Bioscience Discovery, 10(4):222-226, Oct. - 2019

Print & Online, Open Access, Research Journal Available on http://jbsd.in
ISSN: 2229-3469 (Print); ISSN: 2231-024X (Online)
Research Article

Assessment of hematological indices of Albino Rat (*Rattus novergicus*) fed with fish meal

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Article Info

Received: 05-07-2019,
Revised: 11-09-2019,
Accepted: 18-09-2019

Keywords:
Growth, Haematology, Albino rats, Fishmeal, Lipid Profile

Abstract

The study was designed to evaluate the effect of fish meal on the lipid profile and haematological parameters of albino rats (*Rattus novergicus*). A total of 16 rats were used for this study. Two different treatments were applied; the control group, Group A -were fed with standard feed and treatment (test group) Group B were fed with fishmeal. The rats were randomly distributed into two treatment groups of 8 rats per group. The experiment lasted for a period of 8 weeks. Body weight gain and feed intake were recorded during the period of the experiment. At the end of every two weeks interval, the animals were starved for 12 hours and one is randomly selected from each group and sacrificed via cardiac puncture after dazing the animal. The result revealed that rats in the treatment Group A (control) fed with standard feed showed significant ($p \leq 0.05$) increase in cholesterol and glyceride values when compared to rats in the treatment Group B fed with fish meal. The haematological parameters measure remained within normal clinical ranges. The body weight and feed intake was significantly higher in the Group B treated with the fishmeal.

INTRODUCTION

Fish is a very important animal protein in the diet of man. It is widely consumed in many parts of the world for both its high quality protein and low saturated fat content. It contains essential n-3 polyunsaturated fatty acids that are known to support good health, lower the risk of heart disease in adults and are important for neuro-development in infants and young (Marimuthu *et al.*, 2011). Fish is a very good source of animal protein with little or no religious rejection, giving it an advantage over pork or beef (Omojowo, 2009). Fish as a source of nutrients have made important contribution to micronutrient supplies such as vitamins, mineral and fatty acids (Food and Agricultural Organization (FAO), 2000). Fish oil contain vitamins A, D, E and K which have been successfully used in controlling coronary heart disease, arthritis, arteriosclerosis, asthma, auto-immune deficiency diseases and cancer (Bhuiyan *el al.*, 2003). High percentage of poly unsaturated fatty acids found in fish are important in lowering blood cholesterol level (Kent, 2014). Generally, fishes and fishmeal are good sources of high quality animal protein as well as dispensable and indispensible amino acids in humans and animals. In recent years, fish lipids have also assumed great nutritional significance, because of their high polyunsaturated fatty acid levels.

Lipid profile test measures the amount of cholesterol and triglyceride in the blood. Cholesterol and triglyceride are lipids and fats, they are important for the cells but are harmful when built up in the blood (Omodamiro and Nnankwo, 2013). Lipid profile test also helps us to predict our risk of cardiovascular disease and stroke. When one fails to consume adequate amounts of protein, the

blood and tissues can become either too acidic or too alkaline. Lack of dietary protein can retard growth in animals, can be a contributing factor in chronic fatigue, depression, slow wound healing and the decreased resistance to infections. Previous studies have shown that different classes of dietary lipids may promote beneficial or detrimental health conditions in animal that consume them by their capacity to alter blood lipid profile (Adam *et al.*, 2008).

The measurement of these profiles serves as readily available and reliable diagnostic parameter for establishing either condition. This study evaluates the effect of fishmeal on packed cell volume, white blood count, differential blood count and lipid profile of albino rats fed with fishmeal.

MATERIALS AND METHODS

Source of albino rats

Sixteen albino rats *(Rattus novergicus*) of both sexes (30 - 40g) were obtained from Kevon Research Laboratory, Awka and were transported to CLS Research Laboratory, Awka where they were acclimatized for 7 days in a well-ventilated clean metallic cages and maintained at a controlled temperature (20°C) with a 12 hour light-dark cycle and relative humidity of 45 - 50%. During this period they were fed with standard feed and water before the commencement of the experiment.

Experimental Procedure

At the end of the acclimatization, the rats were randomly selected, weighed and distributed into 2 different treatment groups of 8 rats per group. The group A (control) was treated with standard feed while group B was treated with fishmeal. The experiment lasted for 56 days. Food intake (FI), the amount of food the rats consumed for 16 days was studied. Thus the feeds given to the rats were measured on daily basis to determine the feed intake. Individual weights of the rats were taken prior to commencement of the experiment and afterwards on bi-weekly interval. Body Weight Gain (BWG) was obtained using the formula:

$$BWG = \frac{Final\ body\ weight\ (g) - initial\ body\ weight\ (g)}{initial\ body\ weight\ (g)} (Pugalenthi\ et\ al., 2007)$$

At the end of the weeks of the feeding experiments, the animals were starved for 12 hours. One rat from each treatment was randomly selected for haematological and biochemical analysis using appropriate laboratory methods described by Tiez (1995). Using sterile needles and syringes, blood was drawn via cardiac puncture under anesthesia into two ethylemediamine tetraacetic acid disodium salt (EDTA) bottles for determination of Packed Cell Volume (PCV), White Blood Cell (WBC), Cholesterol (CHOL), High Density Lipoprotein Cholesterol (HDL-C), Low Density Lipoprotein Cholesterol (LDL-C) and Triglyceride (TRI).

Statistical Analysis

The mean haematological and biochemical parameters obtained were subjected to one way analysis of variance (ANOVA). Duncan's Multiple Range Tests (DMRT) was used to compare and separate the means among the treatments at a probability level of 5%.

RESULTS AND DISCUSSION

Growth Performance of the Experimental Animals

The growth performance of the experimental animals fed with standard feed and fish meal is shown in Table 1. The rats in treatment group B had higher mean feed intake (401.3±3.66g) which was significantly different ($p<0.05$) from the mean feed intake (309.8±4.56g) of rats in group A (Table 1). The high feed intake of rats in group B may be attributed to the palatability of the fish meal.

Table 1: Growth Performance of Experimental Animals

Experimental Animals	Growth Performance of the Experimental Animals	
	Feed intake g/16 days	Body weight gain g/16 days
Control group animals	309.8^{a}±4.56	350.5^{a}
Test group animals	401.3^{b}±3.66	395.9^{b}

Means with different superscripts in the same column are significantly different ($p>0.05$)

Group B rats fed with fish meal displayed increased body weight gain (395.9g) while control group A showed body weight gain (350.5g). The weight gain displayed by the treatment groups were significantly different ($p<0.05$). Alagbaoso *et al.,* (2017) obtained similar results in their studies, the good performance in weight gain of the rats fed with fish meal may be associated with high quantity of fish feed intake.

The low performance weight gain of rats in group B may be attributed to low quantity of feed they consumed.

Haematological Parameters

Haematological parameters are important indices of the physiological and pathological status for both animals and humans (Adeneye *et al.,* 2006). It can be used to determine the extent of deleterious effect of foreign compounds, including plant extracts, on the blood of the albino rats (Odeyemi *et al.,* 2009; Alagbaoso *et al.,* 2017).

The haematological analysis investigated (Table 2) at the end of the 4 weeks experiment showed that the Packed Cell Volume (PVC) of the rats subjected to the different groups were within the normal clinical range with the rats in the treatment group A having higher mean value which was not significantly different ($p>0.05$) from lower mean value of the rats in the treatment group B. The result obtained for the PCV of the rats in this study is consistent with the findings of Ojo *et al.,* (2015) who reported a reduction in the PCV of albino rats in all treatment groups compared to the control. Higher mean value (11.55 ± 9.11 $xl0^9/l$) occurred in rat of group B then lower mean value (11.31 ± 4.55 x $10^9/1$) record from the rats of group A. These values were significantly different ($p<0.05$). The higher WBC counts obtained in group B may be due to stress on the rats. Leukocytosis (raised WBC count) can be found in acute infections, inflammation and tissue necrosis, metabolic disorders, poisoning, acute infections, acute haemorrhage, leukemia and stress conditions, while leucopenia (reduced WBC count) is associated with viral bacterial and parasitic-infection (Luka and Mohammed, 2013). Increase and decrease in WBC likely explain respectively either disease resistance or the prevalence of disease condition. It may also explain longevity (Mbanasor *et al.,* 2003). Eheba *et al.,* (2008) reported that a decrease in WBC count reflected fall in the production of defensive mechanisms to combat infection. The major functions of WBC are to fight infections, defend the body by phagocytosis against invasion by foreign agents and to produce or atleast transport and distribute antibodies in immune response (Agbon *et al.,* 2013). Lymphocyte values at the end of the experiment were not significantly different ($p>0.05$) in the experimental groups.

Table 2: Mean Haematological Parameters of Albino Rats Fed Different Feed Meals

Haematological Parameters	Group A (Control)	Group B (Fish Meal)
PCV (%)	0.46 ± 0.04^a	0.43 ± 0.02^a
WBC (X $10^9/1$)	11.31 ± 4.55^a	11.55 ± 9.11^a
Lymphocytes (%)	70.3 ± 6.82^a	69.8 ± 15.4^a
Monocytes (%)	8.5 ± 5.00^a	5.8 ± 0.96^b
Neutrophils (%)	21.0 ± 7.8^a	24.5 ± 14.9^b

Means with different superscripts in the same column are significantly different ($p>0.05$)
Mean with same superscripts in the same column are not significantly different ($p<0.0$)

The mean monocyte values observed in this side study have an inverse relationship and their values were statistically significant ($p<0.05$) between the treatments. Monocytes are responsible for defense of tissue against microbial agent, it increases with bacterial infection and decreases with stress (Odoemelam, 2007; Alagbaoso *et al.* 2017). Neutrophils followed the same trend (Table 2). Phagocytosis is carried out mainly by the neutrophils, the commonest type of white blood cell (Robert, 1976). They are known to move about in contact with the endothelium of the blood vessels where they ingest bacteria.

Biochemical Analysis

The result of biochemical analysis is presented in Table 3. The cholesterol (CHOL) in the albino rat in the treatment group A fed with standard feed showed a significant increase ($p<0.05$) when compared to the treatment group B fed with fish meal. This agrees with the findings of Omodamiro and Nwankwo (2013) who reported that animals in their study had significantly different cholesterol

value than control. Fishmeal reduce cholesterol and triglyceride level in the blood. Cholesterol is an important constituent of cell membrane and it is the precursor of steroid hormone and bile acids, high cholesterol level in the blood is however the major cause of cardiovascular disease (Omodamiro and Nwakwo, 2013). Cholesterol is circulated in the body's aqueous extracellular environment by 5 major types of lipotrotein (Chylomicrons, very low-density lipoprotein (VLDL), intermediate-density lipoprotein (TDL), low-density (LDL(and high-density lipoprotein (HDL) (Wadhera and Foody, 2016).

While the values of high density lipoprotein (HDL) cholesterol or good cholesterol differend significantly ($p<0.05$), the low density-lipoprotein (LDL) cholesterol or "bad" cholesterol obtained at the end of the experiment did not differ significantly ($p>0.05$). The findings obtained in this study on the lipid profiles is consistent with the reports of Luka and Mohammed (2013) who investigated the effect of fish oil (Omega-3-fatty acid) on lipid profile of Albino rats. High density lipoprotein mediates the reverse transport of cholesterol from the extra-hepatic tissue to the liver where it is catabolized. It is also considered to have anti-atherogenic property, since there is a negative correlation between HDL and risk of cardiovascular disease. Low density lipoprotein is a major component of the total cholesterol and is directly related to coronary heart disease as a major atherogenic lipoprotein and hence, appear to be the main target of any lipid lowering agent, such as the fish, as reflected in this study.

Low and largely replaced total cholesterol is a primary lipid measure for evaluation of risk due to atherogenic lipoprotein. LDL-C is a measure of the total cholesterol content of LDL particles , reflecting both the number of LDL particle and their individual cholesterol content (Wadhera and Foody, 2016). LDL-cholesterol increase the rate of triacylglycerol catabolism by mobilizing fat from the liver to the adipose tissue. It transports 60% - 70% of the total cholesterol in the plasma. Since there was no significant increase in the level of LDL in this study, it implies that there is low circulatory level which does not enhance the possible deposition arterial wall of lipids and hence does not cause blood related disease. The triglyceride (TRI) mean value in the albino rat in the treatment group A feed with standard feed was significantly different ($p<0.05$) from the mean values of those in the treatment group B fed with fish meal. Triglyceride is one of the types of fat in the blood called lipids. They are therefore regarded as fats carried in the blood from the food we eat.

Result from this study suggested that daily consumption of fish (animal protein) might have some positive effect on body weight, enhances immunostimulatory potentials system and reduces the risks of cardiovascular disease in albino rats.

Table 3: Biochemical Parameters observed in Albino Rats fed different Feed Meals

Biochemical parameters	Group A (Control)	Group B (fish meal)
CHOL (mg/dl)	116.02 ± 15.07^{a}	104.37 ± 10.20^{b}
HDL-C	99.40 ± 36.51^{a}	89.74 ± 33.53^{b}
LDL-C	48.94 ± 9.92^{a}	49.92 ± 16.89^{a}
TRIG	50.65 ± 16.59^{a}	36.40 ± 9.48^{a}

Means with different superscripts in the same column are significantly different ($p>0.05$)
Mean with same superscripts in the same column are not significantly different ($p<0.0$)

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How to cite this article

Ibemenuga Keziah Nwamaka and Nwaka Chukwuka Raphael-Joseph, 2019. Assessment of hematological indices of Albino Rat (*Rattus novergicus*) fed with fish meal. *Bioscience Discovery*, **10**(4):222-226.