GSC Advanced Research and Reviews

eISSN: 2582-4597 CODEN (USA): GARRC2

Cross Ref DOI: 10.30574/gscarr

Journal homepage: https://gsconlinepress.com/journals/gscarr/

(RESEARCH ARTICLE)

Ameliorative effect of aqueous leaf extract of *Moringa oleifera* on diabetes induced appetite and testicular weight loss in Wistar rats

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GSC Advanced Research and Reviews, 2022, 13(01), 158–161

Publication history: Received on 01 September 2022; revised on 15 October 2022; accepted on 18 October 2022

Article DOI: https://doi.org/10.30574/gscarr.2022.13.1.0249

Abstract

The aim of this study was to determine the ameliorative effect of aqueous leaf extract of *Moringa oleifera* on diabetes induced appetite and testicular weight loss in wistar rats. Freshly harvested leaves of *Moringa oleifera* was processed into powder and subsequently extract. Thirty (30) adult male wistar rats were divided into six groups of five rats each. Group 1 was the normal control which was only fed with rat chow and water ad libitum. Group II was induced with diabetes without treatment, Group III-V were induced with diabetes prior to treatment with 100, 200, and 400 mg/kg bw respectively, while Group VI was induced with diabetes and subsequently treated with standard drug. Animal feed intake and weight of the harvested testicle from the rats were determined using standard procedures. The testicular weight as well as feed intake of the untreated diabetic rats were significantly ($P<0.05$) low compared to that reported for the control (Group I). However, this observation was significantly ($P<0.05$) reversed in treated diabetic rats in a dose dependent manner. This study reveals that *Moringa oleifera* can promote testicular health through its anti-diabetic potential.

Keywords: Testicular; *Moringa oleifera*; Diabetes; Feed intake; Appetite

1. Introduction

The deficiency of insulin that characterises Type 1 diabetes has been implicated in a number of systemic effects on the body's metabolism, one of which is reproductive and other metabolic dysfunctions implicated in the increased perception of fullness and possibly reduced hunger which translates to reduced food intake that characterizes diabetic condition [1;2]. Previous research efforts had established that diabetes mellitus adversely affects the development of sperm, the production of androgens and seminiferous tubules architecture [3] all of which are directly related to testicular measurements notably weight [4] which translates to infertility in men [5].

Moringa oleifera, a member of the *Moringaceae* family and native to the sub-Himalayan tracts is widely cultivated in the tropics primarily owing to its characteristic ease of cultivation and management [6; 7]. Therapeutic substances developed from the said plant have been employed in the treatment of diseases such as microbial infection, ulcer, inflammation etc [8]. Although various parts of *Moringa oleifera* have used extensively used in the treatment of diabetes, paucity of data abounds on its effect on testicular weight which is believed could be driven by appetite stability and food intake.

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2. Material and methods

2.1. Collection and Processing of Plant Material

Freshly harvested leaves of *Moringa oleifera* from a home garden was identified and authenticated at the herbarium unit of the Department of Forestry, Michael Okpara University of Agriculture Umudike Abia State. The leaves which were thoroughly washed with clean tap water were dried at room temperature prior to being ground and sieved to fine powder.

2.2. Animals

Adult male albino rats used in this study weighed 150-200 g. They were housed in transparent plastic cages and were fed rat chow and water ad libitium. Acclimatization of the rats lasted for three weeks.

2.3. Extraction of Plant Material

Precisely 400 g of the powdered leaf sample was cold macerated using distilled water for 1 day and afterwards, filtered to obtain the *Moringa oleifera* aqueous leaf extract which was subsequently concentrated in a freeze dryer for use in the study.

2.4. Median Lethal Dose 50% (LD50)

Three groups of three rats each were employed to ascertain the median lethal dose of extract. The rats were separately administered with 10, 100 and 1000 mg/kg of extract orally. Observation made on the rats for signs of toxicity lasted for a day. Being that none of the animals died, the last phase of the experiment in another three groups of one rat each set up were each administered with 1600, 2900 and 5000 mg/kg of extract separately and animals were observed for 48 hr for signs of toxicity [9].

2.5. Induction of Experimental Diabetes

Diabetes mellitus was induced by administering 150 mg/kg of alloxan intraperitoneally. At the end of the 48th hour of induction, rats which manifested over 120 mg/dl of glucose were selected and used for the study [10].

2.6. Animal Grouping

- Group I: was fed with rat chow and water ad libitum.
- Group II: diabetic rats without treatment
- Group III: diabetic rat administered with 100 mg/kg of *Moringa oleifera* leaf extract.
- Group IV: diabetic rat administered with 200mg/kg of *Moringa oleifera* leaf extract.
- Group V: diabetic rat administered with 400mg/kg of *Moringa oleifera* leaf extract.
- Group VI: diabetic rat administered with standard drug

2.7. Sample Collection

Animals were anaesthetized with chlororoform, this was followed by the opening of their abdomen by midline abdominal incision so as to access the reproductive organs (Yakubu et al., 2007).

2.8. Determination Testicular Weight and Feed Intake

Rats were weighed to determine their body weight. Their testes were removed and weighed to calculate the testicular weight as a percentage of body weight. Then, testicular tissue was fixed in 10% neutral-buffered formalin. The tissue was embedded in paraffin wax and sectioned at a thickness of 5 µm [11].

2.9. Statistical Analysis

Data were analyzed using SPSS version 20. Analysis of Variance (ANOVA) and Duncan's multiple range tests were used to compare the mean differences among treatments. $P<0.05$ was considered significant.

3. Results and discussion

Diabetes mellitus is established following impairment in insulin metabolism which translates to diverse arrays of adverse effects on the body's metabolic functionality including reproductive inefficiency.

Table 1 Testicular Weight of Diabetic Rats treated with Aqueous Leaf Extract of *Moringa oleifera*

Group	Treatment	Organ weight (g)
Group I	Normal Control	0.37 ± 0.08^{b}
Group II	Diabetic without treatment	0.25 ± 0.04^{a}
Group III	Diabetic rat + 100 mg/kg	0.54 ± 0.09^{c}
Group IV	Diabetic rat + 200 mg/kg	0.57 ± 0.07^{c}
Group V	Diabetic rat + 400 mg/kg	0.58 ± 0.04^{c}
Group VI	Diabetic rat + STD	0.38 ± 0.06^{b}

Results are expressed as mean ± standard deviation of three determinations. Values with different superscript are significantly different

Table 1 shows the weight of testicles of diabetic rats treated with aqueous leaf extract of *Moringa oleifera*. The testicular weight of diabetic rats which were not administered with extract, was significantly ($P<0.05$) lower than that reported for the control (Group I). However, this was significantly ($P<0.05$) increased in diabetic rats treated with *Moringa oeifera* extract in a dose dependent manner. The increased testicular weight observed on groups III-V treated with aqueous leaf extract of *Moringa oleifera* could be attributed to the reduced level of testosterone which culminates to the breaking down of the sertoli-sertoli cell junction known to be responsible for alterations in the structures of the seminiferous tubule and consequently organ weight loss [12]. This finding is consistent with the fact that seed of *M. oleifera* has been used locally to boost sexual inadequacy. The findings made in this work is consistent with the outcome a research performed by George et al [13] which established a positive influence of *M. oleifera* seed on reproductive indices of livestock.

Table 2 Feed Intake of Diabetic Rats treated with Aqueous Seed Extract of *Moringa oleifera*

Grouping	Treatment	Initial feed intake(g)	Final feed intake (g)
Group I	Normal Control	131.43±5.95	143.42±2.55
Group II	Diabetic without treatment	121.28±4.81	134.28±2.76
Group III	Diabetic rat + 100 mg/kg	144.28±2.77	144.71±3.21
Group IV	Diabetic rat + 200 mg/kg	138.42±2.47	142.43±2.55
Group V	Diabetic rat + 400 mg/kg	134.00±4.89	145.29±1.57
Group VI	Diabetic rat + STD	129.45±4.42	135.22±3.43

Results are expressed as mean ± standard deviation of three determinations

Table 2 shows that feed intake was reduced in diabetic rats which however was improved following treatment with *M. oleifera*. This is substantiated by previous findings affirming that reduction in blood glucose level irrespective of whether it is insulin induced or spontaneous decline within normal range stimulates hunger and feed intake. On the other hand, it is evident though indirectly that hyperglycemia is associated with enhanced perception of fullness and possibly reduced hunger [1].

4. Conclusion

Through this study, it is evident that *Moringa oleifera* could possibly harbour compound(s) with enormous potential to improve testicular health and consequently reproductive performance of ailing testicles. The study further indirectly substantiates its anti-diabetic potential through appetite stimulation and feed intake which is a direct consequence of hypoglycemia.

Compliance with ethical standards

Acknowledgments

Author are grateful to the technical staff of the department Human Physiology, Imo State University for their efforts in ensuring a timely completion of the study.

Disclosure of conflict of interest

Authors declare that no conflict of interest exist.

Statement of ethical approval

Ethical certification was granted for the execution of this study by the university committee on Ethical standards

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