

# Serum Lipid Profile of Rats Fed Wheat-Margarine - Avocado Cake Blends

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**Abstract:** *In this research, the serum lipid profile of rats fed wheat-margarine- avocado cake blends were investigated. Fresh avocado fruits were purchased from the market then sorted, washed, drained and peeled. The creamy mesocarp was homogenized using a mixing bowl and a wooden stick to obtain a smooth puree or paste. Cake blends of margarine and avocado were prepared in the proportions of 100:0, 80:20, 60:40, 40:60, 20:80 and 0:100. The feed intake, body weight pattern and serum lipid profile of albino rats were determined. The result showed high rate of wheat-margarine-avocado cakes consumption with 80:20% substitutions of margarine-avocado cake blends. The body weight of rats fed wheat-margarine-avocado cakes were significantly elevated at end line relative to baseline. The serum lipid profile of the rats fed with wheat/avocado cake blends showed significant increase in total cholesterol, triglycerides and low density lipoprotein cholesterol (LDL-C) levels accompanied with significant increase in serum high density lipoprotein cholesterol (HDL-C) level. Group treated with 100% wheat/avocado cake had the highest value in the assessment of it HDL-C (83.55±49.85) with the least concentration of LDL-C (16.88±2.59).*

**Keywords:** serum, cholesterol, triglyceride and avocado

## 1. Introduction

The contemporaries and modernization have brought about changes in dietary pattern of individuals that favour intake of foods rich in saturated fats and refined sugars, but with low fibre content. The traditional food consisting mainly of roots and tubers, cereals, and vegetables are giving way to fatty foods, sweet snacks and drinks which have too much calories. These changes in dietary pattern among Nigerians, coupled with changes in physical activity, increased use of tobacco and alcoholic beverages have been reported to be responsible for the increase in the prevalence of hyperlipidaemia and obesity [1]. A high level of serum cholesterol has been identified clearly as a risk factor for atherosclerosis and coronary heart disease. High cholesterol diet is however regarded as an important factor in the development of cardiac diseases since it leads to development of hyperlipidaemia, atherosclerosis, and ischemic heart disease [1]. Hypercholesterolemia is a lipoprotein metabolic disorder characterized by high serum low density lipoprotein cholesterol and a major health problem in many societies because of the close correlation between cardiovascular diseases and lipid abnormalities [2, 3].

Dietary factors such as continuous ingestion of high amount of saturated fats and cholesterol are believed to be directly related to hypercholesterolemia and susceptibility to atherosclerosis [4]. Many clinical trials, have demonstrated the relationship between coronary heart diseases and atherosclerosis with hypercholesterolemia, hence it is almost accepted that atherosclerosis is a disorder of lipid transport and metabolism [5]. Clinical trials have also demonstrated that intensive reduction of plasma low density lipoprotein (LDL) cholesterol levels could reverse atherosclerosis and decrease the incidence of cardiovascular diseases [6]

Plants in general and fruits particularly have several compounds with antioxidant properties which include ascorbic acid, carotenoids and polyphenols. Increased consumption of fruits and vegetables is associated with a lowered risk of cardiovascular diseases and even cancer [7]. The study was aimed at determination of serum lipid profile of rats fed wheat-margarine- avocado cakes blends.

## 2. Material and Methods

### Source of Raw Materials

Fresh avocado fruits were purchased from Ikom Market, Ikom Local Government Area of Cross River State. While wheat flour, margarine, sugar, eggs and baking powder were purchased at wurukum market Makurdi, Benue State.

### Preparation of Avocado

The avocado fruits were thoroughly sorted, washed, drained and peeled. The creamy mesocarp was homogenized using a mixing bowl and a wooden stick to obtain a smooth puree or paste.

### Blend Formulation for Wheat Margarine and Avocado Cake Production

Cake blends of margarine and avocado were prepared in the ratio of 100:0, 80:20, 60:40, 40:60, 20:80 and 0:100.

### Production of Wheat/Margarine/Avocado Cake Blends

The method of Akubor[8] was used for the cake preparation. Specified ratios of margarine and avocado were creamed separately with sugar in mixing bowls with wooden stick until it becomes soft and fluffy. The eggs were beaten in a separate bowl and added to the creamed margarine and avocado mixture and mixed together. Wheat flour was sieved and added to the mixture by

folding-in method and the last portion of the flour mixed with baking powder was added to the mixture and mixed together until soft dough was formed. The dough was then transferred into greased pan and baked in a preheated oven at 200°C for 60 minutes.

### Experimental animals and design

The method used by Onyeike et al[5] was adopted in this experiment. A total of 24 male albino rats were used for the feeding experiment which lasted for 21 days (3 weeks). The age of the rats was between two to three months weighing between 115 to 155g. The rats were acclimatized for 7 days and weighed. The weight after acclimatization served as the initial weight for the feeding experiment. Rats were allocated to 6 groups labeled A to F of 4 rats each in well ventilated cages with facilities for food and water. The feed used for the experiment was cake baked in different blends and ratios of avocado and margarine. 50g of the cake blend was given to each group per day for 21 days of the feeding experiment. Group A was fed cake baked with 100% margarine while group F was fed cake baked with 100% avocado throughout the feeding period. Other groups B –E were fed cake baked with margarine and avocado in the following proportion: B = (80:20), C = (60:40), D = (40:60) and E = (20:80) respectively.

Rats were weighed bi-weekly (3 days interval) throughout the experimental period of 21 days (3 weeks) their weights were taken using the digital top loading weighing balance by Harvard Apparatus Ltd.

### Determination of serum lipid profile of albino rats

The method used by Ani[9] was adopted. The cholesterol levels for all the experimental animals were determined using the hand held cardio-check self-test meter. The equipment was used for the determination of the Total cholesterol, Triglyceride, High density lipoprotein cholesterol HDL-C and Low density lipoprotein cholesterol levels in the experimental animals. The blood sample from each of the animals was collected from the medial canthus of the eye using heparinized capillary tubes for the pre and post analysis.

### Data analysis

All data were analyzed using bar charts, mean value  $\pm$  standard deviation, and Relative Percentage Difference (RPD). Data were statistically analyzed using SPSS version 20 and the means were calculated at 0.05 level of significance.

## 3. Results

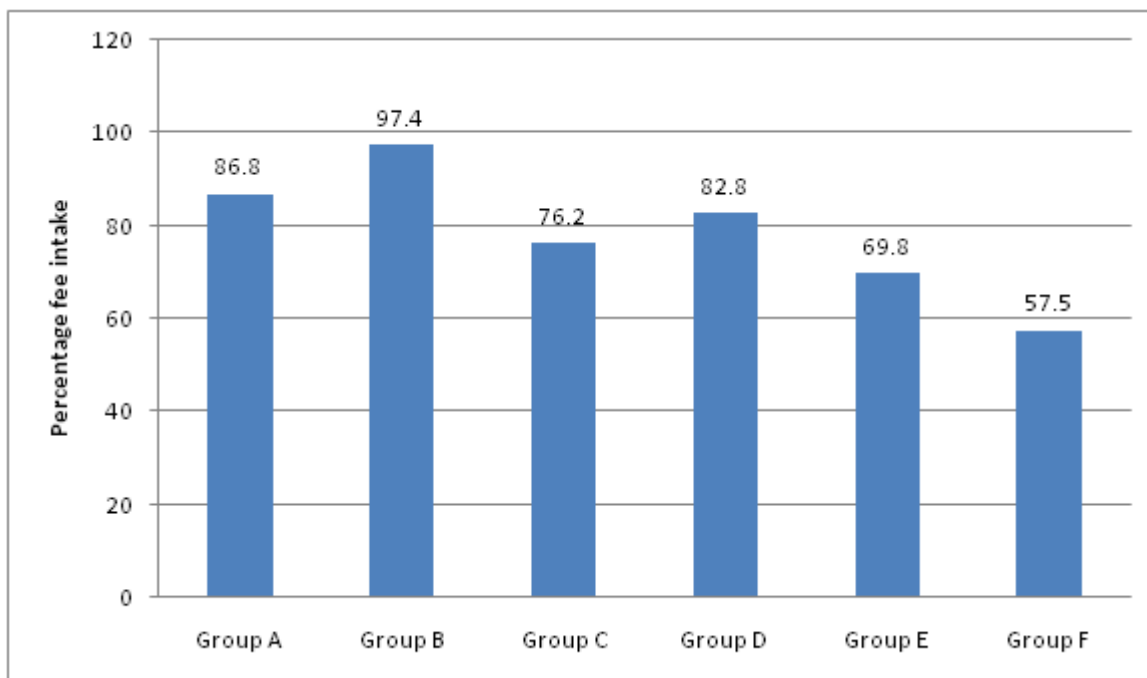


Figure 1: Daily Feed Intake of the Albino Rats

A = 100% Margarine, B = 80% Margarine + 20% Avocado, C = 60% Margarine + 40% Avocado, D = 40% Margarine + 60% Avocado E = 20% Margarine + 80% Avocado and F = 100% Avocado

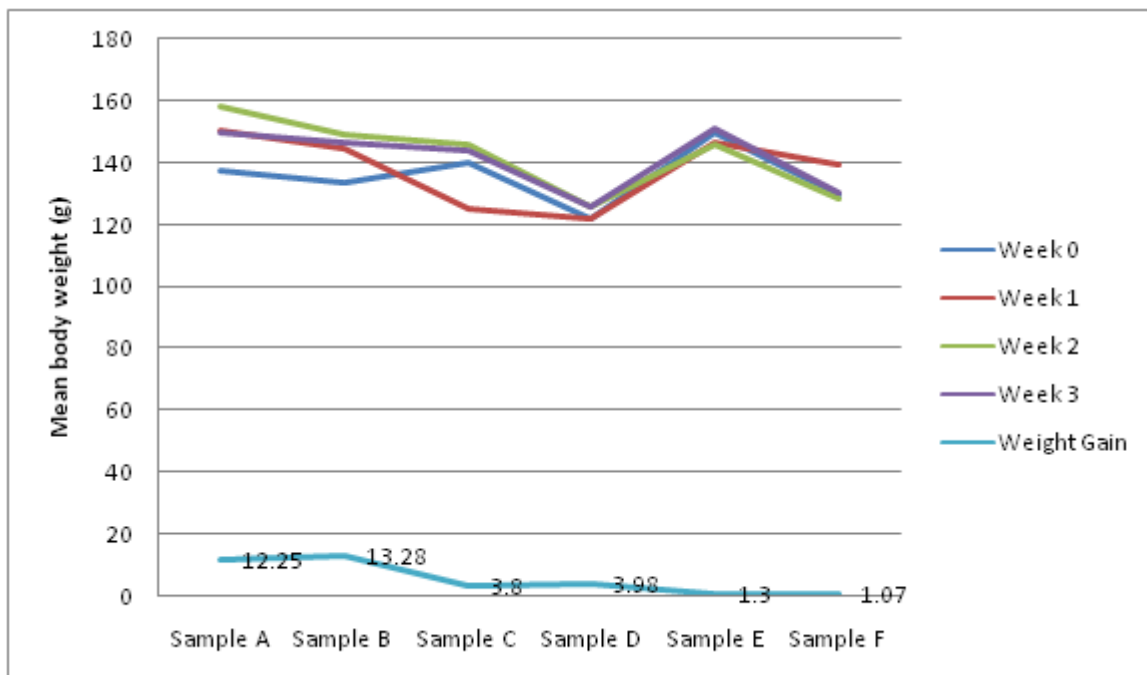


Figure 2: The Weekly Body Weight of Rats in all the Experimental Groups

A = 100% Margarine, B = 80% Margarine + 20% Avocado, C = 60% Margarine + 40% Avocado, D = 40% Margarine + 60% Avocado E = 20% Margarine + 80% Avocado and F = 100% Avocado

Table 1: Serum Lipid Profile of Rats fed Wheat/Margarine/Avocado Cake Blends (mg/dl)

Group	A	B	C	D	E	F
TC <sub>1</sub>	86.86 <sup>c</sup> ±4.98	95.55 <sup>a</sup> ±3.70	82.03 <sup>a</sup> ±6.59	94.57 <sup>b</sup> ±5.02	78.25 <sup>f</sup> ±11.82	84.94 <sup>d</sup> ±9.42
↓↑%	50.89±23.94	53.7±23.3	51.47±21.13	39.43±21.94	52.5±-7.42	19.99±-0.12
TC <sub>2</sub>	137.75 <sup>b</sup> ±28.92	149.25 <sup>a</sup> ±27.00	133.5 <sup>d</sup> ±26.96	134.00 <sup>c</sup> ±4.40	130.75 <sup>e</sup> ±27.72	104.93 <sup>f</sup> ±9.30
TG <sub>1</sub>	73.00 <sup>f</sup> ±8.47	79.64 <sup>d</sup> ±14.45	86.26 <sup>b</sup> ±19.62	77.43 <sup>e</sup> ±8.47	84.07 <sup>c</sup> ±23.41	88.53 <sup>a</sup> ±34.62
↓↑%	160.00±42.78	159.36±-3.95	105.74±18.61	129.57±13.53	87.93±-2.92	79.47±9.56
TG <sub>2</sub>	233.00 <sup>b</sup> ±22.00	239.00 <sup>a</sup> ±10.5	192.00 <sup>d</sup> ±38.23	207.00 <sup>c</sup> ±20.49	172.00 <sup>e</sup> ±51.25	168.00 <sup>f</sup> ±44.18
LDL <sub>1</sub>	7.17 <sup>c</sup> ±2.53	5.60 <sup>e</sup> ±2.03	7.14 <sup>d</sup> ±2.40	5.02 <sup>f</sup> ±1.84	8.30 <sup>b</sup> ±0.50	8.78 <sup>a</sup> ±0.8
↓↑%	33.01±5.87	56.28±6.29	20.58±1.72	23.63±1.47	11.98±4.15	8.1±1.79
LDL <sub>2</sub>	40.18 <sup>b</sup> ±8.40	61.88 <sup>a</sup> ±8.32	27.72 <sup>d</sup> ±4.13	28.65 <sup>c</sup> ±4.65	20.28 <sup>e</sup> ±3.31	16.88 <sup>f</sup> ±2.59
HDL <sub>1</sub>	30.77 <sup>f</sup> ±7.54	51.15 <sup>a</sup> ±8.56	66.15 <sup>b</sup> ±27.10	55.01 <sup>d</sup> ±13.87	63.90 <sup>c</sup> ±40.43	65.37 <sup>b</sup> ±27.20
↓↑%	29.06±-0.85	20.26±10.31	1.4±-22.12	16.13±-5.84	-12.27±-35.45	18.18±22.65
HDL <sub>2</sub>	59.83 <sup>d</sup> ±6.69	71.41 <sup>b</sup> ±4.98	67.55 <sup>c</sup> ±8.03	71.14 <sup>b</sup> ±4.98	51.63 <sup>e</sup> ±18.87	83.55 <sup>a</sup> ±49.85

Values with same superscript in a row do not differ significantly ( $p>0.05$ ).

**Keys:** Subscript <sub>1</sub> = Pre-test result

Subscript <sub>2</sub> = Post-test result

↓↑% = Percentage increase/decrease of Pre/Post data analysis

TC= Total Cholesterol. TG= Triglycerides. LDL= Low Density Lipoprotein.

HDL= High Density Lipoprotein

(N = 4/group)

#### 4. Discussion

Feed intake of the experimental animals is presented in Figure 1. The group fed wheat-margarine-avocado cake blend (group B) consumed more of the diet followed by the group fed wheat-margarine cake. The least consumed was the group fed wheat-avocado cake and this may be attributed with the bitter taste of the wheat-avocado cake. It was documented that margarine contains high level of saturated fatty acids and cholesterol than avocado [10]. Margarine also contains some harmful dietary fats like saturated fat and trans fat which are atherogenic to both human and animals [11, 12]. More so, margarine is hydrogenated in nature which causes rise in total cholesterol levels and low density lipoprotein cholesterol (LDL-C) and can cause greater risk of cancer as well as coronary artery disease than from unsaturated fats [13].

The mean weekly body weight pattern of rat is presented in Figure 2. The result showed that the body weight of all the rat groups increased at the end of the feeding experiment from their initial body weights (that is, acclimatization period). This agrees with Elsayed and Lobona [14] who reported an increase in body weight of rats at the end of feeding experiment of avocado fruit extract. The group fed wheat-margarine cake (control) recorded weight gain of 12.25g higher than group fed wheat-avocado cake with weight gain of 1.07g. There was a significant difference in weight gain between control group of rats (37.4g) and avocado extract group (28.8g) as reported by Elsayed and Lobona [14]. The highest weight gain was noticed in group B rats (13.28g) and this might be attributed to their level of feed intake of group B rats which consumed food more than all other rat groups in the feeding experiment.

The lipid profile of the rats fed wheat/margarine/avocado cake blends is presented in Table 2. The mean values of serum TC, TG, LDL and HDL of the rats recorded at the base line (pre-test) were relatively lower than those documented by John et al. [15]. This is thought to be due to age factor and, the rats used in this study were kept inadequately fed (Fasted) for one week. The result also showed significant ( $p<0.05$ ) increases in their Total Cholesterol, Triglycerides and Low Density Lipoprotein (LDL) levels accompanied with significant increase in serum High Density Lipoprotein (HDL) levels when compared with their initial (pre-test) values. The minimum and maximum values recorded in the wheat/margarine/avocado cake blends might thoughtfully be due to their levels of feed intake as this can also be observed in their body weight gains. Increased serum lipid profile level in rats has also been recorded in high cholesterol diet supplemented for rats [16] The result also showed that the group treated with wheat/avocado cake

had significant ( $p<0.05$ ) increases (83.55mg/dl) in the assessment of its high density lipoprotein cholesterol (HDLc) compared to the group treated with wheat/margarine cake (59.83mg/dl). This is in agreement with the report of Elsayed and Lobna [14] on the Hypolipidemic activities of hydroalcoholic extract of avocado fruit on high cholesterol diet in rats that, there was a significant increase in HDLc (37.8mg/dl) in groups that received avocado extracts diet compared to the control group (29.2mg/dl). Study in the literature proved that avocado pear consumption decreases serum total cholesterol, low density lipoprotein (LDL) cholesterol and triglycerides, and increases high density lipoprotein (HDL) cholesterol levels compared to control diet subjects [17,18]. It was also documented in literature that consumption of fruits and vegetables lowers risk of cardiovascular diseases caused by bad (LDL) cholesterol [19].

#### 5. Conclusion

The rate of consumption of wheat-margarine-avocado cakes was observed to be highest among rats fed 80:20% substitutions of margarine-avocado cake blends. The body weight of rats fed wheat-margarine-avocado cakes were significantly elevated at end line relative to baseline. The intake of wheat/margarine/avocado and wheat/avocado cakes significantly elevated the serum total cholesterol, triglycerides, low density lipoprotein and high density lipoprotein of rats.

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