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Research Article

# Effect of Fluted Pumpkin (*Telfairia Occidentalis)* Seed on Lipid Profile and Atherogenic Indices in Albino Rats Fed with Groundnut (*Arachis hypogaea*)

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## Abstract

*The global rise in cardiovascular diseases (CVDs), predominantly driven by dyslipidaemia and unhealthy dietary patterns, has intensified the search for alternative, plant-based interventions that are both affordable and culturally adaptable. One such promising plant is the fluted pumpkin (Telfairia occidentalis), a tropical leafy vegetable whose seeds are traditionally consumed in parts of West Africa and recognized for their rich phytochemical and nutritional profile. This study was designed to investigate the modulatory effects of Telfairia occidentalis seed supplementation on serum lipid profile—specifically high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides (TG), and total cholesterol (TC)—as well as key atherogenic indices in albino rats fed with groundnut (Arachis hypogaea), a high-fat, high-lipid diet known to predispose hyperlipidaemia. A total of twenty (20) male albino rats weighing between 90–170 grams were randomly assigned into five groups (n=4 per group). Group 1 served as the negative control and was fed a standard rat chow. Group 2, the positive control, was fed a groundnut-enriched diet and standard rat chow. Groups 3, 4, and 5 were fed with the rat feed in addition with the same groundnut-enriched diet supplemented with 15g, 30g, and 45g of boiled and oven-dried T. occidentalis seed flour, respectively, for a period of 28 days. At the end of the experimental period, blood samples were collected and analyzed for lipid parameters using enzymatic end-point spectrophotometric methods, and the atherogenic indices—Cardiac Risk Ratio (CRR), Atherogenic Coefficient (AC), and Atherogenic Index of Plasma (AIP)—were calculated. After analysis the result showed that the negative control group exhibited mean HDL levels of 25.75 ± 4.35mmol/l, LDL 59.73 ± 4.15mmol/l, TG 119.50 ± 7.33mmol/l, TC 107.50 ± 2.08mmol/l. The positive control group exhibited HDL levels of 18.75 ± 2.99 mmol/l, LDL 73.58 ± 3.49mmol/l, TG 159.25 ± 3.77mmol/l, TC 159.25 ± 3.77mmol/l. Group 3 HDL levels of 14.00 ± 3.37 mmol/l, LDL 71.33 ± 3.05mmol/l, TG 137.25 ± 17.11mmol/l, TC 137.25 ± 17.11mmol/l. Group 4 HDL levels of 12.50 ± 3.79mmol/l, LDL 69.55 ± 4.15mmol/l, TG 116.25 ± 3.50mmol/l, TC 106.50 ± 3.00mmol/l. Group 5 HDL levels of 19.00 ± 4.97mmol/l, LDL 121.25 ± 52.1mmol/l, TG 97.75 ± 8.66mmol/l, TC 97.75 ± 8.66mmol/l. The F value of HDL was 6.900 with a P-value of 0.002 indicating significant difference. The F value of LDL was 3.972 with a P-value of 0.022 indicating significant difference. The F value of TG was 23.878 with a P-value of 0.000 indicating significant difference. The F value of TC was 10.325 with a P-value of 0.000 indicating significant difference. The results demonstrated a significant variation ($p < 0.05$) in lipid profile and atherogenic markers across the different treatment groups. Rats in Group 2 showed elevated levels of LDL, TG, and TC, alongside a marked decrease in HDL levels, confirming the atherogenic effect of groundnut-based high-fat diets. In contrast, Groups 3, 4, and particularly Group 5, which received the highest dose of T. occidentalis seeds, showed improved lipid parameters: increased HDL levels and a concomitant reduction in LDL, TG, and TC values. Additionally, the atherogenic indices (AIP, CRR, and AC) were significantly lower in the group supplemented with T. occidentalis, especially at the highest dose, suggesting enhanced cardiovascular protective effects.*

**Keywords:** *Fluted Pumpkin, Lipid Profile, Atherogenic Indices, Albino Rats, Groundnut.*

## INTRODUCTION

Given that cardiovascular diseases (CVD) are still the world's leading cause of death, the growth in hyperlipidemia—high blood lipid levels, including cholesterol and triglycerides—poses a threat to global health. Increases in the prevalence of hyperlipidaemia have been caused by societal movements towards diets high in fat and calories, particularly in developed and urban areas. As a result, there is now a greater focus on finding natural, easily accessible solutions to lower elevated cholesterol [1]. Studies on dietary elements that are often consumed in African countries, such as fluted pumpkin (Telfairia occidentalis) seeds, have demonstrated potential for controlling lipid profiles. These seeds are abundant in healthy substances such unsaturated fats and antioxidants, which may help to promote cardiovascular health [2, 3].

Particularly in hyperlipidemic models like albino rats given high-lipid diets, the possible impact of fluted pumpkin seeds on lipid regulation offers important information for wider applications. According to studies, by raising HDL cholesterol and decreasing LDL cholesterol, these seeds can lower serum lipid levels and atherogenic indices, which are important indicators of CVD risk [4]. Fluted pumpkin seeds have shown a lipid-lowering impact in rat models fed high-fat diets (such as peanut diets), which may have positive cardiovascular effects in people. This is in line with global health objectives that place a high priority on lowering the death rate from CVD by using easily available preventative measures [5, 6]. Investigating natural, affordable food options like fluted pumpkin seeds is essential in a society where cardiovascular disease risks are rising and the corresponding financial pressures are becoming more severe. Particularly in low- and middle-income nations that suffer a disproportionate burden of CVD because of hyperlipidaemia, our discovery may open the door for alternate lipid management techniques that are both successful and culturally appropriate [7,8,9].

Total cholesterol, triglycerides, low-density lipoprotein (LDL) cholesterol, and high-density lipoprotein (HDL) cholesterol are all measured as part of a lipid profile [9, 10]. An increased risk of atherosclerosis and cardiovascular disease is indicated by abnormal levels, particularly high LDL and triglycerides and low HDL. Additionally, a number of lipoprotein ratios or atherogenic indices have been established in an effort to maximise the lipid profile's prognostic power [11, 12]. The risk of cardiovascular illnesses is predicted by these indices, which are mathematical computations based on lipid profile values [13]. The Atherogenic Index of Plasma (AIP), which is a common indicator for determining the risk of atherosclerosis, is computed as the logarithm of the triglyceride to HDL ratio [14]. The bioactive chemicals found in fluted pumpkin seeds are thought to have a lipid-reducing impact, possibly raising HDL cholesterol while lowering triglycerides, total cholesterol, and LDL cholesterol. In order to prevent cardiovascular risks in hyperlipidemic situations syndrome and for individuals seeking to maintain optimal cardiovascular health through natural dietary interventions, the study is to assess if these seeds could lower the atherogenic indices [15. 16].

All things considered, adding cooked fluted pumpkin seeds to the diet offers a healthy and natural way to enhance cardiovascular and lipid metabolism. Boiling helps optimise the health benefits of the seeds by improving nutritional availability and preserving important bioactive components. Given its capacity to enhance atherogenic indices, decrease oxidative stress, and lower cholesterol, fluted pumpkin seeds could be a useful functional diet in the management and prevention of cardiovascular illnesses. [17, 18]

## MATERIALS AND METHODS

### STUDY AREA

The research was carried out in Madonna University Nigeria Elele Campus. Elele is a town located in Ikwerre Local Government Area, Rivers State. It lies roughly between Latitude: 5° 06' 3.24" N, Longitude 6° 48' 50.80" E. It has a population of 20,620 (world population review,2022) and is polarized with local and roadside auto repair workshops, which increases exposure to car paint fumes most likely occur from breathing in its vapor at these stations. Vegetation is made up of thick forest which is annually and selectively deforested to serve as farm lands. Vegetation's is reduced in the semi urban parts, of Elele town. The hydrographic network is fairly developed with many rivers, streams, swamps and lakes. The economy thrives mainly on fishing, agriculture and artisan business while the major means of transportation is the motorcycle riders popularly known as "Okada". Madonna University is a high institution with a tertiary Hospital serving the Elele population. The people living in these areas are mainly Christian with few Muslims and the language they speak is "Ikwere". They share border with Owerri and Port Harcourt. The study area has many rivers, streams, swamps and lakes.

### EXPERIMENTAL ANIMALS

Twenty male albino rats that weighed between 80g - 170g was obtained from the livestock breeding unit of animal friend farm, Royce Road Owerri, was used as the experimental animals. The rats were kept in cages for two weeks at Madonna University animal farm house, allowing acclimatizing to their new environment and was allowed free access to food and water. The animals were allowed to adapt in the animal house then they were weighed using electrical weighing balance

before randomly assigning by method of simple random sampling, test animals were assigned in to five groups composed of four rats each. The cages were cleaned every day to measure the remaining feed in the cages and determine the amount of feed consumed by the rat in a day and also prevent infection of animal, care and treatment were conducted in compliance with the international guidelines of the National Institute of Health (NIH) for laboratory animal's care and use.

## ETHICAL APPROVAL

This research was approved by the administration committee of experimental animals Nigeria. All of the experimental procedures involving animals were conducted in accordance with the institutional animal care guidelines of Madonna University Nigeria and approved by the administration committee of experimental animals, Nigeria. There are no human subjects in this study hence informed consent is not applicable.

## REAGENTS

The chemical and reagents that was used in this work were of analytical grade, they were purchased commercially and the manufacturer's standard operating procedure (SOP) was strictly followed.

## PLANT MATERIAL

Fluted pumpkin fruits and groundnut seeds was bought from a local market in Ugbolu, Asaba in Delta State, identification was done at plant science and biotechnology Department of Madonna University Elele.

The fruits were sliced open and the pulp and seeds removed. The seeds were cleaned and freed from unwanted materials before they were shelled manually as the bad seeds were promptly removed. The good seeds were washed thoroughly and boiled for an hour. Thereafter, the seeds were dried in an oven at 50℃ until a constant weight is achieved. The boiled and oven-dried seeds was then milled in a laboratory miller and used for the study. The groundnut seeds were bought, processed and grinded to a smooth consistency evenly which were also used for the study.

## EXPERIMENTAL DESIGN

Each animal was randomly assigned to five groups of four animals each i.e. 1, 2, 3, 4, and 5. The supplemented diet was homogenized manually palletized and oven-dried at 40℃ to a constant weight and was stored in an air-tight container which was dispensed to the rat daily. Rats in group 1 served as negative control and receives normal rat chow (Vital Feed Limited, Jos, Plateau State, Nigeria), Those in group 2 served as positive control and received normal rat chow and 20g of grinded groundnut. Those in group 3 received 20g of grinded groundnut with 15g of baked fluted pumpkin seeds, those in group 4 received 20g of grinded groundnut with 30g of baked fluted pumpkin seeds, those in group 5 receives 20g of grinded groundnut with 45g of baked fluted pumpkin seeds respectively.

The food was put in their feeding trough bit by bit; at the end of the day the leftover food was gathered weighed and recorded.

The study lasted for 28days. During this period, each group received 65g of feed daily and also have unrestricted access to water.

## SAMPLE COLLECTION AND ANIMAL SACRIFICE

After 28days, the rats were allowed to fast overnight and then blood sample was collected through cardiac puncture. The blood samples collected was transferred to a serum separator tube and allowed to clot, centrifuge for 5mins at 3000rpm. The sera were carefully removed with Pasteur pipette into clean tube and approximately labelled sample containers and was then stored frozen until the time of analysis within seven days. The anticoagulated blood sample was spun at 3000 revolution per minute (RPM) using the bucket centrifuge and it was separated into a clean plain container with the help of a Pasteur pipette leaving behind the deposit of red cells. The sample in the clean plain containers was labelled and preserved from deterioration and putrefaction in a freezer at -20$^0$C. These samples were used for analysis

**Laboratory assay;** The serum Total Cholesterol (TC), Triglyceride (TG) and High-density lipoprotein cholesterol (HDL-C) were determined by standard methods [7]. The LDL-C determination was estimated by difference [8].

The atherogenic indices were calculated as described by [9]

- Cardiac Risk Ratio (CRR)=TC/HDL-C
- Atherogenic Co-efficient (AC)=TC-HDLC/HDL-
- Atherogenic Index of Plasma (AIP)=log (TG/HDL-C)

## STATISTICAL ANALYSIS

The data was analysed using statistical package for social sciences (SPSS) version 20 for windows and result were as mean ± standard error of mean (mean ± SEM) while analysis of variance (ANOVA) was used to determine the difference between treatments. Statistical significance as obtained at $p<0.05$.

## RESULTS

**Table 4.1:** Showing the TC, TG, HDL and LDL levels among different groups fed with fluted pumpkin seeds and groundnut.

| GROUPS | HDL (mmol/L) | LDL (mmol/L) | TG (mmol/L) | TC (mmol/L) |
|---|---|---|---|---|
| Group 1 (Negative Control) | 25.75 ± 4.35 | 59.73 ± 4.15 | 119.50 ± 7.33 | 107.50 ± 2.08 |
| Group 2 (Positive Control) | 18.75 ± 2.99 | 73.58 ± 3.49 | 159.25 ± 3.77 | 159.25 ± 3.77 |
| Group 3 | 14.00 ± 3.37 | 71.33 ± 3.05 | 137.25 ± 17.11 | 137.25 ± 17.11 |
| Group 4 | 12.50 ± 3.79 | 69.55 ± 4.15 | 116.25 ± 3.50 | 106.50 ± 3.00 |
| Group 5 | 19.00 ± 4.97 | 64.35 ± 10.92 | 121.25 ± 52.11 | 97.75 ± 8.66 |
| P –Value | 0.002 | 0.022 | 0.000 | 0.000 |
| F-Value | 6.900 | 3.972 | 23.878 | 10.325 |

Significant at P < 0.05;
Non-Significant > 0.05.

**Table 4.1.** Shows the total cholesterol (TC), Triglycerides (TG), High Density Lipoprotein (HDL) and Low-Density Lipoprotein (LDL) among different groups treated with fluted pumpkin seeds after being fed with groundnut. The negative control group exhibited mean HDL levels of 25.75 ± 4.35mmol/l, LDL 59.73 ± 4.15mmol/l, TG 119.50 ± 7.33mmol/l, TC 107.50 ± 2.08mmol/l. The positive control group exhibited HDL levels of 18.75 ± 2.99 mmol/l, LDL 73.58 ± 3.49mmol/l, TG 159.25 ± 3.77mmol/l, TC 159.25 ± 3.77mmol/l. Group 3 HDL levels of 14.00 ± 3.37 mmol/l, LDL 71.33 ± 3.05mmol/l, TG 137.25 ± 17.11mmol/l, TC 137.25 ± 17.11mmol/l. Group 4 HDL levels of 12.50 ± 3.79mmol/l, LDL 69.55 ± 4.15mmol/l, TG 116.25 ± 3.50mmol/l, TC 106.50 ± 3.00mmol/l. Group 5 HDL levels of 19.00 ± 4.97mmol/l, LDL 121.25 ± 52.1mmol/l, TG 97.75 ± 8.66mmol/l, TC 97.75 ± 8.66mmol/l. The F value of HDL was 6.900 with a P-value of 0.002 indicating significant difference. The F value of LDL was 3.972 with a P-value of 0.022 indicating significant difference. The F value of TG was 23.878 with a P-value of 0.000 indicating significant difference. The F value of TC was 10.325 with a P-value of 0.000 indicating significant difference.

## POST HOC COMPARISON

Table 4.2: Showing the multiple comparisons of the mean values of TC, TG, HDL and LDL levels in albino rat fed with fluted pumpkin seeds and groundnut.

| GROUPS | HDL (mmol/L) | LDL (mmol/L) | TG (mmol/L) | TC (mmol/L) |
|---|---|---|---|---|
| Group 1 VS Group 2 | 0.024* | 0.003* | 0.000* | 0.002* |
| Group 1 VS Group 3 | 0.001* | 0.011* | 0.021* | 0.233 |
| Group 1 VS Group 4 | 0.000* | 0.026* | 0.643 | 0.797 |
| Group 1 VS Group 5 | 0.029* | 0.263 | 0.004* | 0.022* |
| Group 2 VS Group 3 | 0.110 | 0.580 | 0.006* | 0.029* |
| Group 2 VS Group 4 | 0.041* | 0.328 | 0.000* | 0.001* |
| Group 2 VS Group 5 | 0.930 | 0.035* | 0.000* | 0.000* |
| Group 3 VS Group 4 | 0.599 | 0.662 | 0.008* | 0.153 |
| Group 3 VS Group 5 | 0.094 | 0.100 | 0.000* | 0.002* |
| Group 4 VS Group 5 | 0.035* | 0.211 | 0.011* | 0.037* |

Significant at P < 0.05;
Non-Significant > 0.05.
*: Significant

**Table 4.2:** Shows the multiple comparisons of the mean values of TC, TG, HDL and LDL levels among different groups fed with fluted pumpkin seeds and groundnut. Values were considered significant at p <0.05 and not significant at >0.05.

## POST HOC COMPARISON

**Table 4.3:** Showing the comparison between atherogenic indices
Where; Group 1 = CRR
Group 2 = AC
Group 3 = AIP

| GROUPS | ATHEROGENIC INDICES |
|---|---|
| Group 1 Vs Group2 | 0.315 |
| Group 1 Vs Group 3 | 0.000 * |
| Group 2 Vs Group 3 | 0.000 * |

Significant at P <0.05
Non-Significant > 0.05
* Significant

**Table 4.3:** Showing the atherogenic indices of albino rats when the values were compared among different groups fed with groundnut and treated with fluted pumpkin seeds. The group one when compared with group 2 had no significant difference but when compared with group 2 showed a significant difference. Also, when group 2 was compared with group 3 it showed a significant difference.

## DISCUSSION

In this study, albino rats given a high-fat peanut (Arachis hypogaea) diet were used to test the effects of supplementing with Telfairia occidentalis (fluted pumpkin) seeds on blood lipid profile parameters and atherogenic indices. The observed variations in total cholesterol (TC), triglycerides (TG), HDL, and LDL levels between experimental groups offer strong evidence of T. occidentalis seeds' capacity to modulate lipid levels [19].

The atherogenic nature of groundnut seeds when ingested in high-fat dietary formulations is confirmed by the notable rise in LDL, TG, and TC as well as the decrease in HDL levels in Group 2 (positive control: groundnut-only diet). This is consistent with earlier findings that groundnut seeds, despite being high in unsaturated fats, can cause lipid imbalance if they are processed or eaten in excess [20,21]. The model's induction of hyperlipidaemia is reflected in the elevated lipid levels.

However, a dose-dependent improvement in the lipid profile was noted in Groups 3, 4, and 5, which were supplemented with 15g, 30g, and 45g of T. occidentalis seeds, respectively. Group 5 had the most noteworthy outcomes, with HDL levels considerably rising and LDL, TG, and TC levels falling. These results provide credence to the idea that T. occidentalis seed has hypolipidemic properties. The phytochemical components of the seeds, including flavonoids, saponins, tannins, and alkaloids, are well-known for their antioxidant and lipid-reducing properties, which aid in enhancing the liver's ability to eliminate cholesterol and lowering lipid absorption [22].

Important indicators for estimating cardiovascular risk are atherogenic indices, such as the Atherogenic Coefficient (AC), Cardiac Risk Ratio (CRR), and Atherogenic Index of Plasma (AIP). A greater chance of plaque development and arterial occlusion is indicated by elevated indices. Due to groundnut-induced dyslipidaemia, Group 2 showed noticeably higher atherogenic indices, indicating a higher risk of cardiovascular disease. Groups 3 through 5, in particular, showed reduced atherogenic indices, suggesting that T. occidentalis seeds lessened the detrimental effects of a high-fat diet on cardiovascular health. These findings are in line with research by [23], who documented T. occidentalis's capacity to provide cardio-protection in animal models. The protective function of HDL and the advantages of lowering LDL and TG levels with dietary intervention are further supported by the decline in atherogenic indices [24].

Additionally, the seeds' dietary fibre may increase the excretion of cholesterol by encouraging the synthesis of bile acids, which would compel the liver to use the cholesterol that is in circulation [25].

## Conclusion

Telfairia occidentalis seeds have been shown in this study to have strong lipid-modulating properties and to be a useful functional food with cardio-protective advantages. The investigation's main conclusions are: Albino rats fed a high-fat diet based on groundnuts developed hyperlipidaemia and a higher risk of atherogenicity. T. occidentalis seed supplementation dramatically enhanced lipid profiles by lowering LDL, TG, and TC and raising HDL. Rats supplemented with fluted pumpkin seeds showed significantly decreased atherogenic indices (AIP, CRR, and AC), suggesting a lower risk of cardiovascular disease.

The greatest dose (45g) produced the most noticeable benefits, and the effects were dose-dependent. A promising natural remedy for controlling dyslipidaemia and averting cardiovascular disorders is Telfairia occidentalis seed. Its inclusion in diets may provide an affordable, culturally appropriate approach, particularly in populations with limited access to medications that decrease cholesterol.

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