2012 International Conference on Biological and Life Sciences
IPCBEE vol.40 (2012) © (2012) IACSIT Press, Singapore

The Effect of Apple Homogenate on Hypercholestrolemic Rats

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Abstract. The effect of apple homogenate on lipid profile was studied. Thirty-two (32) male albino rats were used for the study. Thirty (30) of the rats were fed with high cholesterol diet to induce hypercholesterolemia while (2) were used as control. Six (6) out of the high cholesterol fed rats were sacrificed to test for the induction. The remaining twenty-four (24) rats were divided into group I,II, and III and were administered with oral homogenate of apple for one, two and three weeks respectively. Two (2) rats were selected as control in each group. The mean serum Total Cholesterol (T-Chol), HDL-Cholesterol, Triglycerides (Tri), VLDL-Cholesterol and LDL-Cholesterol were significantly lower in rats administered with apple homogenate after a week, two and three weeks compared with their controls ($P<0.05$).Rats administered with apple homogenate for three weeks (Group III) showed lower lipid profile (T-Chol:1.77± 0.09,HDL-Cholesterol :0.59±0.03, Tri:0.90±0.04, VLDL-Cholesterol : 0.77± 0.05 and LDL-Cholesterol :0.41± 0.02) when compared with Group I(T-Chol: 2.16 ± 0.09,HDL-Cholesterol :0.72 ±0.05, Tri 1.09± 0.05, VLDL-Cholesterol : 0.94 ± 0.05 and LDL-Cholesterol : 0.50 ± 0.02) $P<0.05$. The result also indicates that lipid profile of the rat's increases with increase in the weight of the rats in the various groups. From these findings it can be said that apple intake may provide a dietary means of controlling some of the risk indices associated with hypercholesterolemia.

Keywords: High Density Lipoprotein (HDL), Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL)

1. Introduction

Studies have indicated possible relationship between diet and various diseases [1]. Apple is one of those fruits that can play a role in decreasing the risk of chronic diseases due to the fibre and chemical components present [2]. Positive effects of fruits and vegetable have been attributed to dietary antioxidants and phenolic compounds [3].High cholesterol which is a risk factor for cardiovascular disease and obesity which is also a risk factor for cardiovascular disease, cancer and diabetes are greatly influenced by diet and lifestyle [4].In a Finnish study of approximately 10,000 people flavonoid intake was associated with lower total mortality[5] .Apples were one of the main sources of dietary flavonoids that showed the strongest associations with decreased mortality. Apple has the highest portion of free phenolics when compared to other fruits [6]. Apple and pear intake has also been associated with weight loss in middle aged overweight women in Brazil [7]. Some studies have shown that a regular intake of fruits like apple, citrus fruits, berries and vegetables is associated with low total cholesterol, low LDL-Cholesterol, triglycerides , total HDL-Cholesterol and LDL/HDL ratios [8]. This work is aimed to assess the effect of apple extract on hypercholesterolemic rats and to evaluate the relationship between body weight and lipid profile of albino rats.

2. Methods

2.1. Experimental Rats

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Thirty-two male albino rats weighing 180-200g were used in this research work. The animals were left to acclimatize under room temperature and humidity with regular light and dark cycle for four (4) weeks and had free access to water and grower mash feed. The protocol used conforms to the guidelines of the National Institute of Health for laboratory animal care.

2.2. Experimental Design

The apples used were mashed using blender and the resulting homogenate was weighed and measured. 0.04g/kg was orally administered per day for the duration of the experiment. Hypercholesterolemia was induced by feeding the rats with high cholesterol diet (10% animal fat, 10% margarine and 10% palm oil all together with 70% grower feed) for three weeks. The new weight of the rats after high cholesterol induction ranges between 220g-250g. Twenty-four (24) rats were grouped into three (3).Eight (8) rats in each group. Six (6) rats from each group were fed with grower mash and oral administration of extract for a week (group I), two weeks (group II) and three weeks (group III).Two (2) rats from each of the groups were used as control and were only fed with grower mash.

2.3. Sample Collection

The animals were sacrificed using a clean and sharp surgical blade after fasting for 12-15 hours. 5ml oral blood from each rat was collected in a dry, clean well labeled sample container. The blood was centrifuged at 4000 rpm for 5-10 minutes and serum collected for the lipid profile tests.

2.4. Lipid Profile Test

Serum Triglyceride was measured using the method of [9], HDL-Cholesterol [10] and LDL-Cholesterol [11].

2.5. Statistical Analysis

Statistical analysis was carried out using student T-test, values at $p<0.05$ were considered significant

Table 1: Lipid Profile after induction of Hypercholesterolemia

Diet	Total-Cholesterol	HDL-Cholesterol	Triglycerides	VLDL-Cholesterol	LDL-Cholesterol
High Cholesterol diet feed n=6	2.54 ± 0.11	0.86 ± 0.04	1.28 ± 0.05	1.10 ± 0.05	0.58 ± 0.02
Normal Diet Feed n=2	1.86 ± 0.04	0.63 ± 0.03	0.95 ± 0.02	0.80 ± 0.01	0.43 ± 0.01

Values are represented as mean ± Standard Deviation

Table 2: Lipid Profile with Apple Extract Co-administered

Group	Total-Cholesterol	HDL- Cholesterol	Triglycerides	VLDL- Cholesterol	LDL- Cholesterol
Group I n=6	2.16 ± 0.09	0.72 ± 0.03	1.09 ± 0.05	0.94 ± 0.05	0.50 ± 0.02
Control n=2	2.81 ± 0.03	0.94 ± 0.01	1.41 ± 0.02	1.24 ± 0.01	0.64 ± 0.01
Group II n=6	1.89 ± 0.11	0.63 ± 0.04	0.96 ± 0.06	0.83 ± 0.05	0.43 ± 0.03
Control n=2	2.71 ± 0.00	0.91 ± 0.01	1.37 ± 0.01	1.18 ± 0.01	0.63 ± 0.01
Group III n=6	1.77 ± 0.09	0.59 ± 0.03	0.90 ± 0.04	0.77 ± 0.05	0.41 ± 0.02
Control n=2	2.82 ± 0.02	0.94 ± 0.01	1.42 ± 0.02	1.24 ± 0.01	0.64 ± 0.01

Values are represented as mean ± Standard Deviation

Table 3: Weight of Rats and Lipid Profile in Group I

Weight (g)	Total-Cholesterol	HDL-Cholesterol	Triglycerides	VLDL-Cholesterol	LDL-Cholesterol
250	2.27 ± 0.02	0.75 ± 0.02	1.14± 0.00	1.00 ± 0.00	0.52 ± 0.00
240	2.15 ± 0.04	0.72 ± 0.00	1.10 ± 0.01	0.93 ± 0.04	0.50 ± 0.00
220	2.06 ± 0.01	0.69 ± 0.01	1.04 ± 0.01	0.90 ± 0.01	0.48 ± 0.01

Values are represented as mean ± Standard Deviation

Table 4: Weight of Rats and Lipid Profile in Group II

Weight (g)	Total-Cholesterol	HDL-Cholesterol	Triglycerides	VLDL-Cholesterol	LDL-Cholesterol
240	2.00± 0.01	0.67± 0.00	1.02 ± 0.00	0.88 ± 0.01	0.46 ± 0.00
230	1.91 ± 0.01	0.64 ± 0.01	0.96 ± 0.01	0.84 ± 0.00	0.44 ± 0.01
210	1.76 ± 0.06	0.59 ± 0.02	0.90 ± 0.05	0.77 ± 0.01	0.41 ± 0.02

Values are represented as mean ± Standard Deviation

Table 5: Weight of Rats and Lipid Profile in Group III

Weight (g)	Total-Cholesterol	HDL-Cholesterol	Triglycerides	VLDL-Cholesterol	LDL-Cholesterol
230	1.87 ± 0.03	0.62 ± 0.02	0.95 ± 0.02	0.83 ± 0.01	0.43 ± 0.01
220	1.76 ± 0.06	0.59 ± 0.02	0.89 ± 0.04	0.77 ± 0.01	0.41 ± 0.03
200	1.67 ± 0.00	0.56 ± 0.01	0.86 ± 0.01	0.72 ± 0.01	0.40 ± 0.01

Values are represented as mean ± Standard Deviation

3. Results and Discussion

In this work hypercholesterolemia was successfully induced in albino rats using 10% animal fat. 10% margarine and 10% Palm oil mixed with 70% grower mash (Table 1). The mean serum total cholesterol, HDL-Cholesterol, Triglycerides, VLDL-Cholesterol and LDL-Cholesterol were significantly lower in rats administered with apple extract after a week, two (2) weeks and three(3) weeks compared with their controls ($P<0.05$). Rats administered with the apple homogenate for three (3) weeks (Group III) showed lower lipid profile when compared with rats administered with apple homogenate for a week (Group I) $P<0.05$. This work therefore signifies that duration of apple intake has a reducing effect on the lipid profile. This is consistent with the findings of [8]. According to [12] Apple cider vinegars, regardless of the production method, decreased triglyceride and VLDL levels in rats. Table 3, 4 and 5 represents the weight of experimental rats in respect to their lipid profile of group I,II and III respectively. The results indicate that the lipid profile of the rats increases with increase in their weights across the various groups which supports the findings of [7].

Apple has been reported to have the highest portion of free phenolics when compared to other fruits [6], this might have contributed to its hypercholestrolemic effect. Apple is one of those fruits that can play a role in decreasing the risk of chronic diseases [2]. It can therefore be concluded that apple consumption may provide a dietary means of controlling some of the risk indices associated with high lipid levels.

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