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Antihyperlipidaemia Effect of Almond Nuts (*Prunus Amygdalus*) on Diabetic Rats

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ABSTRACT

This study examined the antihyperlipidaemic effect of Almond seed (Prunus amygdalus) on Alloxan induced diabetic rats. Sixty male albino rats were divided into six groups (A-F) representing the positive and negative controls, and the test groups for four weeks were used. Diabetes were induced in groups C, D, E and F, except for group A and B which served as the positive control and negative control, respectively. Diabetic rats with blood glucose level greater than 11.00mmol/l were included in the study. The test groups were fed with 60g of prepared almond granules while the controls were fed with standard feed for four weeks. Lipid profile tests were performed weekly. The results of the positive and negative control gave significant increase in TC, TG and LDL, but none in HDL. There was significant decrease in the TC, TG, and LDL levels of the test group compared with the control for week1-4 ($p<0.05$). While there was significant increase in the HDL level of the test group compared with the control. Almond seed has the potential for improving the lipid profile in diabetic rat model.

Key word: *diabetes, cardiovascular, arthrosclerosis Prunus amygdalus, almond, lipid*

1. INTRODUCTION

Diabetes mellitus is a heterogeneous disorder with an increased risk for premature arteriosclerosis due to increase in triglycerides and low density lipoprotein levels [1]. About 70 – 80% of deaths in diabetic patients are due to vascular disease. Glucose control is essential, but this provides only minimal benefit with respect to coronary heart disease prevention. An ideal treatment for diabetes would be drug that will not only control the glycaemic level but also prevents the development of arteriosclerosis and other complications of diabetes [2]. Nowadays, the use of complementary and alternative medicine and especially the consumption of botanicals have been increasing rapid worldwide [3].

Plants have always been a good source of drugs. According to [4,5], the ethno botanical information reports about 800 plants that may possess anti- diabetic potential. Several plants have been used as dietary adjuvant and in treating the number of diseases even without any knowledge on their proper functions and constituents. This practice may be attributed to the uncompromised cost and side effects of synthetic hypoglycemic agents [6]. Although numerous synthetic drugs were developed for the treatment of diabetes mellitus but the safe and effective treatment paradigm is yet to be achieved. Medicinal foods are prescribed widely even when their biologically active compounds are unknown, because of their safety, effectiveness and availability [7].

The World Health Organization (WHO) has recommended the evaluation of traditional plants treatments for diabetes as they are effective, non-toxic, with less or no side effects and are considered to be excellent candidates for oral therapy [8].

Studies have shown that Almond seed contains phytochemicals that may contribute to promoting health and reducing the risk of chronic cardiovascular disease [9,10, 11]

We investigated the hypolipidaemic effect of Almond seed on Alloxan induced diabetic male rats, weather granules of almond seed is capable of lowering the lipid levels of the rats.

2. MATERIALS AND METHODS

2.1 Experimental Design

Sixty (60) male Albino rats of twelve weeks old and weight between 150g to 300g, obtained from the animal house of Anatomy Department, Faculty of Health Science, University of Port Harcourt, Rivers State. They were housed under standard condition at room temperature in cages. The animals were given two weeks for acclimatization with liberal access to water and standard pellet feed (finisher). These animals were kept and cared for under the standard guideline of laboratory animal handling.

The rats were divided into 6 groups of ten (10) rats each into groups (A-F). Group A which was the positive control group (non-induced) was fed with standard pellet (finisher) and water only.

Group B which was the negative control group (induced) was fed with standard pellet (finisher)

and water only. The remaining groups C, D, E, and F which were the test groups (induced) were fed with Almond (*Prunus amygdalus*) granules of 60g and water respectively.

2.2 Seeds Collection

They seeds of *Prunus amydalus* (Almond) was purchased from Well-done Supermarket, Olu Obasanjo Road Port Harcourt, Rivers State.

2.3 Preparation of the seeds Almond (*Prunus amygdalus*) Seeds

The purchased almond seeds were soaked in cold water overnight. It was then removed from the cold water and put into hot water for about thirty (30) minutes for easy removal of the skin. After the removal of the skin, the seeds were washed and air dried. This was followed by drying in an oven until the seeds become crispy. Finally, they were grounded into coarse granules and then stored in an air tight container prior to usage for analysis.

2.4 Induction of Diabetes in Rats

Sixty (60) male Albino rats were subjected to 12 hours fasting but allowed access to water only. Diabetes was induced by injecting alloxan monohydrate freshly prepared by dissolving the alloxan in 0.5ml of normal saline at a concentration of 65mg/kg of body weight intravenously through the tail vein. Diabetes was confirmed by blood glucose estimation after 48 hours of Alloxan injection. Only rats with blood glucose levels greater than 11.0mmol/L were used for the study.

The rats were given free access to food and water, in accordance with the National Institute of Health Guideline for the care and use of laboratory animals (NRC, 1985).

2.5 Blood Sample Collection

At the end of the four weeks experiment, blood samples were obtained from respective rats through cardiac puncture in each of the group for determination of total cholesterol (TC), triglyceride (TG), low density lipoprotein (LDL) and high density lipoprotein (HDL).

3. RESULTS

Comparison between Positive control and Group C at week 1

The comparison between positive control and group C at week 1 is shown in table 3.1. The comparison showed that there was significant decrease in the total cholesterol, triglyceride, and low density lipoprotein at week 1 for the test group C at $P<0.05$. However there was significant increase in the high density lipoprotein of the test group compared with the control ($p<0.05$)

Table 3.1: Comparison between control and (Group C) at week 1.

PARAMETERS	T.CHOL	TRIG	HDL	LDL
Control				
Mean ± SD	2.37±0.15	2.30±0.14	1.79±0.35	1.64±0.60
Week 1 (Group C)				
Mean ± SD	1.87±0.17	1.86±0.15	2.50±0.70	1.48±0.22
P. value	0.0001	0.0004	0.0004	0.005

Comparison between Control and Group D

The comparison between positive control and group D at week 2 is shown in table 3.2. The comparison shows that there was significant decrease in the total cholesterol, triglyceride, and low density lipoprotein at week 2 at P<0.05. However there was significant increase in the high density lipoprotein of the test group compared with the control (p<0.05)

Table 3.2: Comparison between control and Group D at week 2

PARAMETERS	T.CHOL	TRIG	HDL	LDL
Control				
Mean ± SD	2.37±0.15	2.30±0.14	1.69±0.35	1.64±0.60
Week 2 (Group D)				
Mean ± SD	1.63±0.26	1.57±0.15	2.62±0.10	1.39±0.33
P. value	5.9×10-5	5×10-6	0.0002	0.002

Comparison between control and Group E

The comparison between positive control and group E at week 3 is shown in table 3.3 The comparison between control and week 3 (Group F) showed that there was significant decrease in total cholesterol, triglyceride and low density lipoprotein of the test group at P<0.05, high density lipoprotein depicted significant increase in the test group.

Table 3.3: Comparison between control and Group E at Week 3

PARAMETERS	T.CHOL	TRIG	HDL	LDL
Control				
Mean ± SD	2.09±0.15	2.11±0.15	1.48±0.14	1.77±0.28
Week 3 (Group E)				
Mean ± SD	1.57±0.17	1.56±0.15	2.30±0.10	1.28±0.22
P. value	0.02	0.007	2.4×10-5	0.03

Comparison between control and Group F at week 4.

The comparison between positive control and group F at week 4 is shown in table 4.4. There was significant decrease in total cholesterol, triglyceride, and low density lipoprotein of the test group compared with the control, $p<0.05$. Significant increase was observed in the high density lipoprotein of the test group F compared with the control $p<0.05$

Table 3.4: Comparison between control and Week 4 (Group F).

PARAMETERS	T.CHOL	TRIG	HDL	LDL
Control				
Mean ± SD	2.09±0.15	2.11±0.15	1.58±0.14	1.17±0.28
Week 4 (Group F)				
Mean ± SD	1.63±0.26	1.57±0.15	2.62±0.10	1.69±0.33
P. value	0.002	0.0001	0.0013	0.008

DISCUSSION

This work studied the lipids and glucose lowering effect of almond seeds and found out that they are enriched with the lipid lowering agent. Significant reduction was recorded in the lipid profile level: triglyceride, LDL and Total cholesterol as the week's progresses. This could be as a result of their low fat composition and by implication, consumption of the seeds could be used therapeutically to reduce blood Total cholesterol, LDL and triglyceride and thus prevent/ manage atherosclerosis. The finding in this study of the ability of the almond seed to reduce blood cholesterol is in agreement with the report of [10] that shows that administration of the seeds was

able to significantly reduce serum total cholesterol of hyperlipidaemic rats.

More so, there was significant increase in the level of high density lipoprotein (HDL)of the diabetic rats fed with almond seed granules compared with the control ($p<0.05$).

The finding in this study of significantly high HDL in the rats fed with seeds is a positive finding as HDL, is known to facilitate the removal of LDL from the blood vessels and transferring them to the liver where they are degraded, hence the resultant reduction in the lipid level (Libby *et al.*, 1998; Barter *et al.*, 2007). Mechanisms responsible for the LDL-C reduction observed with almond consumption are likely associated with the nutrients almonds provide. Biologically active by nature, these nutrients target primary mechanistic routes of LDL-C reduction, including decreased (re)absorption of cholesterol and bile acid, increased bile acid and cholesterol excretion, and increased LDL-C receptor activity. The nutrients present in almonds may regulate enzymes involved in de novo cholesterol synthesis and bile acid production (Barryman *et al*., 2011)

The glycated haemoglobin recorded a significant decrease in rats fed with Almond seeds throughout the duration of the study compared with the control ($p<0.05$). Diabetes is a group of disorders characterized by hyperglycaemia and altered metabolism of lipids, as the glucose control improved it manifested in the glycated haemoglobin levels. It is imperative to incorporate almond seeds in the regiment for effective management of diabetes.

CONCLUSION

Diabetes as a chronic metabolic disorder is characterized by hyperglycaemia, altered metabolism of lipids, carbohydrates and proteins. This alteration in lipid metabolism is associated with cardiovascular complications, a leading cause of death among diabetics. Based on this study Almond seed lowered the total cholesterol and triglyceride level of diabetic rats, and increased the high density lipoprotein level, as such consumption of almond nuts should be incorporated the in management of diabetes.

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