Effect Of Taurine On Blood Glucose Level And Liver Enzymes Of Alloxan -Induced Diabetic Wistar Rats

* [1]Tanko Y., [1] Jimoh A, [1]Nasiru A.O., [1]Abdullahi A. [2]Mohammed K.A., [2]Abdulrazak A and [1]Mohammed A.

[1]Department of Human Physiology, Faculty of Medicine, Ahmadu Bello University, Zaria, Nigeria.
[2]Department of Human Physiology, Faculty of Medicine Kaduna State University, Kaduna, Nigeria
Email: yusuftanko@abu.edu.ng

Abstract: The aims of this study was to evaluate the effects of Taurine on blood glucose level and liver enzymes in diabetic rats. Alloxan-induced diabetic rats were injected intraperitoneally. Administration of Taurine to diabetic rats at doses of 200 and 400 mg/kg was able to decrease glucose levels significantly ($p<0.05$) compared to control untreated diabetic group. The concentrations of the liver enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) were significantly ($p<0.05$) reduced at the doses of 200 mg/kg and 400 mg/kg compared with the control untreated diabetic group. It may be concluded that oral administration of Taurine demonstrated remarkable anti-diabetic activity in alloxan induced-diabetic rats. It also could have protective effect against hepatic disorders.

[Tanko Y., Jimoh A, Nasiru A.O., Abdullahi A. Mohammed K.A., Abdulrazak A and Mohammed A.. **Effect Of Taurine On Blood Glucose Level And Liver Enzymes Of Alloxan -Induced Diabetic Wistar Rats.** *Life Sci J* 2016;13(11):30-33]. ISSN: 1097-8135 (Print) / ISSN: 2372-613X (Online). http://www.lifesciencesite.com. 5. doi:10.7537/marslsj131116.05.

Keywords: Taurine, Alloxan, Liver enzymes, Blood glucose level

Introduction

Diabetes mellitus is a metabolic disorder of the endocrine system that precipitates disturbances in glucose, lipid, and protein homeostasis (Effiong *et al.,* 2013). Diabetes Mellitus (DM) is a metabolic disease of multiple aetiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism, resulting from defects in insulin secretion, action or both (Odewabi *et al.,*2013). Diabetes mellitus is characterized by hyperglycemia, hypercholesterolemia, and hypertriglyceridemia, resulting from defects in insulin secretion or reduced sensitivity of the tissue to insulin(insulin resistance) and/or combination of both (Kumar *et al.,* 2011). The disease is found in all parts of the world and it is increasing rapidly worldwide. It is secondary to a deficiency of the number of pancreatic β-cells of the islets of Langerhans or resistance of tissue cells to insulin. People suffering from diabetes cannot produce or properly use insulin, and so they persistently have high blood glucose. Liver enzymes can serve as a marker of hepatocellular injury example aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP). Although these enzymes are elevated in liver disease, the elevation can also be secondary to enzyme induction without hepatic pathology (Raghda *et al.,* 2012). Taurine (beta- aminoethanesulphoric acid) is a special type of amino acid with a ubiquitous tissue distribution in most mammals. This compound was first discovered in ox bile from which its name was derived (John, 1988). Alloxan is the most prominent chemical compound used in diabetogenic research. In research it is used for induction of type 1 diabetes. Alloxan is a urea derivative which causes selective necrosis of the β- cell of pancreas of islets. It has been widely used to induce experimental diabetes in animals such as rabbits, rats, mice and dogs with different grades of disease severity by varying the dose of alloxan used (Tripathi *et al.,*2014).

The aim of this research is to determine the effect of Taurine on blood glucose levels and Liver enzymes of alloxan induced diabetic Wistar rats.

Materials And Methods

Animals

A total of twenty five (25) apparently healthy Wistar albino rats of both sexes, between the ages of 8-10 weeks old and weighing between 80-100 g were used for the study. The animals were obtained from Department of Human Anatomy, Ahmadu Bello University, Zaria. The animals were kept in well aerated laboratory cages in the Department of Human physiology animal house and were allowed to acclimatize to the laboratory environment for a period of 2weeks before the commencement of the experiment. They were maintained on standard animal feeds and drinking water *ad libitum.* This research was carried out in Ahmadu Bello University in accordance with the rules governing the use of laboratory animals as accepted internationally.

Chemicals and drugs

All chemicals and drugs used were of analytical grade. Alloxan was purchased from (Sigma chemical Company St. Louis U.S.A.). A digital glucometer (Accu-Chek Advantage, Roche Diagnostic, Germany)

was used for the determination of the blood glucose levels of the animals. Each tablet of taurine (1g Abcamplc, 330 Cambridge, science park Cambridge CB4 OFL United kingdom, was reconstituted to 100mg/mL suspension, just prior to its daily administration. Glibenclimide tablet (5mg/tablet, Nature field U.S.A) was obtained from a pharmaceutical store in Zaria, Nigeria. They were reconstituted to 1mg/ml in distilled water prior to daily administration.

Induction of experimental diabetes mellitus

The animals were fasted for 6-8h with free access to water prior to the induction of diabetes. Diabetes was induced by single intraperitoneal injection of Alloxan monohydrate (Sigma St. Louis, U.S.A.) at a dose of 150 mg/kg body weight which was dissolved in 5ml of sodium citrate solution into 6-8h fasted rats (Katsumata *et al*., 1999). Since Alloxan is capable of producing fatal hypoglycemia as a result of massive pancreatic insulin release from damaged pancreas. Rats were treated with 20% glucose solution orally after 30min. The rats were then kept for the next 24 h on 5% glucose solution bottles in their cages to prevent hypoglycemic (Dhandapani *et al*., 2002)..

Experimental design

After 72 h of Alloxan treatment, blood was collected from tail vein of the rats. Rats having fasting blood glucose level greater than ≥200 mg/dL were considered as diabetic (Stanley and Venugopal, 2001). After induction of diabetes the diabetic animals were randomly divided into five groups as follows:

Group 1: (Non- Diabetic normal rats), received distilled water orally.

Group 2: (Diabetic untreated Wistar rats) were given 10 ml/kg of distilled water orally daily.

Group 3: (Diabetic treated) were treated with 100 mg/kg body weight of Taurine orally for 21 days.

Group 4: (Diabetic treated) were treated with 200 mg/kg body weight of Taurine orally for 21 days.

Group 5: (Diabetes treated) were treated with 1mg/kg body weight of glibenclimide orally for 21 days.

Determination of blood glucose levels:

All blood samples were collected from the tail vein of the rats on weekly basis for 3 weeks. Fasting blood glucose levels were determined by using glucose oxidase method expressed in the unit of mg/dL (Beach and Turner, 1958) using a digital glucometer (Accu-Chek Advantage, Roche Diagnostic, Germany) and the results were expressed in the unit of mg/dL (Rheney and Kirk, 2000).

Collection and Preparation of Serum Samples for Analysis

At the end of the treatment period, all animals were subjected to light anesthesia by exposing them to chloroform soaked in cotton wool placed in anesthetic box covered with lid. Blood samples of about 3ml were drawn from the heart of each sacrificed animal from all groups by cardiac puncture. The samples were collected in Eppendrof tubes and were allowed to clot. Thereafter the serum was separated by centrifugation, using Denley BS400 centrifuge (England) at 3000 *g* for 10 minutes. The supernatant collected were used for the analysis.

Table 1: Effect of Taurine on Serum Blood glucose Levels of Alloxan –Induced Diabetic Wistar Rats

GROUP	DAY (0)	DAY (7)	DAY(14)	DAY (21)
Normal Control	117.40 ± 4.88 [a]	95.40 ± 3.38 [a]	95.60 ± 1.47 [a]	100.80 ± 3.76 [a]
Untreated Diabetes	421.00 ± 21.12	308.40 ± 41.16	358.40 ± 32.40	333.80 ± 27.06
Diabetic+100mg Taurine	410.40 ± 49.45[ns]	244.00 ± 29.31[a]	221.80 ± 10.83 [a]	157.40 ± 14.09 [a]
Diabetic+200mg Taurine	409.40 ± 49.3ns	221.60 ± 24.21[a]	210.20 ± 29.46 [a]	137.80 ± 11.72[a]
Diabetic+glibenclamide 1mg/kg	400.20 ± 54.82[ns]	202.20 ± 16.58[a]	147.80 ± 20.09[a]	99.00 ± 9.57[a]

Values are expressed as mean ± SEM; n=5 [a] p<0.05

Table 2: Effect of Taurine on Serum Liver enzymes of Alloxan –Induced Diabetic Wistar Rats

Groups	ALT (I.U/L)	AST (I.U/L)	ALP (IU/L)
Normal control (Normoglycemic)	29.20 ± 1.11 [a]	37.25 ± 3.60 [a]	15.16 ± 5.41 [a]
Diabetic untreated	42.40 ± 3.61[a]	45.80 ± 3.12[a]	26.70 ± 5.13[a]
Diabetic + Taurine (100mg/kg)	21.20 ± 1.60[a]	29.00 ± 2.74[a]	10.70 ± 0.85[a]
Diabetic + taurine (200mg/kg)	19.60 ± 4.90 [a]	32.40 ± 3.60[a]	39.75 ± 2.18[a]
Diabetic + glibenclamide (1mg/kg)	24.00 ± 3.40 [a]	28.80 ± 0.90[a]	25.33 ± 3.69[a]

Values are expressed as mean ± SEM; n=5 [a] p<0.05

Determination of liver enzymes

Serum Alkaline Phosphatase (ALP) activity was assayed by the method of (Bassy *et al.,* 1946). Serum Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) activities were assayed by the method of (Reitman and Frankel 1957)

Statistical analysis

Data obtained from the study were expressed as mean ± SEM. The differences between the groups were analyzed by one-way analysis of variance (ANOVA) followed by post hoc multiple comparison tests of Tukey's using SPSS statistical tool version 19. Values of $p < 0.005$ were considered as significant.

Discussion

Diabetes Mellitus is endocrine disorder which can be considered as the biggest impact on adults of working age in developing countries and major cause of high economic loss (Mahabir and Gulliford 1997). It has been pointed to the environment of numerous numbers of medicinal plants with long history in folk use in management of diabetic patient [Soto et al., 2010).

In the present study, diabetes we induced diabetes in rats by injecting alloxan intraperitoneally. The cytotoxic effects of alloxan are due to its active damaging insulin secreting β-pancreatic cells, leading to reduce endogenous insulin release, and lower intake of glucose by the cells which leads to increases blood sugar level (Lenzen, 2008).

The capacity of extract lower increased blood glucose concentration significantly ($P < 0.05$) within normal limits is considered crucial for the liver to restore its normal homeostasis in experimental diabetic rats. Taurine effect was potentiating the function of β-cells in sugar metabolism. It is may have an unidentified agent that improves the function of insulin in sugar metabolism. Such hypoglycemic effect of Taurine may increase the effect of insulin in sugar metabolism in diabetic animals by making fat cells to respond more to insulin and it is highly possible to activate the enzyme that causes insulin to bind to cell receptors and to inhibit the enzyme that makes to block this process leading to increase insulin sensitivity. Taking together, it is plausible to postulate that mechanism for the anti-diabetic potential of Taurine is partly due to stimulate insulin secretion, release as well as regeneration of β-cells of Langerhans islets, activation of enzymes responsible for glucose utilization. Administration of Taurine decreased the concentrations of liver enzymes AST and ALT in diabetic rats. The concentration of plasma glucose was found to decrease significantly in diabetic rats treated with the two doses of Taurine which is thought to be a result of the significant ($P < 0.05$) decrease in the level of liver enzymes. [Table 2]. The decrease in the activities of gluconeogenesis leads to the decreased level of glucose in blood. It is hypothesized that a sequential metabolic association between increased glycolysis and decreased gluconeogenesis induced by Taurine points to the possible biochemical mechanism through which sugar homeostasis and liver enzymes are maintained (Muthu et al., 2008) Liver enzymes such as AST, ALT are released to circulation when liver cells are damaged by alloxan including muscle injury and viral hepatitis as well as cardiac problem. Increased levels of AST and ALT are indicative of cellular damage and make disorder in the functional activity of liver cell membrane.

In conclusion this investigation supports that oral administration of Taurine have anti-diabetic activities and effective in decreasing concentrations of blood glucose levels in diabetic rats. Results demonstrate positive effect on liver enzymes. Administration of Taurine likely represents a safe and effective means to reduce the risk factors for the development of diabetic complications. More research on Taurine should be undertaken because it has new potential management of diabetes and liver disorders.

Corresponding Author:
Yusuf. Tanko.
Department of Human Physiology, Ahmadu Bello University, Zaria, Nigeria.
Email: yusuftanko@abu.edu.ng

References.

1. Barar, F.S.K., (2002). Essentials of Pharmaco Therapeutic. 3rd Edn., S. Chand and Company Ltd., New Delhi.
2. Bassey, O. A., Lowry, O. H. and Brock, M. J. (1946). A method for the rapid determination of alkaline phosphatase with five cubic millimeters of serum. *Journal of Biological Chemistry,* 164: 321-329.
3. Beach, E.F., Turner, JJ (1958). An enzymatic methods for glucose determination in body fluids. Clin Chem. 4:462-465.
4. Chartila, R.W. (1996). Hepatomegaly and abnormal liver test due to glycogenesis in adults With diabetes. *Journal of medicine*, 75(6): 327-333.
5. Dhandapani, S., Ramasamy, S. V., Rajagopal, S. and Namasivayam, N. (2002). Hypolipidemic effect of *Cuminumcyminum* L. on alloxan-induced diabetic rats. *Pharmacology Res*earch, 46: 251-255.
6. Duncan RC, Knapp RG, Miller MC (1977). Test of hypothesis in population Means. In: *Introductory Biostatistics for the health sciences*. John Wiley and Sons Inc. NY: pp.71-96.
7. Effiong, E.E., Igile, G.O., Mgbeje, B.I.A., Otu, E.A. and Ebong, P. E. (2013). Hepatoprotective and anti-diabetic effect of combined extracts of *Moringaoleifera* and *vernonia amygdala*in streptozocin-induced diabetic albino wister rats. *Journal of diabetes and endocrinology* 4(4): 45-50. Doi: 10.5897/JDE2013.0069.

8. Gavrovskya L, Ryzhova O, Safonova A, Mathew A K and Sapronov N S (2008). Protective effect taurine on rats with experimental insulin-dependent diabetes mellitus. Bulletin of Exprimental biology and medicine, 146(2):226-228.
9. Han, N., Htoo- Htoo, K. S. and Aung, H. (2012). Determination of abnormal liver function tests in Diabetes patients in myanmar. *International journal of diabetes research*, 1(3): 36-41 doi 10.5923/j.diabetes.20120103.02.
10. Idris, A.S., Mekky, K.F., Abdalla, B.E. and Ali, K.A. (2011). Liver function test in type 2 sudanese Diabetic patients. *International journal of nutrition and metabolism*, 3(2): 17 21.
11. John, H. (1988). The biosynthesis, function and deficiency signs of taurine in cats. *Nutritional Subcommittee CVMA pet food certification program*, 29: 598-601.
12. Katsumata, K., Katsumata, Y., Ozawa, T. and Katsumata, K. (1999). Potentiating effects of combined usage of three sulfonylurea drugs on the occurrence of alloxin induced diabetes in rats. *Horm. Metab. Res,*25: 125-126.
13. Kumar, R., Vimal, A., Veerma, R., Anil, B. and Priti, V. (2011). Hypoglycemic and hypolipid emic effect of Allopolyherbal formations in streptozocin induce diabetes mellitus in rats. *International journal of diabetes mellitus*, 3: 45-50 doi: 10.1016/j.ijdm.2011.01.005.
14. Lenzen S (2008) The mechanism of alloxan and streptozotocin-induced diabetes. Diabetologia, 51,216-226.
15. Mahabir.D and Gulliford M.C (1997) Use of medicinal plants for diabetes in Trinidadand Tobago, Rev Panam Salud Publica, 1(1997) 174-179.
16. Muthu G Balasubramanian R, Raju S, John. W, Ekambaram. K,. Mani. RK Kunchu, K Mohanraj P, Balasundaram J (2008) (Hepatoprotective and Antioxidant Effect of *Pisonia aculeata L.* against CCl4- Induced Hepatic Damage in Rats. Sci Pharm, 76203–215.
17. Odewabi, A.O., Akinola E.G., Ogundahunsi, O.A., Oyegunle V.A., Amballi, A.A., Raimi, T. and Adeniyi, F.A. (2013). Liver enzymes and its correlayes in treated and newly diagnosed type 2 diabetes mellitus in patients in osogbo, south west, Nigeria. *Asian journal of medical sciences*, 5(5): 108-112. ISSN: 2040-8765.
18. Raghda, R.S., Rasha, H.S., Ahmed, M.A. and Mona, H.T.(2013). Effect of antiepileptic drugs on liver enzymes. *Beni-suef university journal of basic and applied science*, 2: 14-19 doi: org/10.16/j.Bybas.2013.09.002.
19. Ravindranath, A. and Vandana, J. (2014). Advances in the management of type 1 diabetesmellitus. *World journal diabetes*, 5(5): 689-696 doi:10.4239/wjd.v5.i5.689.
20. Reitman S and Frankel S (1957). A colorimetric method for the determination of serum Glutamine oxaloacetic acid and glutamic pyruvic acid and Transaminase. *Journal of Clinical Pathology,* 28; pp 56-63.
21. Rheney CC, Kirk KK (2000). Perfomance of three blood glucose meters. Ann Pharmacother. March; 34(3):317-21.
22. Simo, R., Hernadez, C., Genesca, J., Jardi, R., Messa, J. (1996). High prevalence of hepatitis C Virus infection in diabetic patients. *Diabetes care*, 19: 998-1000.
23. Soto. C, Pérez. J, García. V, Uría. E, Vadillo. M, Raya. L (2010) Effect of silymarin on kidneys of rats suffering from alloxan-induced diabetes mellitus, Phytomedicine, 171090-4.
24. Stanley, M.P. and Venugopal, M.P. (2001). Anti-oxidant action of *Tinosporacordifolia* root extract inalloxan diabetic rats. *Phytother Res*, 15:213-218.
25. Tripathi, V. and Verma, J. (2014). Different models used to induce diabetes: a comprehensive review. *International journal of pharmacy and pharmaceutical sciences*, 6(6): 29-32. ISSN-0975-1491.

11/24/2016