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Haematological Parameters of Alloxan-Induced Diabetic Rats Treated with Ethanol Extract of *Talinum Triangulare*

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Abstract
Thirty albino rats were divided into six groups. Groups 1, 2, 3, 4 and 5 were induced diabetes using Alloxan. Groups 1, 2 and 3 were treated with 200mg/kg, 400mg/kg, and 600mg/kg body weights of the plant extract respectively. Group 4 (positive control) was treated with the antidiabetic drug Metformin. Group 5 (negative control) was untreated, Group 6 was the normal control. All rats were fed with rat feed and distilled water ad libitum for 28 days and were then sacrificed for blood collection and analysis. Results revealed a significant decrease in HB ($P<0.05$) in group 5 (negative control) compared with treatment groups but a significant increase in group 4 compared with the normal, a non-significant decrease in RBC ($P>0.05$) in group 5 compared with the normal and a significant decrease compared with the other treatment groups. PCV showed a non-significant decrease in group 3, and a non-significant increase in MCV in all treatment groups compared with the normal. MCH was significantly decreased in group 4 compared with groups 2, 3, and the normal. MCHC recorded a significant increase in groups 2 and 3 compared with the normal. WBC differential count revealed a non-significant decrease in Group 5 in lymphocytes and basophils, a significant increase in monocytes in groups 1 and 3 compared to the normal and other experimental groups, significant changes in neutrophils while eosinophils were significantly reduced in group 3 and the normal. These results show the positive effect of Talinum triangulare and how it compares with Metformin.

Keywords: Talinum triangulare, Alloxan-induced diabetes, Hematological parameters, Lipid profile

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I. INTRODUCTION

Most plants are used in traditional medicine systems around the world because of their medicinal effects. Plants usually possess antioxidant and antidiabetic potentials primarily because they are rich in bioactive compounds such as phenols, flavonoids, phytosterols, phytoestrogens, carotenoids, and vitamins such as vitamin A, C and E, and fiber (Samtiya *et al*., 2021).

Talinum triangulare is a leafy vegetable found in open waste places with rich top soil. It is a member of the *Portulaceae* family found predominantly in West and Central Africa. *Talinum triangulare* is commonly called "Water leaf" since it has a lot of water. It is a very popular pot herb in Nigeria and the Cameroons (Oguntibeji, 2019). *Talinum triangulare* is an excellent source of bioactive constituents such as tannins, alkaloids, saponins, phenols and flavonoids (Aja *et al*., 2010), with flavonoids and phenols being most abundant, which implies that this plant has medicinal properties.

Diabetes mellitus poses a serious threat to human existence. Diabetes is associated with altered metabolism of fuel molecules. These changes usually lead to hyperglycemia, hypertriglyceridemia, hypercholesterolemia and a total derangement of normal metabolism.

Changes in hematological parameters usually associated with type 2 diabetes include changes in the function, structure, and metabolism of red blood cells, white blood cells, platelets and coagulation systems (Antwi-Baffour *et al.*, 2018). Conventional drugs used in the treatment of diabetes usually come with various side effects and are not able to address all the pathological complications of the disorder.

Plants used in the traditional setting both as food and medicine represent a valuable alternative or adjunct for the control of this disease, since they have series of medicinal and nutraceutical properties (Rang *et al.,* 2007), and generally the have less side effects. However, dosage is usually a concern with herbal medicine. It is against this background that this study was carried out, to investigate the effect of graded doses of ethanol extract of *Talinum triangulare* on some hematological parameters of alloxan-induced diabetic rats. This could give a valuable insight to the possible beneficial effects of the plant in people with diabetes and could set the stage for the development of the proper dose regimens for medicinal plants.

II. Materials and Methods

Plant collection and extract preparation

Fresh young shoots of *Talinum triangulare* were harvested from a bush in Ikot Osurua, Ikot Ekpene L.G.A. The plant sample was taken first to the Department of Biological Sciences in Akwa Ibom State Polytechnic for identification by a botanist. Thereafter, the plant sample was conveyed to the Biochemistry laboratory for preparation. The young fresh shoots were removed and rinsed in distilled water to remove all debris. The plant sample was then air-dried at room temperature to remove all external moisture. The plant sample was cut into smaller pieces and soaked in 70% ethanol for 72 hours. After 72 hours, the filtrate was then put in a water bath at 50°C for evaporation until a semi-solid paste was recovered. This was wrapped in aluminium foil and kept in a refrigerator for subsequent use.

Alloxan monohydrate was ordered from London and obtained through an agent in Akwa Ibom State University (AKSU), Ikot Akpaden, Akwa Ibom State, Nigeria. Metformin was purchased from a registered pharmacy in Ikot Ekpene, Akwa Ibom State.

2.2 Animal Grouping and Management

Thirty albino Wistar rats, weighing 101-228g were randomly divided into six groups. Groups 1, 2, 3, 4 and 5 were induced diabetes using Alloxan (50 mg/ kg) body weight which was injected into the rats intraperitoneally. Three different doses of the prepared ethanol extract of *Talinum triangulare* (200 mg/kg, 400 mg/kg and 600 mg/kg) body weights were measured and administered to the animals in groups 1, 2, and 3 respectively once orally for 28 days. Group 4 (positive control), was also treated with the antidiabetic drug, Metformin (50mg/kg body weight), once orally throughout the period of the study, while Group 5 was the negative control (untreated). Group 6 was the normal group and was allowed on distilled water and commercial rat feed only. All the animals were allowed free access to feed and water *ad libitum* throughout the experimental period. At the end of 28 days, the animals were sacrificed after an overnight fast using chloroform vapour in a dessicator. Blood was collected by thoracic incision and part of the blood was used to investigate some hematological parameters in the rats while the remaining part was used to get the serum which was then used to assay for the lipid profile.

2.3 Hematological Assay

Hematological parameters were analyzed using the automated Sysmex hematologic analyzer which measures up to 18 different parameters in one reading. The analysis was carried out within 24 hours of collecting the blood samples.

2.5 Statistical Analysis

Data obtained from the experiment was subjected to one-way analysis of variance (ANOVA). Significant differences were obtained at $P<0.05$ by Bonferroni multiple range test and LSD using the Statistical Package for Social Sciences (SPSS) version 24

III. Results

Table 3.1: Table showing the effect of ethanol extract of *Talinum triangulare* on some hematological parameters of alloxan-induced diabetic rats

GROUPS	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
PARAMETERS						
HB (g/dl)	14.45±0.20	14.68±0.29	14.88±0.30	15.03±0.16	12.38±0.52	13.63±0.88
RBC ($x10^6$/ul)	8.26±0.14	8.66±0.10	8.53±0.13	8.42±0.14	7.31±0.26	8.07±0.50
PCV (%).	43.70±0.92	44.40±0.56	38.68±1.97	45.25±1.59	44.07±1.37	30.50±2.86
MCV (fl).	52.93±0.92	51.80±0.15	52.78±1.31	53.83±2.57	51.60±1.08	48.83±0.80
MCH (pg)	17.47±0.25	16.95±0.14	16.92±0.26	17.85±0.41.	17.42±0.23	16.88±0.15

MCHC (g/dl).	33.28±0.35	32.70±0.33	32.10±0.97	33.33±0.81	33.78±0.40	34.55±0.45
WBC (x10³ul).	12.99±3.48	11.25±0.50	15.14±1.46	20.85±2.71.	25.02±1.25	17.25± 2.06
LYM (%)	32.45±4.92	40.03±6.47	31.92±1.44	34.95±1.19	44.38±7.63	30.93±2.91
MONO (%)	27.37±1.61	19.80±5.34	29.80±5.28	20.10±4.73	22.80±4.73	26.88±2.16
PLT (x10³ul)	460.25±28.35	566.75±12.83	511.75±33.80	586.50±90.62	600.78±88.55	459.75±31.75
NEU (%)	37.70±4.41	38.23±3.01	34.85±3.38	47.78±4.26	30.53±4.24	37.60±5.08
BASO (%)	1.30±0.37	1.88±0.32	1.43±0.40	1.40±0.26	1.98±0.87	1.98±0.85
EOS (%).	0.18±0.05	0.23±0.08	1.95±1.78	0.98±0.44	0.33±0.85	0.13
MCV (fl).	52.93±0.92	51.80±0.15	52.78±1.31	53.83±2.57	51.60±1.08	48.83±0.80
MCH (pg)	17.47±0.25	16.95±0.14	16.92±0.26	17.85±0.41.	17.42±0.23	16.88±0.15
MCHC (g/dl).	33.28±0.35	32.70±0.33	32.10±0.97	33.33±0.81	33.78±0.40	34.55±0.45
WBC (x10³ul).	12.99±3.48	11.25±0.50	15.14±1.46	20.85±2.71.	25.02±1.25	17.25± 2.06
LYM (%)	32.45±4.92	40.03±6.47	31.92±1.44	34.95±1.19	44.38±7.63	30.93±2.91
MONO (%)	27.37±1.61	19.80±5.34	29.80±5.28	20.10±4.73	22.80±4.73	26.88±2.16
PLT (x10³ul)	460.25±28.35	566.75±12.83	511.75±33.80	586.50±90.62	600.78±88.55	459.75±31.75
NEU (%)	37.70±4.41	38.23±3.01	34.85±3.38	47.78±4.26	30.53±4.24	37.60±5.08
BASO (%)	1.30±0.37	1.88±0.32	1.43±0.40	1.40±0.26	1.98±0.87	1.98±0.85

All values are expressed as mean ± SEM. Means with P values less than 0.05 are considered significant.

IV. DISCUSSION

Table 1 shows the values of some hematological parameters in the Alloxan-induced diabetic rats treated with ethanol extract of *Talinum triangulare*.

There was a significant decrease in HB in group 5 (diabetic untreated) animals compared with the treatment groups and the normal. This shows the negative effect of alloxan. Group 4 animals (treated with Metformin) recorded a significant increase in HB compared with the other treatment groups and the normal. This implies that Metformin exerted a positive effect on the Alloxan-induced diabetic rats.

Observing the extract-treated groups (1, 2, and 3), there was a non-significant, but dose-dependent increase in the HB compared to the normal, which implies that higher doses of the plant extract could have produced more

profound effects. The RBCs recorded a significant increase in all the treatment groups compared with the diabetic untreated group (Group 5).

This suggests that the ethanol extract of *Talinum triangulare* compares favourably with Metformin in combating red blood cells depletion in diabetes. The significant decrease in the RBC count in Group 5 could be as a result of the effect of the alloxan-induced diabetes with no treatment whatsoever. Alloxan works by generating hydroxyl radical, reacting with glutathione to form dialuric acid, which auto-oxidizes to generate superoxide radicals, hydrogen peroxide as well as hydroxyl radicals. The hydroxyl radical formed then causes destruction of the B cells resulting in a kind of insulin dependent diabetes (El-Missiry *et al.*, 2000).

Alloxan diabetes results in anemia which manifests in decreased red blood cell (RBC) count, hemoglobin (Hb), and packed cell volume (PCV). A state of microcytic hypochromic anemia is usually a common finding (Ogunmefun *et al.,*2017)

Interestingly, it was observed that the extract-treated groups recorded increased RBC volumes (though non-significant) when compared with the normal, suggesting that *Talinum triangulare* leaf extract may be able to boost blood volumes even in healthy subjects. PCV showed a significant decrease in group 3 and the normal compared with the other treatment groups. The reason for this cannot be explained but maybe as a result of individual differences such as body size or weight, and body fat. It is on record that body weight plays a major role in patients' responses to treatment and outcomes (Agu *et al*.,2018).

MCV was significantly increased in all the treatment groups compared with the normal. This could be as a result of the phytochemicals present in *Talinum triangulare*.. Previous studies have reported that *Talinum triangulare* is rich in phytochemicals (Aja *et al.*, 2010; Agunbiade *et al.*, 2015). Moreover, *Talinum triangulare* is reported to be very rich in antioxidants (Aja *et al.,* 2010; Ezekwe *et al*., 2013).

The white blood cell (TWBC) was significantly increased in group 5, also pointing to the negative effect of the alloxan-induced diabetes. The WBC differential count also recorded a significant increase ($P< 0.05$) in lymphocytes compared with the normal and a non-significant increase ($P>0.05$) compared with the other groups. This observation is consistent with the report of Motahareh *et al*. (2024), who submitted that WBC count is usually higher in diabetic patients. The significant increase in lymphocytes in the animals in Group 5 could be due to inflammation. This suggestion is further strengthened by the observation that eosinophils was also significantly increased in the diabetic untreated (Group 5) animals. It is on record that eosinophils are usually highly increased in inflammation and infection because they form an integral component of the innate immune system (Makoto *et al.*, 2020).

Report has shown that patients with T2DM had significantly increased total white blood cells count (TWBC), absolute neutrophil, basophil, lymphocytes, monocytes counts and the relative counts of neutrophils and basophils in comparison to controls (Getachew *et al.,* 2024). In diabetic patients, hematological changes are associated with the production of reactive oxygen species (ROS), resulting from prolonged hyperglycemia. Excessive ROS production causes oxidative stress, leading to tissue damage, alterations in hematological indices, endothelial and RBC dysfunction (Arkew *et al.*, 2021; Mabdi *et al.*, 2021). Thus patients with DM are more prone to anemia (Mbata *et al.*, 2015). Some studies have revealed that Total WBC count, neutrophil and lymphocyte counts are higher in T2DM patients (Ilango *et al.* 2019; Arkew *et al.* 2021).

These results suggest that *Talinum triangulare* could be useful in slowing down the progression of diabetic complications such as negative changes in hematological parameters and lipid profile.

V. CONCLUSION

From the results obtained from this study, it may be concluded that *Talinum triangulare* ethanol extract was able to mitigate the negative effects of alloxan-induced diabetes on the hematological parameters and lipid profile of albino Wistar rats at the doses used, and could be useful in slowing down the progression of diabetic complications. However, from the trend observed, it is possible that higher doses of the extract could have produced more profound effects.

Compliance with ethical standards

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Disclosure of conflict of interest
No conflict of interest to be disclosed.

Statement of Ethical Approval
This work was formally approved by the Research and Development Committee of Akwa Ibom State Polytechnic, Ikot Osurua.

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