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The Effect of Extract of *Portulaca oleracea* on Glucose Tolerance in Diabetic Wistar Rats

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The *hypoglycemic* effect of *Portulaca oleracea* have been documented. Its ability to enhance glucose tolerance in wistar rats made diabetic by chronic fructose feeding was studied. Eighteen female wistar rats were divided into three groups of six rats each. Group 1 (Normal Control) was fed with normal rat chow. Group 2 (Experimental Group I) was fed with fructose mixed with top feed (50% of fructose + 50% of top fed) to induce diabetes and exposed to low dose of *Portulaca oleracea* extract (200mg/kg). Group 3 (Experimental Group II) was fed with fructose mixed with top feed (50% of fructose + 50% of top fed) to induce diabetes and exposed to high dose of *Portulaca oleracea* extract (400mg/kg) for two weeks after which the rats were fasted overnight and glucose tolerance test was carried out on each rat the following morning. Student"s t test was used to analyze data. Results show that *Portulaca oleracea* has the ability to enhance glucose tolerance in diabetic rats. It could be considered therefore in post meal control of blood glucose in insulin resistant diabetic patients.

Key words: Diabetes, *Portulaca oleracea and Hypoglycemia.*

Glucose is an essential constituent blood. The blood sugar concentration or blood glucose level is the amount of glucose (sugar) present in the blood of a human or animal. The exactness of such level is of great value to keep body metabolism well maintained (Simon and Ohkubo 1995).

Normally in mammals, the body maintains the blood glucose level at a reference range between about 3.6 and 5.8 mmol/L, or 64.8 and 104.4 mg/dl. Effective control of blood glucose level is important for normal metabolic functioning of the body and therapeutic regulation of diabetic blood glucose level remains important for better control over the chronic ailment. The human body naturally tightly regulates blood glucose levels as a part of metabolic homeostasis (Pereira *et al.*,., 2005).

Diabetes is a global disease with a huge adverse impact on health. It is a metabolic disorder characterized by hyperglycemia and alterations in carbohydrate, fat and protein metabolism, associated with absolute or relative deficiencies in insulin secretion and/or insulin action. The symptoms of Diabetes are polyuria, polydipsia, polyphagia, pruritus and unexpected weight loss, and so on (Velasco *et al.*,1993).

Diabetes occurs at any time of life from infancy to old age. Type 1 Diabetes result from the body's failure to produce insulin, and requires the patient to continuously inject insulin. Type 2 Diabetes results from insulin resistance, a condition in which cells fail to use insulin properly, sometimes combined with an absolute insulin deficiency. It is primarily a life style disorder which accounts for around 90% of diabetic cases and

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increasing at an astonishing rate particularly in developing countries like Nigeria (Sigal *et al.*,2006). Type 2 Diabetes Mellitus, which is commoner of two major types of Diabetes mellitus, is increasingly being recognized in relatively young persons, due to the high prevalence of environmental and genetic risk factors. People living with type 2 Diabetes mellitus are more vulnerable to varied forms of both short- and long-term complications, which often lead to their premature death. This vulnerability to increased morbidity and mortality is seen in patients with type 2 Diabetes mellitus because of its insidious onset and late recognition, especially in resource-poor developing countries like Nigeria. It is predicted that prevalence of Diabetes mellitus in adults will increase in the next two decades and much of the increase will occur in developing countries where the majority of patients are aged between 45 and 64(King et. al,1995).

Most common employed *hypoglycemic* agents are suphonylureas and biguamidas. These drugs however have their disadvantages such as primary and secondary failure as well as potential for induction of severe *hypoglycemia*. Some herbs and spices has been shown to be effective, relatively non toxic and have substantial scientific documentation to attest to their efficacy in the management of diabetes minlitus (okeke *et al.*,1998)

Portulaca oleracea is also known as verdolaga, pigweed, little hogweed or pusley is an annual succulent in the family *portulacaceae*. It is a prostrate herb with fleshy, reddish stems and thick succulent leaves which are oval shaped and about 25 mm long. The flowers appear depending upon rainfall and may occur year round. The flowers open singly at the center of the leaf cluster for only a few hours on sunny morning. Seeds are formed in a tiny pod, which opens when the seed are ready. *Portulaca oleracea* has a tap root with fibrous secondary roots and is able to tolerate poor, compacted soil and drought. *Portulaca oleracea* contains many biologically active compounds and is a source of many nutrients. The plant is known in traditional Chinese medicine in some part of china as hypotensive and antidiabetic. It is widely used in china not only as an edible plant, but also as a traditional Chinese herbal medicine for alleviating pain and swelling. It also has the abilities of defending the body against bacteria, virus, Diabetes, and for enhancing immunity (Jiang *et al.*,., 2005), but the mechanism of action of its compounds have not been clarified.

In many developing countries like Nigeria, larger parts of the population rely heavily on traditional medicinal plants to meet their primary health care needs. The *hypoglycemic* effect of *Portulaca oleracea* have been documented and its ability to enhance glucose tolerance in rats made diabetic by destruction of â cells of the pancreas have also been documented (Azubike et. al,2010). This study aims to determine the effect of *Portulaca oleracea* on glucose tolerance in diabetic Wistar rats made diabetic by chronic fructose feeding

MATERIAL AND METHODS

The *Portulaca oleracea* used in this study was obtained from Santual botanical garden Benin City, Edo state, Nigeria. The flowers were removed from the stem of the plant and then dried for several days. It was then grounded into powder. 37.6g of powder was extracted with distil water (100 ml) with constant stirring for 4 hours and left overnight before filtering. The filtrate was dried in a rotary evaporator under reduced pressure at 55^{o}C and then weighed daily until a constant weight of 15.8g was obtained. The difference between the weight of powder and the weight of material obtained after drying was taken as weight of active ingredient in calculating the concentration of extract used.

The glucose analyzer and strip used in this study were purchased from orland Inc Onisha, Anambra state, Nigeria. Fructose was obtained from Labtek global ventures Benin City, Edo state, Nigeria.

Experimental Animals

Eighteen albino Wistar rats were purchased from the animal house of the Faculty of basic medical sciences, Ambrose Ali University, Ekpoma, Nigeria. The animals were carefully selected, ensuring that they were in good state of health. The animals were randomly placed into three groups of six rats each, housed in the animal house of the Faculty of basic medical science, Delta State University, Abraka, Nigeria with 12 hours light and 12 hours dark cycle to acclimatize for two weeks. During this period, the animals

Table 1. Effect of *Portulaca oleracea* on the blood glucose level of diabetic Wistar rats.

Duration	Control (Non diabetic) + 1ml glucose	Diabetes Mellitus + 1ml glucose + POL low dose (200mg/kg)	Diabetes Mellitus + 1ml glucose + POL high dose (400mg/kg)
0 minutes	70.50±9.71	159.00±67.44*	153.99±54.14*
30 minutes	83.67±11.40	120.33±7.50*	101.70±5.43*
1 hour	109.83±22.11	115.83±11.13*	98.50±29.75*
1.5 hour	120.07±35.05	114.90±49.82*	96.33±29.92*
2 hour	78.33±7.23	81.33±9.46	48.83±8.59

Values are presented as means ± SD; *P < 0.05 compared with control group. (n=6)

were given feed and tap water ad libitum.

Experimental Design

Prior to commencement of the experiment, the animal were randomly divided into three groups of six rats each. Group 1 (Normal Control) was fed with normal rat chow. Group 2 (Experimental Group I) was fed with fructose mixed with top feed (50% of fructose + 50% of top fed) to induce diabetes and exposed to low dose of *Portulaca oleracea* extract.

Group 3 (Experimental Group II) was fed with fructose mixed with top feed (50% of fructose + 50% of top fed) to induce diabetes and exposed to high dose of *Portulaca oleracea* extract.

Induction of Diabetes

50% of Fructose was mixed with 50% of top feed (normal rat chow) and then given to each rat to eat for two weeks. At the end of two weeks, the rats were tested with a glucose analyzer (GT-1640) and confirmed diabetic (150 to 200 mg/dL)

Group 1 (Normal Control)

Each rat in this group was orally administered with 1.0 mg of glucose. The blood sample was collected from the tail of the animal at 0, 0.5, 1.0, 1.5 and 2.0 hours and the blood glucose level of blood sample at various points was measured by a glucose analyzer, then the result was recorded.

Group 2 Diabetes + *P.oleracea* Low dose (DM+POL+LD)

Each rat in this group were made diabetic through fructose mixed with top feed (i.e. 50% of fructose + 50% of top weed) and was orally administered with 1.0 mg of glucose and 0.2ml of *Portulaca oleracea* extract. The blood sample was collected from the tail of the animal at 0, 0.5, 1.0, 1.5 and 2.0 hours after *Portulaca oleracea* extract administration. Blood glucose level of blood sample at various points was measured by a glucose analyzer and the result was recorded.

Group 3 Dabetes + *P.oleracea* high dose group (DM+POL HD)

Each animal in this group was orally administered with 1.0 mg of glucose and 0.4ml of *Portulaca oleracea* extract. The blood sample was collected from the tail of the animal at 0, 0.5, 1.0, 1.5 and 2.0 hours after *Portulaca oleracea* extract administration. Blood glucose level of blood sample at various points was measured by a glucose analyzer and the result was recorded.

Administration of *Portulaca oleracea* extract

Before the administration of *P. oleracea* extract, 20g of glucose was dissolved in 20 ml of water (1g =1 ml) and the two experimental groups received both *P. oleracea* extract and glucose. After overnight fasting with free access to water, the rats were orally administrated using gavage with glucose (1ml) and *P. oleracea* extract suspension, which was dissolved in distil water with dose 0.2 mil for *P. oleracea* Low dose group and 0.4 mil for *P. oleracea* high dose group. The normal control group received glucose (1mg) and tap water as placebo. Administration was done between 09hrs and 11hrs GMT and was for only one day.

RESULTS

In this study, changes in the blood glucose level due the effect of *Portulaca oleracea* on low and high doses was carried out. These

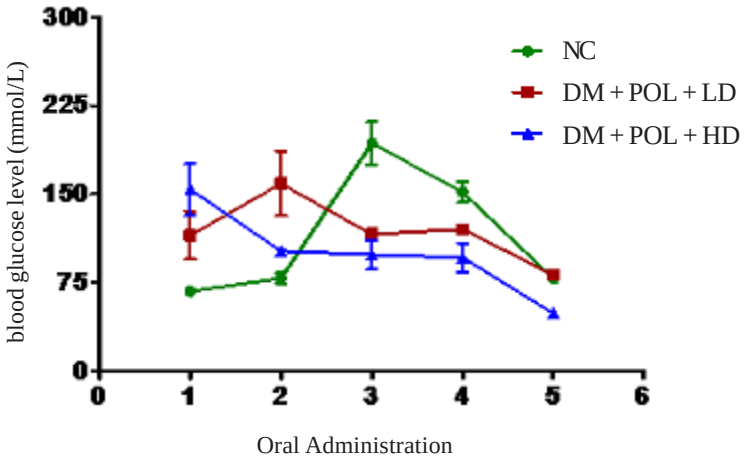

Fig 1. Effect of POL on blood glucose in the acute blood glucose test.

varying doses (200mg/kg and 400mg/kg) in diabetic rats were compared with that of normal control.

DISCUSSION

P. oleracea has been used as a traditional medicine for many years in China, owing to its therapeutical properties of anti-bacteria, anti-virus, and enhancing immunity (Gao *et al.*,2007). Fructose inhibits insulin secretion by the pancreatic cells and causes insulin resistance, so it is an effective diabetes-induced agent. It has been widely used to induce diabetes mellitus in experimental animal models allowing investigation of *hypoglycemic* agents in the treatment of diabetes (Wu *et al.*,2006; Kar *et al.*,2003). Fructose injection consistently produced symptoms of diabetes mellitus including *hyperglycemia*, decreased insulin levels, polyuria and weight loss (Kar *et al.*,2003).

The blood glucose level increased after the induction of diabetes by chronic fructose feeding and it remained high during the experiment. When diabetic rats were treated for the first 30 minutes with *P.oleracea* extract, the glucose level increased slightly, and 1 hour, the blood glucose level started decreasing but still remained higher than the normal control level, after 1.5 hour the blood glucose level was decreased significantly, and the *hypoglycemic* effect could be maintained for 2 hours. The result indicated that *P.oleracea* has *hypoglycemic* activity, which may be a new aspect to consider with respect to post meal glucose reduction.

The findings in this present study is similar to a report carried out by Olagunju *et al*; 2005 on the *hypoglycemic* effect of extract of carica papaya. This could be due to phytochemical constituent's saponin and flavonoid present in *P. oleracea* (Lu *et al.*,2005; Zhao *et al.*,2006; Singab *et al.*,2005). According to Abdel-Hassan *et al.*,2000, saponins and glycosidic components of *Citrullus colocynthis* were responsible for *hypoglycemic* effect in Fructose induced rats. A study by Chakravarthy *et al.*,1980 showed that flavonoid fraction of P. marsupium caused pancreatic beta cell regranulation and explained the possible anti-diabetic mechanism of the plant. While Epicatechin, a pure flavonoid isolated from the ethanol extract of P. marsupium, has also been shown to possess significant anti-diabetic effect (Chakravarthy *et al.*,1982b and; Sheehan *et al.*,1983). The administration of *P.oleracea* caused a significant ($p<0.05$) and dose dependent reduction in the blood glucose level from the 30 minutes interval to 2 hours interval. Further investigation should be done on purification and identification of the anti-diabetic ingredients of P.oleracea and its possible use for a longer period to find long term effect on diabetic rats.

CONCLUSION

The present study shows that *P.oleracea* has a *hypoglycemic* effect possibly by stimulation of insulin secretion and therefore could be used in the management of postprandial hyperglycemia in insulin resistant or type II diabetic animals.

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