

Effects of Watermelon Seed Extracts on Fasting Lipid Profile in Streptozocin Induced Diabetic Albino Rats

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Abstract: The study was designed to assess the Hypolipidaemic and Hypoglycaemic function of watermelon seed extracts in Streptozocin induced Diabetic Albino rats. Total of twenty rats were randomly allocated into three (3) groups of five (5) rats each; Non Diabetic Control, Diabetic Control and the Diabetes treated with 200mg of watermelon seed extracts for a period of 28 days. Diabetes was induced by single intraperitoneal injection of Streptozocin (60mg/kg b.w). After 28th treatment, the rats were sacrificed under Diethyl ether anaesthesia and the blood was collected directly from heart. Serum concentration of glucose, Cholesterol, Triglycerides, HDL and LDL of all the animals in each group were determined. The results shows a significant reduction ($p<0.05$) of Fasting glucose, cholesterol, TG and LDL cholesterol of Diabetic treated with 200mg concentration of seed extracts when compared with Normal and Diabetic Controls. In Conclusion, watermelon seed extract therefore exhibits both Hypolipidaemic and Hypoglycaemic property.

Keywords: Diabetes mellitus, Lipid Profile, Watermelon seed extracts, Fasting Blood sugar.

1. INTRODUCTION

Diabetes mellitus is a heterogeneous primary disorder of carbohydrate metabolism in which glucose is underutilized. It is characterized by impaired glucose homeostasis with perturbed carbohydrates, fats and protein metabolism as a results of defects in insulin secretion, insulin action or both (Barcelo, 2001). Insulin is a protein manufactured by beta cells of islets of langerhans in the pancrease: It promotes rapid uptake of glucose by peripheral tissues, inhibit gluconeogenesis and glycogenolysis (Bolarins, 2013). Diabetes Mellitus is a global public health problem with increasing prevalence. It's predicted that about 366 million people worldwide will be diabetic by the year 2030 (Wild et al., 2004).

Nutraceuticals and functional foods are very recently advancing in the prevention of various metabolic maladies through dietary regimen module (Ambreen, 2014). Evidence is accumulating that fruits are direct and concentrated source of natural substances that posses health promoting properties (Butt et al., 2008). Watermelon is a good source of Vitamin B, B6 and magnesium (Huh, et al., 2008). Additionally, watermelon is enriched with carotenoids, vitamin C, Citrulline, Flavonoids, fats and cholesterol free (Brutton et al., 2009 Leskovar et al., 2004). Herbal treatment of Diabetes is currently gaining momentum with variety of plant derived properties being promoted as capable of reducing of reducing blood sugar levels (Muhammad e tal., 2015).

Studies have shown that increased elevation of total or low density lipoprotein (LDL) cholesterol in the blood plays an important role in the development of coronary heart disease (Law, 1999), whereas high HDL-cholesterol may protect against coronary heart disease (Sheten et al., 1991; Castelli et al.,1992). The Cardiovascular disease is a cause of morbidity

and mortality among the diabetics and this may be due to derangement in serum levels of lipoproteins. It has been suggested that the increase in triglyceridemia may be due to insulin deficiency which results in faulty glucose utilization, causing hyperglycemia and mobilization of fatty acids from adipose tissues. In diabetes, blood glucose is not utilized by tissue resulting in hyperglycemia. The fatty acid from adipose tissue are mobilized for the purpose of ATP formation and excess fatty acid are accumulated in the liver, which are subsequently converted to triglyceride (Shih, 1997)

2. MATERIALS AND METHODS

Materials used in this study includes: Syringe and needle, cotton wool, Fluoride oxalate container and plain bottles, Volumetric flask, measuring cylinders, micro pipettes, Weighing balance, Spectrophotometer, test tubes, Glucometer (Accu-Check Active 444, Roche Diagnostic GmbH, Germany), Timer, Centrifuge, Rotary evaporator, Methanol, Diethyl ether, Streptozocin

Plant Materials; Watermelon fruits were purchased from Ultra modern market Dutse, Jigawa state, Nigeria. It was identified and authenticated by specialist in the Botany unit, Department of Biological science, Federal University, Dutse.

Extract Preparation; Watermelon fruits were dissected into halves, flesh was removed and seeds collected. The seeds were thoroughly washed, dried in room temperature and milled into a fine powder. Using a weighing balance, powdered extract was weighed into a beaker, soaked in 250ml of absolute methanol for 48hours. The solution was filtered using Whatman filter paper No. 1 and concentrated at 50^oc with rotary evaporator and freeze-dried prior to use.

Experimental animals; Albino rats weighing 129-165g obtained from Department of Pharmacology, ABU Zaria were used in this study. The animals were housed in healthy condition at a constant environment with a 12-h light/dark cycle and nutritionally balanced pellets and water *ad libitum* to acclimatize for a period of two weeks before the commencement of the experiment

Diabetes Induction; Diabetes was induced by single intraperitoneal injection of freshly prepared solution of STZ at a dose of 60mg/kg body weight in 0.1 M citrate buffer, pH 4.5. Diabetes was confirmed by measuring 10-h fasting blood glucose. Animal with blood glucose ≥ 280 mg/dl were considered diabetic

Study design; Twenty albino rats were randomly allocated into three groups of five rats each (n=4). Group 1: Non Diabetic Control rats; Group 2: Diabetic Control rats; Group C: Diabetic rats treated with 200mg of watermelon seed extract. The administration of extract was totally by gavage. The serum concentration of cholesterol, HDL, LDL and triglycerides of all the animals in each group were determined after the 28th treatment. On the 29th day of treatment and following an overnight fast, the animals were sacrificed under Diethyether anaesthesia and blood specimens were collected directly from heart.

Biochemical analysis: Total cholesterol was estimated in accordance with method of Trinder, (1969), serum triglycerides was estimated using the method described by (Lothar, 1998), HDL was estimated in accordance to the method of LDL cholesterol values were calculated according to Friedewald's formula. Blood glucose estimation was done by one touch electronic glucometer (Accu-Check Active 444, Roche Diagnostic GmbH, Germany) using glucose test strips according to the method of Giordano et al., 1989.

Chemicals used; All chemicals used are of analytical grades obtained from Sigma (St Louis, USA) unless otherwise stated.

3. RESULTS

Table1: Serum levels of Lipid Profile and Glucose in STZ – Induced Diabetic Albino Rats after Treatment with 200mg of Watermelon Seed extracts for 28 days.

GROUPS	FBG(mg/dl)	CHOL(mg/dl)	TG(mg/dl)	HDL(mg/dl)	LDL(mg/dl)
NC(n=5)	73.1±1.3	105.08±5.24	69.8±1.95	51.92±2.06	36.64±5.82
DC(n=5)	391.1±7.9	136.38±4.07	143.84±6.27	37.76±1.79	81.10±2.79
Diabetic+ 200mg extract(n=5)	235.9±22.4	75.73±6.39	56.45±5.03	50.18±4.12	60.48±3.93

Results are Mean±SD; n= number of rats; NC= Non Diabetic control; DC= Diabetic

4. DISCUSSION

According to world health organization (WHO) cardiovascular disease (CVD), cancer, chronic respiratory disease, and diabetes are the main cause of morbidity and mortality throughout the globe in 2008 (Alwan, 2008). Dyslipidemia as a risk factor of CVD can be defined as the elevation, derangement or attenuation of plasma lipoproteins concentration. Generally, dyslipidemia is defined as the total cholesterol, LDL, TG, apo B or Lp (a) levels above the 90th percentile or HDL and apo A levels below the 10th percentile of the general population (Dobsn et al., 1996).

Results of the current study revealed an increase ($p < 0.05$) blood cholesterol, triglyceride and LDL cholesterol in the diabetic compared to Non diabetic control group. The elevation might be due to an increased action of hormone sensitive enzyme, lipase, which promotes lipolysis, and hence increase the level of free fatty acids in the plasma that is readily catabolised to acetyl CoA, the resultant acetyl CoA is channeled to cholesterol synthesis, thereby increasing blood cholesterol level.

Significantly reduced ($P < 0.005$) levels of TG, cholesterol and LDL were observed after administration of 200mg of watermelon seed extract for 28 days. Findings of this research was in agreement with the work of Bako, et al.,(2014) and Claudia et al., (2006) who suggests that many plant extracts possess hypolipidaemic characteristics of combating atherosclerosis (which is one of the major diabetic complications) by lowering the levels of cholesterol, TG and LDL. The reduction of TG and LDL with reference to this study as per as lipid profile

The hypolipidaemic functions of watermelon seed extracts may be due to its ability to induce regeneration of the beta cells of the islet of langerhans in the pancrease and potentiation of insulin secretion from surviving beta cells. The increase in the insulin secretion and consequent decrease in blood glucose levels may lead to stimulation of fatty acid biosynthesis and also incorporation of fatty acid into triglyceride in the liver and adipose tissues. In the presence of insulin, action of enzyme lipase will be inhibited thereby arresting the mobilization of fatty acids by glucagon and hence decrease in the plasma levels of fatty acids will be observed.

The inverse relationship that exists between HDL and coronary heart diseases has long been documented, HDL causes removal of cholesterol from non hepatic peripheral tissues to the liver for catabolism and excretion via mechanism called reverse cholesterol transport (Khanet, et al., 2003).

The present study indicates that insulin increases the number of LDL receptor, so chronic insulin deficiency might be associated with a diminished level of LDL receptor. This causes the increase in LDL particles and result in the increase in LDL-cholesterol value in diabetes mellitus.

5. CONCLUSION

Overall, it may be concluded that administration of methanolic seed extract of watermelon at 200 mg/kg body weight exhibited promising antidiabetic and Hypolipidaemic activity in streptozotocin-induced diabetic rats. The anti-dyslipidemic activity of watermelon seed extracts could represent a protective mechanism against the development of atherosclerosis, especially in diabetic condition and may prove to be of clinical importance in the management of type 2 diabetes. However, this may not be safe at higher doses.

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