

Anti-hyperlipidemic Effect of Methanol Seed Kernel Extract of *Mangifera indica* on Wistar Rats fed High Fat Diet

Abstract

The aim of this study was to evaluate the hyperlipidemia effect of the methanol seed kernel extract of *Mangifera indica* on Wistar rats. Mango seed kernels were dried at room temperature before being ground to fine powder. 500 g of mango seed kernel powder was soaked in 500 ml of methanol and shaken intermittently for 72 h after which the extract was concentrated. Twenty five adult male Wistar rats were divided into five groups of five rats each. **Group I**: was the normal control and was fed only normal rat chow. **Groups II-V** was induced hyperlipidemia, however, while Group II was not treated with the extract (negative control), **Groups III and IV** were treated with 150 and 350 mg/kg body weight of methanol seed kernel extracts of *Mangifera indica* and Group V the standard drug (atorvastatin). Treatment lasted for 21 days, after which rats were sacrificed and blood sample collected subsequently analyzed via standard procedures. Hyperlipidemia was characterized by increased levels of total cholesterol and Low Density Lipoprotein (LDL). Oral administration of the methanol seed kernel extract of *Mangifera indica* significantly ($P < 0.05$) reduced the aforementioned indices to levels which though were significantly ($P < 0.05$) higher than that reported in the normal control group. On the other hand, it was observed that the levels of high density lipoprotein (HDL) and triacylglyceride (TG) in the negative control (**Group II**) were significantly low but increased following oral administration of extract in a dose dependent manner. It was also observed that extract reduced the weight of hyperlipidemic rats.

Keywords: Lipoprotein, Hyperlipidemia, *Mangifera indica*, Atorvastatin, Kernel

Introduction

Hyperlipidemia is a secondary metabolic dysregulation orchestrated by enhanced levels of plasma lipid, including primarily total cholesterol, triglyceride and Low Density Lipoprotein alongside decreases High Density Lipoprotein reason for which atherosclerosis is initiated and progressed [1]. Increased serum levels of triglyceride, cholesterol and LDL have been identified as core risk factors for the untimely development of cardiovascular diseases like

hypertension and coronary heart disease [2] and have been traced to increased uptake of lipid via the gut or enhanced endogenous synthesis of the said molecules.

The use of plants with therapeutic significance has been an integral component of the human health care system since prehistoric times and interest in the practice has improved tremendously, evident by the fact that an estimated 80% global population depend on it to be relieved of one disease or the other [3].

Mango is of the genus *Mangifera* consisting of 30 species of tropical fruiting trees in the flowering family *Anacardiaceae*. Botanically, it is called *Mangifera indica*. Its application in Ayurvedic medicine dates back to more 4000 years ago. Ayurveda was able to establish that the various parts of this tree have varied medicinal properties. Parts of the tree are rich in mangiferin, a polyphenolic antioxidant, anti-lipid peroxidation, immunomodulation, cardiotoxic, hypotensive, wound healing and anti-degenerative and anti-diabetic properties [4].

Although, it has been established that different parts of *Mangifera indica* (mango) have the unique therapeutic ability, it is yet to be known whether or not the seed could be useful in the treatment of hyperlipidemia, hence, the imperatives of this study are determined.

Materials and Methods

Collection and processing of plant material

Mango (*Mangifera indica*) seed was identified in the herbarium unit of the department of Biological Science, Ahmadu Bello University Zaria Kaduna State. The seed kernel was subsequently dislodged and afterwards dried at room temperature for ten days. The dried seed kernels were pulverized with the aid of mortar and pestle and sieved to obtain a fine powder. The

500g of powdered plant sample was introduced into a conical flask containing 500ml of methanol and shaken intermittently for 3 days. The extract was dried in water bath below 40°C

Animals

Adult male **Wistar rats** weighing 120-160g were procured from the animal house of the Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic Unwana Afikpo, Ebonyi State. The rats were housed in well ventilated cages under standard laboratory conditions and were maintained at ambient temperature and relative humidity respectively. They were fed **grower mash** (Vital feeds Nigeria Ltd) and provided with water. Acclimatization lasted for two **weeks, after** which experiment commenced.

Preparation of High Fat Diets (HFD)

The high fat diet was prepared by mixing 60 ml of cholesterol with 5 g of rat chow feed. (Hassarajani *et al.*, 2007).

Animal grouping

A total number of twenty five adult male **Wistar rats** were in this study. Animals were divided into five groups of rats per group.

Group I (Normal group): animals were allowed access to rat chow and water

Group II (Negative control): animals were induced hyperlipidemia without treatment

Group III: Hyperlipidemic rats were administered with 150mg/kg of MSKE.

Group IV: Hyperlipidemic rats were administered with 350mg/kg of MSKE.

Group V: Hyperlipidemic rats were administered with 4 mg/kg of atorvastatin.

Treatment lasted for 21 days **treatment, after** which rats were anesthetized by exposure to chloroform, sacrificed and blood sample collected in plain bottles and afterwards centrifuged at 500 rpm for 10 minutes.

Biochemical assays for lipids

Cholesterol, HDL and triacylglyceride levels were estimated from serum by CHOD-PAP according to the method of Devi and Sharma, (2004), respectively. LDL and HDL were calculated using the method by Johnson *et al.* (1997). While the atherogenic index was calculated by using the method described by Muruganandan *et al.* (2005)

Body Weight Measurement

The weight of the rats was determined prior to hyperlipidemia induction, after induction and after treatment. The changes **in body weight were calculated** and recorded.

Statistical analysis

Data generated from the study was analyzed using statistics software IBM SPSS Statistics 21. Data were expressed as mean \pm standard deviation (SD). The results were considered as significant at $P < 0.05$. Mean values were compared using one way analysis of variance (ANOVA).

Table 1: Lipid Profile of Hyperlipidemic Rats administered with Methanol Leaf Extract of *M. indica*

| Groups | Treatment | TC (mg/dl) | HDL (mg/dl) | LDL (mg/dl) | TG (mg/dl) |
|-----------|---------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|
| Group I | Normal control (NC) | 60.23 \pm 2.37 ^d | 19.11 \pm 5.09 ^a | 56.12 \pm 2.41 ^d | 24.62 \pm 4.01 ^{bc} |
| Group II | Negative Control | 76.10 \pm 3.89 ^e | 13.21 \pm 2.01 ^{ab} | 58.50 \pm 3.29 ^d | 19.12 \pm 1.85 ^a |
| Group III | 150mg/kg MLEMI | 64.21 \pm 5.54 ^{bc} | 21.13 \pm 2.32 ^b | 41.20 \pm 4.86 ^b | 23.20 \pm 1.64 ^c |

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|-----------------|----------------|-------------------------|-------------------------|--------------------------|-------------------------|
| Group IV | 300mg/kg MLEMI | 63.10±2.50 ^a | 26.12±2.30 ^c | 43.5±4.498 ^{bc} | 28.21±1.03 ^b |
| Group V | Atovarstatin | 60.30±2.30 ^b | 22.12±3.21 ^b | 23.21±1.98 ^a | 28.91±3.24 ^a |

Results are expressed as mean ± standard deviation of three determinations. Values with the same superscript in the column are significantly at P≤0.05.

Table 2: Effect of Methanol Leaf Extract of *M. indica* on the weight of Hyperlipidemic Rats

| Groups | Treatment | Wt. before induction | Wt. after induction | Wt. after treatment |
|------------------|---------------------|----------------------|---------------------|---------------------|
| Group I | Normal control (NC) | 145.62±2.34 | 180.12±3.78 | 150.65±6.30 |
| Group II | Negative Control | 110.11±6.39 | 161.29±3.75 | 130.63±5.80 |
| Group III | 150mg/kg MSKE | 102.43±5.34 | 147.13±4.57 | 104.12±3.28 |
| Group IV | 300mg/kg MSKE | 128.56±3.46 | 185.60±5.01 | 150.21±3.46 |
| Group V | Atovarstatin | 120.22±2.32 | 176.34±3.60 | 138.34±6.90 |

Results are expressed as mean ± standard deviation of three determinations.

Result and Discussions

For the levels of lipid to be elevated, it is either, the amount of lipid absorbed through the gut is increased or the endogenous synthesis of lipid is enhanced. Thus, in order to reduce hyperlipidemia, it is either the endogenous synthesis is blocked or absorption is decreased. Table 1 shows the lipid profile of hyperlipidemic rats administered with methanol leaf extract of *Mangifera indica* (mango) indicating that feeding a high fat diet on animals significantly increased the level of total cholesterol and Low Density Lipoprotein (LDL). However, oral administration of methanol mango seed kernel extract significantly (P<0.05) reduced the aforementioned indices to the levels which though were significantly (P<0.05) higher than that

reported in the normal control group. On the other hand, it was observed that the levels of high density lipoprotein (HDL) and Triacylglyceride (TG) in the negative control (Group II) were significantly low but increased following oral administration of extract in a dose dependent manner. This may be attributed to enhanced inhibition of intestinal absorption of cholesterol, interference with lipoprotein production, increased expression of hepatic LDL receptors and their protection which culminate to leading to increased elimination of LDL-C from the blood and its increased degradation of cholesterol in the body, all of which translate to declined serum dual-C levels which may have also reduced serum cholesterol (TC) levels (Brown and Goldstein, 1981). This is consistent with the findings of Khyati et al (2010) which showed that the aqueous leaf extract of *Mangifera indica* significantly ($P < 0.05$) reduced TC, TG, LDL-C, VLDL and significant increase in HDL-C ($p < 0.05$). Table 2 shows the effect of treatment with MLEMI on the weight of hyperlipidemic rats, indicating that treatment with extract reduced the weight of hyperlipidemic rats.

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