



# Pharmacological insights into cashew methanolic nut extract: mitigating obesity and oxidative reactions under high-fat diet conditions

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## Abstract

**Background:** Obesity is taken into consideration as principal threat elements for improvement of many continual metabolic illnesses and prevention of weight problems in assuaging those illnesses is globally challenging. This look at investigated the capacity anti-weight problems impact of *Anacardium occidentale* methanolic nut extract in high-fats food plan precipitated overweight rats as compared to Simvastatin.

**Methods:** Fifty (50) male Wistar rats weighing (180±20g) have been used and weight problems turned into precipitated the use of high-fats food plan. The animals have been divided into 5 groups (10rats/group): control, HFD, HFD+100mg/kgb.wt *Anacardium occidentale*, HFD+200100mg/kgbwt *Anacardium occidentale* and HFD+40mg/kgb.wt Simvastatin group. Body weight and blood glucose have been measured weekly. On the ultimate day of the experiment, the animals have been sacrificed and blood pattern have been gathered for biochemical estimation of lipid profile, insulin, leptin, ghrelin, oxidative strain parameters and Markers of Kidney capabilities.

**Results:** Treatment with *Anacardium occidentale* nut extract significantly ( $p<0.05$ ) lower the frame weight, blood glucose, leptin, triglyceride (TG), overall cholesterol (TC), low-density lipoprotein (LDL), very-low density lipoprotein (VLDL) and greater the high-density lipoprotein (HDL) and ghrelin ranges in high-fats food plan handled rats. Furthermore, Glutathione peroxidase (GPx), Superoxide dismutase (SOD), Reduced glutathione (GSH), and Catalase (CAT) ranges have been significantly ( $p<0.05$ ) will increase with a lower Malondialdehyde (MDA) stage in high-fats food plan handled rats. Also, Markers of kidney capabilities urea, uric acid and creatinine stage have been stepped forward in high-fats food plan handled rats.

**Conclusion:** From those findings, *Anacardium occidentale* nut extract has capacity anti-weight problems consequences and it is able to be explored as opportunity remedy in stopping weight problems-associated metabolic disease.

**Keywords:** Sankhya philosophy, Humanism philosophy, Scientist

## 1. Introduction

Obesity occurrence has tripled in quantity on the grounds that 1975, and in 2016 worldwide envisioned overweight person with a frame mass index (BMI) of more 30 changed into 1.9 billion and a further 650 million are obese (BMI>25) [1]. Many elements together with nutritional choice for high-fats and caloric wealthy diets, sedentary lifestyle, genetic susceptibility, and endocrine problems make contributions to the growing fashion of weight problems. The main etiology for weight problems and obese is the power imbalance wherein power consumption exceeding the power expenditure [2].

Obesity is a metabolic ailment resulting from peculiar or immoderate frame fats accumulation in adipose tissue main to pathogenesis of severa metabolic illnesses related to weight problems consists of hyperlipidemia, hypertension, atherosclerotic, cardiovascular sickness and sort 2 diabetes mellitus [3,4]. These illnesses are often followed through insulin resistance, expanded oxidative pressure, and improved inflammatory marker expression [5]. Obesity associated insulin resistance is a middle component for pathogenesis of long-time diabetes headaches together with diabetic nephropathy [6].

Obesity is taken into consideration as peril component for the improvement, unfold and development of persistent kidney sickness [7].

Furthermore, expanded oxidative pressure in weight problems commonly worsen through excessive degree of reactive oxygen species and decline manufacturing of frame defense endogenous antioxidant enzymes (superoxide dismutase (SOD), catalase (CAT), glutathione S-transferase (GST), and glutathione peroxidases (GPx) [8]. Excessive reactive molecules motive mobile harm and improvement of more than one illness because of declining endogenous antioxidant device potential to get rid of loose radicals [9]. Therefore, remedy and prevention of weight problems and obese is one of the international fitness challenges.

Currently, the widely known strategies for stopping weight problems and obese contain calorie weight-reduction plan limit and good enough workout which aren't nicely maintained. Also, along with weight-reduction plan limit and right good enough workout practice, the emergent hobby to lessen frame weight via scientific treatment options (drugs) has been suggested to have destructive aspect effect [10]. Hence, there's

pressing want to look for powerful technique and secure treatment options for remedy and prevention of weight problems-related metabolic illnesses.

Natural vegetation or fruit or nuts, wealthy in phenolic compounds are recognized for his or her big capacity healing results inclusive of anticancer, antibacterial, antioxidant, antidiabetic, and anti-inflammatory properties <sup>[11]</sup>. One of the 0.33 rank well-known dietary plant nuts withinside the global is cashew nut (*Anacardium occidentale* L.) which could modulate the chance of growing many metabolic diseases <sup>[12]</sup>. *Anacardium occidentale* is a plant originated from Brazilian this is normally ate up in nature and utilized in peoples medication with excessive fee fit for human consumption nut and a supply of carbohydrates, proteins, phosphorous, iron, zinc, magnesium, fibers, and fatty acids <sup>[13]</sup>. The diverse elements of the plant are medicinally explored to deal with exclusive ailments <sup>[14]</sup>. Phytochemical evaluation of *Anacardium occidentale* plant found out the presences of many bioactive compounds and different polyphenols as well <sup>[15]</sup>. *Anacardium occidentale* nuts are wealthy of unsaturated fatty acids, flavonoids, anthocyanins and tannins, fiber, folate and tocopherols <sup>[16-19]</sup>. Despite diverse healing results of this plant elements, there were little interest at the intake of *Anacardium occidentale* nuts for prevention and remedy of continual metabolic diseases. Therefore, the prevailing look at geared toward investigating the capacity anti-weight problems results of methanolic extract of *Anacardium occidentale* nut in excessive-fats diet (HFD) prompted overweight male Wistar rats.

## 2. Materials and Methods

### 2.1 Collection of plant materials

Fresh *Anacardium occidentale* nuts were harvested from Plant Agricultural Research Farm, Ladoké Akintola University of Technology, Ogbomosho, Oyo State, Nigeria. The plant nut was identified, authenticated, and given a voucher specimen number LH0533 by Dr. A. T. J. Ogunkunle at Biology Department, Ladoké Akintola University of Technology, Ogbomosho, Oyo State, Nigeria.

### 2.2 Extraction of *Anacardium occidentale* nut

The *Anacardium occidentale* nuts were thoroughly washed and air-dried at room temperature. The outer coated was removed to obtain the nuts. Then, the nuts were grinded into fine powder form by an electric blender and stored in air-tight container. 500g of the fine powdered form was extracted in a Soxhlet apparatus with 95% methanol solvent. The methanolic extract was also kept in air-tight container and store at 4°C until used.

### 2.3 Experimental animals

Fifty (50) healthy male Wistar rats (180±20g) were used. The animals were obtained from the Animal Research House of Physiology Department, Ladoké Akintola University of Technology, Ogbomosho, Oyo State, Nigeria. The rats were housed in a plastic cage (10rats per each cage) under free-pathogen conditions of relative humidity (45±5%), temperature

(25±5°C) and 12hours light/dark cycles. The animals were acclimatized for two (2) weeks and had free access to rat pellet feed with water *ad libitum* before the experiment was commence. All experimental protocols and handling of animals were performed in accordance with the guidelines of the National Institutes of Health for the Care and Use of Laboratory Animals.

### 2.4 Animals grouping and treatment

The fifty (50) rats were randomly divided into five major groups of ten rats per each group (n=10).

Group 1: Normal pellet diet (Normal control)

Group 2: High-fat diet (Obese control)

Group 3: High-fat diet + 100mg/kgb.wt *Anacardium occidentale* methanolic nut extract

Group 4: High-fat diet + 200mg/kgb.wt *Anacardium occidentale* methanolic nut extract

Group 5: High-fat diet + 40mg/kgb.wt Simvastatin

All the groups were water *ad libitum* and administration of the nut extract was done via oral gavage with oral cannula. The experimental period last for six (6) weeks.

### 2.5 Fasting plasma glucose level and body weight assessment

Fasting plasma glucose levels and body weight changes of the rats were measured at weekly intervals prior and during the administration of *Anacardium occidentale* methanolic nut extract, throughout the experimental period. Plasma glucose levels were determined by glucose oxidase/peroxidase (GOD-POD) method with a glucometer and test stripes (Accu-Chek Advantage, Roche Diagnostic, Germany).

### 2.6 Determination of biochemical parameters

At the end of the period of experiment, the animals were fasted overnight (12hours fasting), anaesthetized with intraperitoneal injection of ketamine-75mg/kg and xylazine-20mg/kg and then sacrificed by cervical dislocation. Fasting blood samples were collected from the apex beat of the rats' heart via cardiac puncture into heparinized tubes, centrifuged at 3000rpm for 5mins and supernatant plasma was retrieved for biochemical analysis.

The levels of plasma triglyceride (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were determined using enzymatic colorimetric methods with a commercial Diagnostic kit (Genzyme Diagnostics, MA, USA). Plasma levels of very-density lipoprotein (VLDL-C) were estimated according to Friedewald formula.

The Plasma insulin, leptin and ghrelin levels were measured by an enzyme link immunosorbent assay (ELISA) method using ELISA kits respectively. Also, superoxide dismutase (SOD), glutathione (GSH), glutathione peroxidase (GPx) and catalase (CAT) antioxidant activities were estimated by enzyme linked immunosorbent assay (ELISA) methods using Rat SOD, GSH GPx and CAT ELISA Kits as described by Sigma-Aldrich Kit. Malondialdehyde (MDA) was measured following the

manufacturer's instructions (Oxford Biomedical Research, USA).

Markers of kidney function (blood urea nitrogen (BUN), plasma creatinine, and uric acid) were determined using the commercially kits from Siemens Health Care Diagnostics.

## 2.7 Statistical analysis

Statistical Package for Social Sciences (SPSS), version 20.0 software was used for the experimental data analysis. Data were expressed as mean  $\pm$  SEM (n=10). Mean differences between groups were tested for statistical significance using one-way analysis of variance (ANOVA) followed by Bonferroni post hoc test. P-value less than 0.05 ( $P < 0.05$ ) were considered statistical significant for all data analysis.

## 3. Results

### 3.1 Effects of *Anacardium occidentale* nut extract on body weight in HFD-induced obese rats

The frame weight of high-fats weight-reduction plan triggered overweight organization rats became significantly ( $p < 0.05$ ) expanded in comparison with the rats fed with regular weight-reduction plan (manipulate organization). Treatment with 100mg/kg and 200mg/kg of *Anacardium occidentale* nut extract and 40mg/kg of Simvastatin respectively decreased the frame weight in agencies 3, four and five in comparison to the untreated overweight organization.

### 3.2 Effects of *Anacardium occidentale* nut extract on plasma blood glucose and insulin concentration levels in HFD-induced obese rats

Plasma blood glucose stage and insulin awareness have been significantly ( $p < 0.05$ ) will increase in high-fats weight-reduction plan untreated institution in comparison with the manipulate institution. Oral management of 100mg/kg and 200mg/kg of *Anacardium occidentale* nut extract and 40mg/kg of Simvastatin attenuates the blood glucose and insulin awareness stages in organizations 3, 4, and five whilst in comparison with untreated overweight institution.

### 3.3 Effects of *Anacardium occidentale* nut extract on lipid profile parameters in HFD-induced obese rats

Untreated obese group rats showed significant ( $p < 0.05$ ) increases in total cholesterol (TC,) triglyceride (TG), low-density lipoprotein-cholesterol (LDL-c), very-low density lipoprotein-cholesterol (VLDL-c), levels while high-density lipoprotein-cholesterol (HDL-c) level decreased significantly when compared with the control. Administration of 100mg/kg and 200mg/kg of *Anacardium occidentale* nut extract and 40mg/kg of Simvastatin markedly reversed the levels of TC, TG, LDL-c, and VLDL-c with improve HDL-c level in groups 3, 4, and 5 when compared with the untreated obese group. Also, atherogenic index (AI) and Cardiac risk index (CRI) were significantly ( $p < 0.05$ ) higher in untreated obese group rats when compared to the control group and treatment with both doses of *Anacardium occidentale* nut extract and Simvastatin lower these levels in groups 3, 4, and 5.

## 4. Discussion and Conclusion

### 4.1 Discussion

Obesity is a serious global health problem. It is characterized by elevated lipid accumulation in an expanded adipose tissue mass. The imbalance between calorie intake and energy expenditure cause obesity. Natural plant compounds and their derivatives have been used as alternative and complementary therapies for treating obesity without mortality or obvious adverse effects. In this study, we investigate the potential therapeutic anti-obesity effects of *Anacardium occidentale* methanolic nut extract in high-fat diet induced obese rats.

Intakes of high-fat diet responsible for body weight gain due to its high energy and fat contents. Rats fed with high-fat diet in this study exhibited significantly higher body weight gain indicative obesity state, which supports the previous studies. Treatment with both doses of *Anacardium occidentale* nut extract markedly reduced their bodyweights compared to the weight of untreated obese rats.

Obesity is closely related to the development of metabolic disorders, including dyslipidemia, insulin resistance, and hepatic steatosis. High-fat diets are known to produce significant negative effects on the lipid panel. These effects are suggested to be mediated through increased lipids absorption from the gastrointestinal tract (GIT) and a reduction of cholesterol metabolism. In this present study, animals fed with high-fat diet showed obesity related dyslipidemia with elevated TG, TC, LDL and VLDL levels and decreased in HDL. Also, TC/HDL ratio is used to predict the risk of cardiovascular disease. This ratio is called cardiac risk index. High total cholesterol levels and low HDL level will increase the cardiac risk index. Our results show that animals fed with HFD has the highest TC/HDL ratio, indicating a high risk of cardiovascular disease. Treatments with 100mg/kgb.wt and 200mg/kgb.wt *Anacardium occidentale* nut extract showed decreased levels of TC, TG, LDL and VLDL along with significant increase in HDL level and lower cardiac risk index. The present results are consistent with a report in which treatment with *Moringa* crude extract improve blood HDL level and lower levels of triglycerides, cholesterol, and LDL. These suggest that *Anacardium occidentale* nut alleviating dyslipidemia, atherogenic index, and provide protection from development of hypertension and cardiovascular diseases.

Obesity is associated with leptin and insulin resistance leading to hyperinsulinemia and hyperleptinemia, which are further linked with excessive body weight, especially central obesity. Therefore, improvement in glucose and fat metabolism by enhancement of both the insulin and leptin sensitivity and decreasing their levels is considered to be emphatic treatment strategy for obese patients. HFD has been reported to increase the insulin level, causing insulin resistance and hyperinsulinemia in rats. In the present study, it was revealed that treatment with *Anacardium occidentale* nut suppressed increase in insulin level in HFD fed rats.

### 4.2 Conclusion

In view of these findings, Administration of *Anacardium occidentale* methanolic nut extract prevents increase in body

weight gain and improves dyslipidemia, blood glucose, metabolic hormones, and lower oxidative stress and enhanced kidney functions, which indicates anti-obesity effects. The presences of polyphenols compound with strong antioxidant properties in *Anacardium occidentale* nut responsible for this ameliorative effect. Therefore, consumption of this *Anacardium occidentale* nut as part of diet may be a good alternative strategy for preventing obesity and its associated metabolic disease.

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