extract (Yakubu *et al*., 2015).The calculated blood indices MCV, MCH and MCHC have a particular importance in anemia diagnosis in rat animals (Coles, 1986). The non-significant effects on these indices relating to RBC suggest that there was no effect on the average size of RBC (microcytes), and also in the hemoglobin weight per RBC. This implies that the plant extract 500, 1000 and 1500mg/kg/day body weight does not process any potential of including anemia throughout the 14 days period of administration. WBCs were non-significantly altered, an indication of no pathological condition which may not imply change on the immune system by the plant extracts.

The non-significant effect of plant extracts on the RBC and Hb throughout the experimental period (14 days) is an indication that there was no distraction of matured RBCs and no change in the rate of production of RBCs (erythropoiesis). (Polenakovic and Sikole, 1996; Sanchez-EL-Sner *et al*., 2004). The non-significant effect on the RBC and Hb also implies that there was no change in the oxygen-carrying capacity of the blood and amount of oxygen delivered to the tissues following the extract administration since RBC and Hb are very important in transferring respiratory gases. (De Grachy, 1976). The value of circulating neitrophils was reduced in the rats administered with the plant extract in this study. Increased circulating neutrophils serve as an index of bacterial infection in the body (Guyton and Hall, 2006). It is believed that the

reduction of mean value of circulating neutrophils in this study is indirect, probably due to the antibacterial action of *G. alata* (Dimitrina *et al*., 2016). There was on decrement in the level of PCV relative to control (at concentration 1000 mg/kg body weight) when aqueous extract was given to the rats.

The absence of significant change on tested blood indices (except PCV at 1000 mg/kg body weight) may therefore suggest that the extract is safety in the rats with no deletions effect on the haemotological parameters.

Table 1. Body weight and body weight gain in rats orally given *G. alata* aqueous extract for two weeks.

Parameters		
Treatment groups	Body weight (g) 0 week	Body weight gain (g) Two weeks
Control	127±12.65	148±5.41^{NS}
500mg/kg/day	98±1.77	119±2.10^{NS}
1000mg/kg/day	98±1.83	119±2.59^{NS}
1500mg/kg/day	143±19.91	171±24.03*

Values are expressed as mean ±S.E; NS = Not Significant; *Significant = ($p<0.05$).

Table 2. Hematological analysis of rats given G. *alata* aqueous extract for two weeks.

Groups				
Parameters	**1.Control**	**2.(500mg/kg/day)**	**3. (1000mg/kg/day)**	**4. (1500mg/kg/day)**
Hb (g/dl)	11.75±0.50	11.50±0.57 ^{NS}	10.75±0.95 ^{NS}	10.75±0.50 ^{NS}
RBC ($X10^6MM^3$)	5.75±1.25	5.5±0.50^{NS}	5.25±0.85^{NS}	4.37±1.10 ^{NS}
PCV (%)	36.72±6.75	36.91±1.77^{NS}	32.79±3.20 *	39.81±1.15 ^{NS}
MCV (M^3)	43.00±3.80	51.00±6.60 ^{NS}	52.25±12.71 ^{NS}	49.56±7.77 ^{NS}
MCH (pg)	12.75±1.70	14.25±2.75 ^{NS}	17.00±2.16 ^{NS}	15.25±2.81 ^{NS}
MCHC (%)	30.00±1.63	30.75±2.50 ^{NS}	30.00±1.82 ^{NS}	31.00±2.94 ^{NS}
WBC ($X10^3$ MM^3)	5.75±1.25	2.25±0.50 ^{NS}	5.25±0.86 ^{NS}	4.37±1.10 ^{NS}
LYMPHOCYTES	0.61±0.08	0.62±0.06 ^{NS}	0.61±0.01 ^{NS}	0.61±0.01 ^{NS}
NEUTROPHILS	0.26±0.08	0.24±0.01 ^{NS}	0.25±0.09 ^{NS}	0.25±0.01 ^{NS}

Values are expressed as mean ±S.E; NS = Not Significant; *Significant = ($p<0.05$).

Conclusion:

The present study showed that *G. alata* aqueous extract did not induce a various haematological changes in the male albino rats for 14 days (except PCV). Weight gained for experimental animals however decreased with medium doses (500 and 1000 mg/kg body weight). This may have implication when it comes to searching for medicinal plants with active compound that can help reduce weight gain. Consumption of this plant may have tremendous impact on subjects suffering from hyper-triglyceridermia.

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