



## Effects of Watermelon (*Citrullus Lanatus*) Seed on Blood Glucose and Electrolyte Parameters in Diabetic Wistar Rats

\*<sup>1</sup>OMIGIE IO; AGOREYO FO

Department of Physiology, School of Basic Medical Sciences, University of Benin, Benin City

Correspondence Address: Dr Mrs) Magdalene Omigie, Department of Physiology, School of Basic Medical Sciences, University of Benin, Benin City, Email address: magdaleneomigie@yahoo.com

**KEY WORDS:** Watermelon, Diabetes, blood glucose, electrolyte, Wistar rats

**ABSTRACT:** Given the prevalence of diabetes worldwide, with its associated complications, this study is aimed at investigating the effect of *citrullus lanatus* seed extract on blood glucose concentration and electrolyte parameters. *Citrullus lanatus* is an antioxidant and has been shown to reduce oxidative stress (Khaki *et al.*, 2013). Effects of phytochemicals (flavonoids) on pancreatic  $\beta$ -cells leading to their proliferation and secretion of more insulin have been proposed by Mahesh and Menon (2004), as the mechanism by which medicinal plants used in the treatment of diabetes mellitus reduce hyperglycaemia in streptozotocin-induced diabetic rats. Fifteen female wistar rats were used in the study, they were divided into three groups of five rats each, namely; the control group, diabetes control group administered distilled water, and diabetes group administered watermelon seed extract. The diabetic groups were made diabetic by single intraperitoneal injection of streptozotocin (60 mg/kg). Daily watermelon seed extract was administered orally (200 mg per kilogram body weight), one week post streptozotocin injection. On 29th day the rats were sacrificed and blood was collected via the inferior vena cava, into plain bottles and fluoride oxalate sample tubes for electrolyte; ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{HCO}_3^-$ ,  $\text{Cl}^-$ ) and glucose analyses, respectively. Results showed that plasma glucose concentration decreased significantly ( $P<0.05$ ) at week 2 and 4. However, administration of methanolic extract of *Citrullus lanatus* seed did not have any significant effects ( $P>0.05$ ) on  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ , and  $\text{HCO}_3^-$  concentrations . In conclusion, watermelon seed extract may be of supportive treatment to combat diabetes complications. © JASEM

<http://dx.doi.org/10.4314/jasem.v18i2.12>

Despite the availability of medication for management of diabetes, the interest in alternative traditional remedies is increasing (Pari and Umamaheswari, 2000). *Citrullus lanatus* seed contains phytochemical constituents like alkaloids, flavonoids, tannins, amino acids, carbohydrates, cardiotropins, terpenoids, oils and fats in the methanolic extract of plant material when compared with other solvents Flavanoids, have been reported to possess antiviral, anti-allergic, antiplatelet, anti-inflammatory, antitumor and antioxidant activities (Johnson *et al.*, 2012).

Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species, such as singlet oxygen, superoxide, peroxy radicals, hydroxyl radicals and peroxy nitrite (Johnson, 2001). Diabetes is one of the pathological processes known to be related to an unbalanced production of reactive oxygen species, such as hydroxyl radicals ( $\text{HO}$ ),

superoxide anions ( $\text{O}_2^-$ ) and hydrogen peroxide ( $\text{H}_2\text{O}_2$ ). In diabetes there is decrease in the level of electrolytes ( $(\text{Na}^+\text{Cl}^-)$  as a result of osmotic diuresis with subsequent loss of water and electrolytes induced by glycosuria (Adrogue *et al.*, 1986).

### MATERIALS AND METHODS

The following materials were used: Syringe and needle, Measuring cylinders Burette, volumetric flask, Beakers, conical flask, pipette, test tubes, Heparinized tubes, Plain tubes, electronic weigh balance, Cotton wool, Spectrophotometer, Stop watch, Dissecting set, Weigh machine, Centrifuge, Streptozotocin, Methanol, Chloroform.

Water melon fruit was obtained from New Benin, a local market in Benin City, Edo State. The flesh was removed and seeds collected were washed, sun-dried and milled into fine powder. This powdered sample was weighed into a beaker, soaked into 250ml of

Methanol (absolute) stirring continuously for a period of 48 hours. At the end of 48 hours the solution was filtered and the filtrate was concentrated using a rotary evaporator, then freeze dried prior to usage. The administration of extract was totally by gavage.

Fifteen adult wistar albino female rats with an average weight of 190g were used in this study. They were obtained from the animal house of the College of Medicine, Ambrose Alli University, Ekpoma, Edo State, Nigeria. The rats were allowed to acclimatize for a period of two weeks during which they were well fed with food and water. The rats were allocated into three groups, Group A: normal control (n=5), Group B: diabetic control (n=5) and Group C: diabetes + watermelon seed extract (n=5). The albino rats were fed growers mash once a day before the induction of diabetes and twice daily after inducing them with diabetes. The animals were maintained under laboratory conditions of room temperature, humidity and light. Diabetes was induced in rats by a single intraperitoneal injection of freshly prepared solution of 60mg/kg body weight streptozotocin in physiological saline. Rats were monitored twice daily for body weight and for food and water intake.

Basal glucose levels for all the rats were determined prior to streptozotocin injection, using an automated blood glucose analyzer (Glucometer Elite XL). After one week of streptozotocin administration and 12 h of fasting, blood glucose was determined and rats with double blood glucose concentrations of the baseline were declared diabetic and used for the study. The seed extract of *callinus decdyuu* was administered to the rats for a period of 4 weeks.

On day 29 the rats were sacrificed and blood was collected by cardiac puncture into plain bottles and fluoride oxalate sample tubes for electrolyte; ( $\text{Na}^+$ ), potassium ( $\text{K}^+$ ), chloride ( $\text{Cl}^-$ ), and bicarbonate ( $\text{HCO}_3^-$ ), and glucose analyses, respectively. The blood samples were taken to UBTH (University of Benin Teaching Hospital) to be analyzed. Glucose and electrolytes were assayed for using glucose oxidase method and flame photometry respectively.

#### Statistical Analysis

Data are presented as means  $\pm$ S.E.M and analyzed by one way ANOVA according to the method of Snedecor and Cochran (1980). Groups were compared by the least significant difference test (LSD) at the 5% level of probability. The data were analyzed by SPSS software.

## RESULTS AND DISCUSSION

**TABLE 1** Effect of watermelon seed extract administration on fasting blood glucose concentration (mg/dl)

S/NO	Group A (Non-diabetic control (normal)) mg/dl	Group B (Diabetic Control) mg/dl	Group C (Diabetes + 200mg of watermelon seed extract) mg/dl
Baseline	74 $\pm$ 3.30	70 $\pm$ 1.58	71 $\pm$ 2.34
Induction		403.80 $\pm$ 43.80	419.75 $\pm$ 33.45
Week 1	72.8 $\pm$ 3.25	204.2 $\pm$ 40.05	191.00 $\pm$ 36.22
Week 2	73.4 $\pm$ 2.42	561.75 $\pm$ 15.35	369.67 $\pm$ 79.77*
Week 3	71.8 $\pm$ 2.99	481.33 $\pm$ 71.93	390.1 $\pm$ 103.71
Week 4	76.0 $\pm$ 2.32	380.00 $\pm$ 12.00	266.75 $\pm$ 99.54*

Data presented as mean  $\pm$  SEM. \*Values are significantly different ( $P < 0.05$ ) when compared with diabetic control.

**TABLE 2** Effect of watermelon seed extract administration on serum electrolyte concentrations in diabetic rats.

PARAMETERS	Group A (Non-diabetic control (normal))	GroupB (Diabetic Control)	Group C (Diabetes+ 200mg of watermelon seed extract)
Sodium (meq/L)	145 $\pm$ 0.71	148 $\pm$ 0.00	145 $\pm$ 4.55
Potassium (meq/L)	7.33 $\pm$ 1.10	6.15 $\pm$ 0.65	5.88 $\pm$ 0.35
Bicarbonate (meq/L)	15.50 $\pm$ 1.44	17 $\pm$ 1.00	15.25 $\pm$ 1.32
Chloride (meq/L)	119 $\pm$ 0.58	115 $\pm$ 1.00	117 $\pm$ 1.29

Data presented as mean  $\pm$  SEM: The present investigation indicates that administration of the methanolic extract of *Citrullus lanatus* seed extract at a dose of 200 mg/kg body weight caused a reduction in the blood glucose concentrations in group C (diabetes + watermelon seed extract) at week

2 and 4 (Table 1). The presence of tannins and saponins, phytochemicals with recognizable hypoglycaemic effects, as well as the presence of soluble fibre and carbohydrates in *citrullus lanatus* seed, may contribute to this hypoglycaemic effect which is in line with the work done by (Nasiri *et al.*,

2009). Effect of phytochemicals (flavonoids) on pancreatic  $\beta$ -cells leading to their proliferation and secretion of more insulin have been proposed by Mahesh and Menon (2004) as the mechanism by which medicinal plants uses in reducing hyperglycaemia in streptozotocin-induced diabetic rats. Decrease in blood glucose concentration obtained from diabetes + extract group on the week 1 and 3, was not significant when compared to diabetic control group (Table 1). It is possible that this methanolic extract of *Citrullus lanatus* seed induces hypoglycemia by triggering insulin release from the  $\beta$ -cell of the islet of Langerhan or by hepatic glucose reduction, with the amount of insulin released directly related to the volume of extract administered. On the other hand, it is possible that this extract reduced blood glucose by stimulating insulin release from the  $\beta$ -cells of the pancreas that may have survived streptozotocin destruction (Onoagbe *et al.*, 1999).

In diabetes there is decrease in the level of sodium ion as a result of osmotic diuresis with subsequent loss of water and electrolytes induced by glycosuria (Adrogue *et al.*, 1986). Methanolic extract of *Citrullus lanatus* did not cause any significant difference in electrolyte concentration between the groups. This may be due to the duration at which the animals were diabetic, because electrolyte imbalance is not seen at the early stage of diabetes or it could be due to the concentration of administered dose.

In conclusion, watermelon seed extract may be of supportive treatment to combat diabetes complications as seen from the findings of this work.

## REFERENCE

- Adrogue, H.J, Ledere E.D , Suki W.N and Eknoyan G. (1986). Determination of plasma potassium levels in diabetic ketoacidosis. Medicine. 65:163-172.
- Johnson, J.T., Iwang, E.U., Hemen, J.z.. Odey,M.O., Efiong, E.E., Eteng, O.E. (2012). Evaluation of anti-nutrient contents of watermelon *Citrullus lanatus*. Ann Biol Res. 3(11):5145-5150.
- Johnson, I.T., Pokorny, J. N., Gordon, M. (2001). Antioxidants and Antitumour Properties. In: *Antioxidants in Food*, (Eds.). p 100-123.
- Khaki, A, Fatemeh F and ohammedN.(2013).Effects of water melon seed extract (*Citrullus Vulgaris*) on spermatogenesis in rat. Int. J. women's health reproduction sci. 1:3.
- Mahesh T and Menon VP. (2004). Quercetin elevates oxidative stress in streptozotocin- induced diabetic rats. Phytother Res. 18: 123-127.
- Nassiri, M., Khaki, A., Gharachurlu, S., Ashteani, A. Rastegarnea, K., Rezazadeh, S. (2009). Effects of Ginger on spermatogenesis in Streptozotocin induced Diabetic Rat, *Iran. J. Med. Plants*, 8(31):118-125.
- Onoagbe, I.O., Lau, H.U., Esekheigbe, A., Dawha, I.M., Salami, C.O. (1999). Effects of *Irvingia grandifolia* and *Spondias mombin* on blood glucose and triglyceride concentrations in streptozotocin-induced diabetic rats. Biokemistri, 9(1): 17-22.
- Pari, L., Umamaheswari, J. (2000). Antihyperglycaemic activity of *Musa sapientum* flowers: effect on lipid peroxidation in alloxan diabetic rats. *Phytother. Res.*, 14: 1-3.