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MORINGA OLIEFERA SEEDS FORMULATION AND ITS EFFECT AS A BIOACTIVE TOOL ON GLYCEMIC INDEX OF HEALTHY ALBINO RATS

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ABSTRACT

Introduction: Glycemic control through diet is necessary for preventing or limiting the consequences of diabetes mellitus. Therefore, the consumption of functional foods and nutraceutical or bioactive compounds derived from plants used as food can be used as nutritional tools because of their clinical effects. Thus, *Moringa oleifera* is a vegetable plant protein with bio-active multipurpose, it has been used as a food source and for traditional medicine purposes due to possible antihyperglycemic properties. These properties may be explained by the presence of numerous phytochemicals in the seeds. The aim of this study was to determine the bioactive potential of Moringa oliefera seed on glycemic index on healthy albino rats. **Materials and methods:** The seeds of *Moringa oleifera* were collected in Maiduguri, Borno State Nigeria and the rats weighing 110-120g were procured from Faculty of Pharmacy Animal farm. The seed was dried and grinded into powder using pestle and mortar. The milk like powder was weighed and stored in an airtight container. The animals were acclimatization and randomly divided into Four groups of three animals per group, with one group serving as control. They were weighed and fasted for twelve (12) hours (overnight) before diet administration. **Result:** The Postprandial glucose Level of rats treated with *Moringa oleifera* formulated diet indicated significantly result with $p<0.05$ lower compared to the test control. **Conclusion:** The scarce number of human studies, together with a diverse range of methodologies and Moringa oliefera seed doses, should be encouraged. In addition, evidence regarding changes in insulin levels due to Moringa oliefera seeds indicated potential intervention hence could be used an agent to cutile the hypoglycemic case.

KEYWORDS: Moringa oliefera, Seeds, Bioactive, Glycemic, Albino rats.

INTRODUCTION

Moringa oleifera is a tree belonging to the family Moringaceae, genus *Moringa*, originally native from the Himalayans but currently cultivated in many tropical and subtropical regions around the world (Leone et al., 2015). Different parts of Moringa oliefera such as leaves, fruits, flowers, and roots have been used as food and in traditional medicine (Popoola et al., 2013). For example, leaves, the most commonly used part, contain many nutrients including beta-carotene; vitamins B, C, and E; minerals (calcium, iron, potassium, magnesium, etc.); essential and non-essential amino acids; and carbohydrates; among others (Fawoolo et al., 2018).

Moringa oliefera has been used in traditional medicine for the treatment of various conditions and, more recently, has been proposed to be of benefit in numerous diseases including cardiovascular, diabetes, cancer, neurological, gastroenterological, and inflammatory (Anwar et al., 2007) Such broad applications attributed to Moringa oliefera, may be explained by the vast amounts of compounds present in the different parts of the tree. For instance, phytochemicals derived from the seeds of Moringa oliefera including glycosidic glycosylates (GLSs), isothiocyanates (ITCs), nitriles, carbamates, and thiocarbamates, have shown anti-inflammatory, antioxidant, hypotensive, antibacterial, and chemo preventive properties (Jaja-Chimedza et al., 2018).

Moringa oliefera seeds powder can be used for human consumption and for commercial purposes (Azad et al., 2017). Moringa seeds are rich in zinc that regulates insulin hormone secretion in Islets of Langerhans. These seeds are also used in folk remedies for the treatment of diabetes in native countries such as India, Srilanka, Philippines and Nigeria, Scientific evaluation revealed the composition of the seeds with medicinal properties (Ayotunde et al 2011).

Moringa oleifera seeds is said to regulate the insulin hormone secretion. When the production of insulin becomes normal, the levels of sugar remain normal in bloodstream. The extract was used as an effective anti-diabetic agent in clinical trials. Even though diabetes may be caused by different phenomena involving

pancreas and insulin production in islets of Langerhans, the use of plant product help to adjust the insulin level in the blood system ((Anwar et al 2007).

Glycemic index (GI) is a relative ranking of carbohydrate in food according to how they affect blood glucose levels. Carbohydrate with a low GI value (55 or less) are, ore slowly digested, absorbed and metabolized and cause a lower and slower rise in blood glucose and therefore, usually insulin level. The disease diabetes is highly prevalent worldwide when compared with many other diseases, it is fast becoming the epidemic of the 21st century. It is estimated that in the year 2000, there were 171 million diabetic peoples in the world. This estimation is expected to increase to reach 366 million diabetic peoples by 2030 WHO (2006). Diabetes mellitus is defined as a disease in which the body is unable to use and store glucose, properly. It is caused by the abnormality of carbohydrate metabolism which is linked to either low blood insulin level or insensitivity of target organs to insulin (Maiti et al., 2004).

There are many types of diabetes, however, the two main types of diabetes are Type 1 (insulin-dependent), where the body is completely stop producing insulin, accordingly patients must take insulin injections daily to survive. Type 2 (non-insulin dependent) where the body is unable to produce enough insulin, or the produced insulin does not work properly. Patients of type 2 mostly have a family history of diabetes (inherited), overweight or over 40 years of age. Interestingly, type 2 (non-insulin dependent) diabetes mellitus is much more prevalent than type 1 (insulin dependent) diabetes, affecting the people of both developed and developing countries (Olefsky, 2004, Kavishankar et al 2011). Up to 250,000 children in developing countries under the age of 14 years have type 1 diabetes; around 38,000 of these children are in Africa (Das & Shah, 2011).

Therefore, Herbal preparation from plant parts (seed) play a role in the diseases; most of them speed up the natural healing process. Numerous medicinal plants and their formulations are used for various disorders in ethno medical practices as well as traditional systems of medicines in the world (Une Hemant et al., 2014). In Nigeria, medicinal plants have been used as natural medicine since the days immemorial. Many of these medicinal plants and plant products are part of our diet as spices and vegetables (Umaru et al., 2018).

MATERIALS AND METHODS

The *Moringa oleifera* seed were collected from Maiduguri in Borno state, Nigeria. The Plant was identified by Prof Sharif Madu and authenticated at the Botany Department in University of Maiduguri.

Extraction of Seed Powder

Moringa seeds were obtained from the pods of Moringa plant, the seed were air dried and the husk was separated from the seed. The seed was dried again and grinded into powder using pestle and mortar. The milk like powder was weighed and stored in an airtight container.

Procurement of Experimental Animals

Fifteen albino rats weighing 110-150g were obtained from the faculty of pharmacy university of Maiduguri, Borno state Nigeria. They were housed in plastic cages with a stainless wire net cover for good ventilations. They were kept at room temperature and were allowed to acclimatize to the environment for two days, during these period they were fed with standard laboratory chow from Jos (vital feed).The animals were handled in accordance with the National Institute Health (NIH) guide for the care of laboratory animals

Experimental Design

After acclimatization the animals were randomly divided into Four groups of three animals per group, with one group serving as control. They were weighed and fasted for twelve (12) hours (overnight) before diet administration.

Method

The blood glucose of the rats was taken at zero hours from the tail vein and measured using the accu check glucometer and test strip before fed with moringa seed powder and normal feed.

Administration of Diet

The feed was mixed with *moringa oleifera* lam seed sample in a ratio of 50:0 25:25g ,10:40g and control were fed with vital feed.

Feed Efficiency Ratio

The feed was consumed within 45 minutes.

Measurement of Blood Glucose

A fasting blood sugar level was taken after an overnight fasting. Rats were fed, at a two hour interval after feeding and consumption the blood glucose levels of animals in each group fed with the stated ratio of feed was measured animal using automatic glucose analyzer (Accu-check, Blood glucose monitoring kit),the blood was collected from the tail vein of the animal. These procedures were repeated for twelve days. The glycemic response was determined as the incremental area under the blood glucose curve measured geometrically from the blood glucose from the blood glucose concentration time graph of fasting level.

RESULTS AND DISCUSSIONS

Results

Table 1: Postprandial glucose Level of Rats Treated with *Moringa oleifera* formulated diet (mg/dL).

		Day 1		Day 2		Day 3	
Group	**Normal Blood Glucose**	**FBS**	**After 2 hours**	**FBS**	**After 2 hours**	**FBS**	**After 2 hours**
Control	111.25±2.99	111.25±2.99 [d]	118.25 ± 1.71	108.75±1.71 [d]	120.50± 2.08	109.25 ±3.30 [d]	123.25 ± 2.50
Group 1 (50 %)	117.25±2.21	76.25±5.08[bcd]	**88.50 ± 3.11[bc]**	70.25±3.30[bcd]	**74.25±1.71[bc]**	63.25±2.22[abcd]	**68.00±1.82[abc]**
Group 2 (25 %)	119.75±1.71	83.25 ± 3.30[cd]	97.25 ± 2.22[c]	80.50±2.65[cd]	85.50 ± 2.08[c]	73.25±1.71[abcd]	80.50±1.04[abc]
Group 3 (10 %)	116.53±1.37	94.00 ± 2.94[cd]	106.00± 1.41[c]	89.25 ± 2.63[cd]	104.75 2.22[c]	79.75±1.55[abcd]	92.50±2.08[abc]

Values are Mean ± SD; (n = 4)

[a] Significantly (p< 0.05) lower compared to different treatment days in each row

[b] Significantly (p< 0.05) lower compared to different percentage diet formulation

[c] Significantly (p< 0.05) lower compared to normal rats fasting blood glucose

[d] Significantly (p<0.05) lower compared to two hours postprandial

Table 2: Body Weights (gm) of Rats before and after Treatment

Group	Weight before treatment	Weight after treatment	% Decrease in Weight
Control	128.23 ± 1.87	147.35 ± 2.36	-
Group 1 (50 %)	130.90 ± 1.00	**121.65 ± 2.38**	**92.93**
Group 2 (25 %)	131.13 ± 1.50	126.50 ± 0.82	96.47
Group 3 (10 %)	136.30 ± 0.90	133.40 ± 1.51	97.87

The result of replicate analysis was represented as mean± standard deviation. statistical analysis was done using statistical package for social sciences. Differences within the group means were analyzed using the one-way analysis of variance (ANOVA). The results were considered statistically significant at p>0.05.

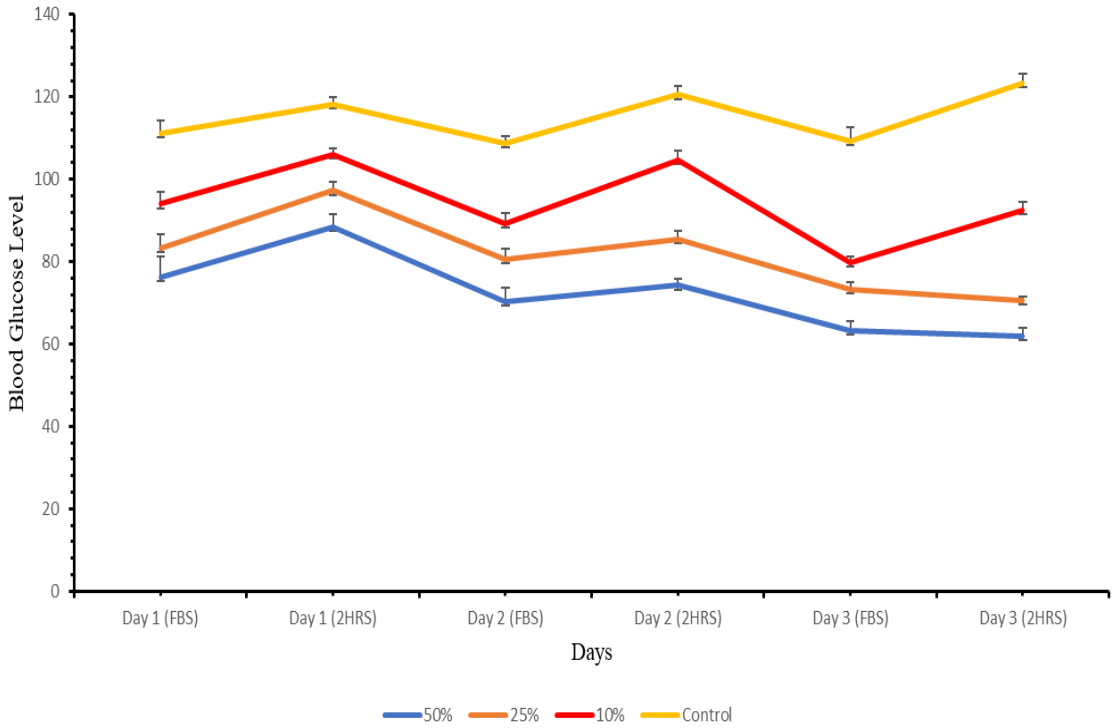

Figure 1: Fasting and Postprandial Blood glucose Level of Rats administered *Moringa oleifera* formulated diet.

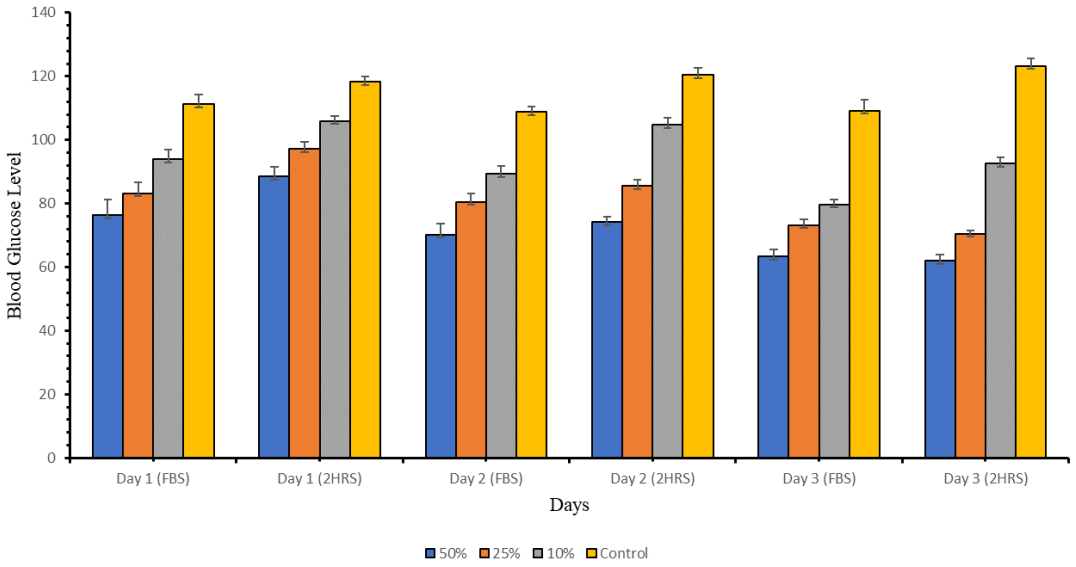

Figure 1: Fasting and Postprandial Blood glucose Level of rats administered *Moringa oleifera* formulated diet.

DISCUSSIONS

As an antidiabetic agent, seeds of Moringa oleifera have been scientifically proven (Gupta et al., 2012, Al malki et al., 2015). Most of the researchers have used solvent extract of Moringa oleifera plant part. Nevertheless, the recommendation is that the only plant part is preferable. In the present study we used seed powder formulation (Vongsak et al., 2013). We did not evaluate or isolate the possible therapeutic components of Moringa oleifera seed, since the literature has a great variety of studies that did it. The formulated diet is been used to feed albino rats with normal blood glucose levels. These rats were grouped and fed with different ratios of the formulated diet. Blood glucose levels of these rats were taken at fasting state and at two hours postprandial. the process was repeated for three days.

It was recorded that *moringa oleifera* lam seed has high effect in reducing blood glucose levels as shown in Table 1, in group one where 50% of the extract day one showed an decreases in the glucose level by 88.50 ± 3.11 (mg/dL), day two 74.25±1.71 (mg/dL) and day three with lowest blood glucose of 68.00±1.82 (mg/dL). On feeding, blood glucose levels reduced a little but with subsequent feeding of formulated diet sugar levels dropped. Therefore, within the group's rats fed with equal amount of diet had very close or almost same glucose levels. Across the groups with increase in the percentage of moringa in every formulated diet showed a high decrease in glucose levels, i.e. the more the moringa in the diet the lower the glucose level across the group with increase in time of administration. This agrees with the study which shows significant improvement in hemoglobin and total protein levels on long term treatment with extract this indicated that it has favorable effect in bringing down the severity of glucose in the blood system (Jaiswal et al., 2009). This indirectly confirming thereby the activity of the seed of *Moringa oliefera*.

The effects of oral administration of Moringa oleifera seed powder on the weight level variables are shown in Table 2. Animals concomitantly exposed to M. oleifera seed showed a decrease in the weight with increase in percentage in the concentration of the seed formulated diet of 121.65 ± 2.38 (mg/dL)at 50% concentration with a percentage activity of 92.98% when compared to 147.35 ± 2.36 (mg/dL) after treatment in normal animals. While, decreased in weight was observed at the dose of 20% and 10%. The variables were found to be sensitive to any increase in dose of the treatments.

Fig. 3 and Fig 4 confirms a significant induction of Moringa oliefera seed powder in the reduction of glucose level at various concentration. Administration of M. oleifera seed powder in normal animals did change in the glucose level and weight of the treated Animals. Thus, showed marked depletion of glucose concentration in blood by 92.98% which was more pronounced at 50 % concentration of the formulation dose of M. oleifera than at 20 and 105.

In relationship to existing literature and previous research (Al-malki et al., 2015, Omodanisi et al ., 2017, Azevedo et al., 2018) it is evident that moringa seed has an antidiabetic effect, and has showed a high drop in normal blood glucose levels in people who use it as local traditional medicine for liver diseases and inflammations. Moringa oleifera lam seed has a low glycemic index and it does not only effective as antidiabetic but helps in maintaining blood glucose levels in normal albino rats.

CONCLUSIONS

This study has demonstrated that the administration of moringa *oleifera* lam seed on normal albino rats have showed high efficiency in lowering of blood sugar. From the results in tables above it is seen that the normal glycemic index of the rats is reduced which will help to

speed up the natural healing process and will improve the glycemic control of diabetic rats. Thus, study suggest the use of *Moringa oliefera* in pharmaceutical, food industry and hospital to maintain blood glucose to avert the danger of diabetes.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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