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Effect of Sesame Seeds on Biochemical and Haematological Parameters in Wistar Rat

***Madaki, F.M[1]., Muhammad, L.M.,[2] Alhassan, S.I.,[2] Abdulrahman, M.[1] and Tanimu, N. A**

[1]Department of Biochemistry, School of Life Sciences, Federal University of Technology, Minna, Niger State.

[2]Department of Plant Biology, School of Life Sciences, Federal University of Technology, Minna, Niger State.

ABSTRACT

Sesame seeds and its components have the tendency to provide various health benefits and have been proven to exhibit anticancer, antioxidant, and cholesterol lowering properties. This research aims to evaluate the effect of Sesame seed on biochemical composition and hematological parameters in wistar rats. Animal study was performed by feeding wistar rat with specific ration of formulated sesame feed for twenty-one (21) days. Biochemical, and hematological analyses were carried out using standard methods. The significant ($p<0.05$) difference were recorded in all the parameters across the groups in the biochemical component of the kidney with creatine value ranged from (5.47±0.31-7.53±0.43) from group B and D, Urea ranged from (20.84±1.36-30.44±1.76) from group C and Control, Uric acid, (4.49±0.25-5.13±0.30) from group C and Control, Na, (143.19±276-157.23±2.47) from group B and Control, K, (7.04±0.29-8.21±0.36) from group D and C, Bicarbonate (22.02±0.94-28.00±1.42). Significant ($P<0.05$) were recorded in the biochemical component of Liver in the following parameters (TP, ALB, ALP, ALT, AST, CHO, LDL, HDL, TRIGS and TB. There was significant ($P<0.05$) difference in haematological parameters like HB with the value ranged, (7.30±0.52-9.03±0.29), and RBCS (6.96±0.37-8.37±0.39). Sesame has ability to ameliorate and improve some biochemical and haematological parameters in rat which could make a good candidate for diet supplementation especially in certain disease conditions.

KEYWORDS: *Sesame indicum,* Biochemical and Hematological parameters.

*Corresponding Author: nmmadaki@gmail.com 08147769502

1.0 Introduction

Sesame seeds (Sesam indicum) are renowned for their rich nutrient profile and bioactive components, including essential fatty acids, proteins, vitamins, and lignans (Andargie *et al.,* 2021). Traditionally, they have been used in various culinary and medicinal applications, particularly in Asian and Middle Eastern cultures (Anilakumar *et al.,* 2010). Recent scientific investigations have begun to uncover the health benefits associated with sesame seeds, (Langyan *et al.,* 2022) suggesting their potential role in modulating various physiological functions (Rabe *et al.,* 2024). The biochemical and haematological parameters in organisms serve as crucial indicators of their health status (Ahmad *et al.,* 2024). These parameters can provide insights into the metabolic, nutritional, and overall health state of an organism (Liu *et al.* 2024). In research, Wistar rats (Rattus norvegicus) are frequently employed as model organisms due to their well-characterized physiology and similarity to human in metabolic processes (Hashway and Wilding, 2020).

The study of the effects of sesame seeds on the biochemical and haematological parameters in Wistar rats aims to elucidate the potential health benefits and therapeutic applications of sesame seeds. Understanding how these seeds influence parameters such as lipid profiles, liver enzymes, blood glucose levels, and hematological indices (Vajdi *et al.,* 2024) can contribute to the broader field of nutritional science and pave the way for future dietary recommendations and therapeutic strategies.

This present research seeks to investigate the impact of sesame seed supplementation on the biochemical and haematological parameters in Wistar rats. The findings from this study will enhance our understanding of the nutritional and pharmacological properties of sesame seeds, potentially advocating their inclusion in dietary regimens aimed at improving health and preventing disease.

2.0 MATERIALS AND METHODS

2.1 Materials

2.2 Collection of samples

Beniseed (*Sesamum indicum*) was obtained in December, 2022 from Jataaboki, in Shiroro Local Government of Niger State, and it was further blend using electric blender in Biochemistry lab, Federal University of Technology Minna, Niger State.

2.3 Reagents and chemicals

Sulfuric acid, mix catalyst, distilled water, commercial kit (AGAPE, Switzerland) with the help of UV-visible spectrophotometer at wavelength specified as described Tietz *et al*., 2006 and Ominia *et al* 2020.

2.7 Hematology sample preparation

Blood samples of the survived mice were taken after the 21 days treatment by sacrificing the mice. The sacrifice was done using blade on their cervical region and their blood samples were collected into EDTA sample bottle for further hematological analysis. The hematological analysis was done using standard method described by Akhter, 2021.

4% boric acid, methyl red, Sodium Hydroxide (NaOH), Hydrogen Chloride (HCl), petroleum ether, 1,25% NaOH, mixture of ethanol and diethyl ether, hydroxide, chloroform, acetic acid. All reagent used were of analytical grade.

2.4 Experimental animals

The experimental rats for the screening were bought from National Institute for Research, Jos Plateau State, Nigeria. The wistar rats were acclimatized for 10 days at the Animal Holding Unit, Department of Biochemistry, for subsequent use. All experiments were performed on animals using standard methods and in conformation with accepted rules for laboratory animal care**.**

2.5 Experimental designed

Twenty wistar rats were randomly divided into 5 groups of four rats each. Group 1 served as normal control (100% normal feed), Group 2 served as 75% of feed and 25% of sample, Group 3 served as 50% of feed and 50% of sample, Group 4 served as 25% of feed and 75% of sample, and Group 5 served as 100% of beniseed. The diet was fed to the animals for 3 weeks (21 days) [6] (Irshad *et al*., 2023).

2.6 Biochemical analyses

Biochemical parameters; ALT, AST, ALP, total protein, albumin, cholesterol, triglycerides, LDL, HDL, creatinine, urea, uric acid, sodium, potassium and bicarbonate were assayed using

3.0 Result

3.1 Biochemical parameter (Liver) of *Sesamum indicum*

The result presented in table 3.1 show the effect of *Sesamum indicum* on biochemical parameters. There were significant ($p < 0.05$) difference across the group, with TP value ranged from (12.18±1.31-17.60±1.12) recorded from group D as the highest and control as the least, However, ALB value ranged from (9.10±0.26- 12.10±0.20), where group B gave the highest value and least value taking from control group same scenario means recorded in ALT with the value ranged from (19.26 ± 0.87-23.37 ± 1.02), the control group gave the highest value while the least value taking from group C. Significant ($P < 0.05$) difference was recorded in AST with the value ranged from (27.70 ± 1.21-37.16 ± 1.70), the highest value was documented from the control group while the least value taken from group C. Similar pattern of result was recorded for CHO with the values ranged from (303.91 ± 3.43-337.39 ± 2.81), the highest was recorded from group D and least value taking from the control group. For the LDL the value ranged from (97.90 ± 2.48-114.71 ± 2.23) the highest value was recorded from the control while the least value documented from group C for HDL the value ranged from (65.11 ± 2.38-76.93 ± 1.55) recorded from least value. In the TRIGS the value ranged from (125.55 ± 1.96-157.45 ± 2.87) recorded from group D as the highest and group B gave the least value. More also, TB value ranged between (0.06 ± 0.02-0.76 ± 0.03), the highest value was documented from the control group while the least group taking from group A. However, this means no significant ($p > 0.05$) different in ALP, this its value ranged from (66.96 ± 1.54-81.011 ± 2.42) the highest value was documented from the control while the least taking from group C.

Table 3.1: Biochemical parameter (Liver) of *Sesamum indicum*

Parameters	Group A	Group B	Group C	Group D	Control
TP (g/L)	14.30 ± 1.03^{ab}	15.82 ± 0.66^{ab}	17.38 ± 1.21^{a}	17.60 ± 1.12^{a}	12.18 ± 1.31^{b}
ALB(g/L)	9.25 ± 0.24^{b}	12.10 ± 0.29^{a}	11.49 ± 0.75^{a}	11.24 ± 0.61^{a}	9.10 ± 0.26^{b}
ALP(U/L)	76.49 ± 2.10^{a}	69.89 ± 2.30^{ab}	66.96 ± 1.54^{ab}	70.83 ± 1.36^{ab}	81.01 ± 2.42^{a}
ALT(U/L)	21.35 ± 1.04^{a}	22.55 ± 0.94^{a}	19.26 ± 0.87^{b}	19.40 ± 0.99^{b}	23.37 ± 1.02^{a}
AST(U/L)	35.95 ± 1.64^{a}	29.55 ± 0.93^{b}	27.70 ± 1.21^{b}	29.57 ± 1.72^{b}	37.16 ± 1.70^{a}
CHO(mmol/L)	320.17 ± 1.13^{a}	312.63 ± 1.79^{a}	322.93 ± 2.45^{a}	337.39 ± 2.81^{a}	303.91 ± 3.43^{a}
LDL(mmol/L)	103.95 ± 1.47^{a}	101.18 ± 2.70^{a}	97.90 ± 2.48^{b}	108.54 ± 2.21^{a}	114.71 ± 2.23^{a}
HDL(mmol/L)	74.01 ± 2.54^{a}	76.93 ± 1.55^{a}	76.41 ± 2.92^{a}	72.93 ± 2.19^{a}	65.11 ± 2.38^{b}
TRIGS(mmol/L)	130.57 ± 1.63^{a}	125.55 ± 1.96^{b}	132.40 ± 1.92^{a}	157.45 ± 2.87^{a}	143.15 ± 2.34^{a}
TB(mg/dL)	0.06 ± 0.02^{c}	0.54 ± 0.03^{b}	0.51 ± 0.02^{b}	0.60 ± 0.04^{b}	0.76 ± 0.03^{a}

Values are Mean ± Standard Deviation of determination of three replicates. Superscripts with different values on same columns are $p<0.05$ (significantly different).

3.2 Biochemical parameter (Kidney) of *Sesamum indicum*

The result presented in table 3.2 show the effect of sesame seeds on biochemical parameters of kidneys in wisferrat. There were significant (P<0.05) difference in the creatine and Urea with their values ranged as following creatine (5.47±0.31-753±043) where the highest value was documented from group D and the least value from group C. For the Urea the value ranged between (20.84±1.36-30.44±1.76)

Table 3.2: Biochemical parameter (Kidney) of *Sesamum indicum*

Parameters	Group A	Group B	Group C	Group D	Control
Creatinine (mg/dL)	6.32±0.43^{abc}	5.47±0.31^{a}	5.72±0.49^{ab}	7.53±0.43^{c}	7.04±0.19^{bc}
Urea (mg/dL)	25.03±1.56^{ab}	23.14±1.40^{b}	20.84±1.36^{c}	29.98±1.24^{a}	30.44±1.76^{a}
Uric acid (mg/dL)	4.26±0.28^{ab}	4.71±0.16^{ab}	4.09±0.25^{ab}	4.69±0.30^{ab}	5.13±0.30^{a}
Na (mEq/L)	149.91±2.59^{ab}	143.19±2.76^{ab}	145.24±1.95^{ab}	154.01±2.73^{a}	157.23±2.47^{a}
K (mEq/L)	7.31±0.19^{a}	7.90±0.32^{a}	8.21±0.36^{a}	7.04±0.29^{ab}	7.07±0.25^{ab}
Bicarbonate (mg/dL)	22.35±1.14^{ab}	26.56±1.97^{a}	26.01±1.48^{a}	28.00±1.42^{a}	22.02±0.94^{ab}

Values are Mean ± Standard Deviation of determination of three replicates. Superscripts with different values on same columns are significantly different (p<0.05).

3.3 Hematological parameters of rats fed with *Sesamum indicum*

The result presented in table 3.3 shows the effect of sesame seedon haematological parameter of wister rat There were significant (p<0.5) difference in the HB and RBCs with their values ranged as follow, HB (7.08±0.13-9.03±0.29) recorded from D as the highest value. However, RBCs value ranged from (6.96±0.37-8.37±0.39) documented from group B as the highest value and the check group gave the least value.

Table 3.3: Hematological parameters of rats fed with *Sesamum indicum*

Parameters	Group A	Group B	Group C	Group D	Control
HB (g/dL)	7.30±0.52^{b}	8.09±0.77^{ab}	8.11±0.22^{ab}	9.03±0.29^{a}	7.08±0.13^{b}
PCV (%)	35.00±1.00^{a}	38.00±100^{a}	37.00±1.00^{a}	38.00±1.00^{a}	37.00±1.00^{a}
MCV(fi)	42.00±2.00^{a}	43.50±1.50^{a}	43.00±2.0^{a}	45.00±2.00^{a}	41.50±1.50^{a}
MCH (pg)	30.50±1.50^{a}	32.00±2.00^{a}	34.00±2.00^{a}	37.00±2.00^{a}	32.00±2.00^{a}
MCHC (g/dL)	41.50±1.50^{a}	40.50±1.50^{a}	41.50±1.50^{a}	42.50±1.50^{a}	41.00±2.00^{a}
PLT (10^{6}/L)	146.50±1.50^{a}	144.50±2.50^{a}	143.50±1.50^{a}	140.50±2.50^{a}	141.00±2.00^{a}
RBCs (10^{12}/L)	7.36±0.49^{ab}	8.37±0.39^{a}	8.09±0.23^{ab}	8.25±0.29^{ab}	6.96±0.37^{b}
TWBCs (10^{9}/L)	6.58±0.37^{a}	7.00±0.22^{a}	7.47±0.35^{a}	6.59±0.38^{a}	7.40±0.44^{a}
L (10^{9}/L)	25.50±1.50^{a}	27.00±2.00^{a}	25.00±2.00^{a}	26.00±1.00^{a}	21.50±1.50^{a}

Values are Mean ± Standard Deviation of determination of three replicates. Superscripts with different values on same columns are $p<0.05$ (significantly different)

Discussions

It can be deduced from the biochemical results that the lowering of enzyme by *Sesamum indicum*, is an indication that *Sesamum indicum* can be used in treatment/ management of myocardial infarction of the heart, hepatitis, kidney infection, inflammation, atherosclerosis etc which is related to the study of Ibrahim *et al.* (2020) who reported that fermented and roasted sesame could retard the progression of inflammation and atherosclerotic lesion development and therefore may be useful as a health supplement for the prevention and treatment of inflammation and atherosclerosis diseases .

Hematological studies provide vital information regarding the status of bone marrow activity and intravascular effect such as hemolysis. The hematological analysis of the animals fed with *Sesamum indicum* showed no significant difference ($p<0.05$) between the treated groups (Group A, B, C, D mg/kg bw) in most of the parameters (MCH, MCV, MCHC, PLT, and RDWC) showing that Beniseed had no adverse effect on the blood of experimental rats, except for Lymphocytes (L), Hemoglobin (H), Red blood cell (RBC) and Packed cell volume (PCV) which recorded significantly ($p<0.05$) higher values in group D when compared to the control group. The increased number of lymphocytes through diet as seen in this study may indicate the immune system boosting capability of *Sesamum indicum*. Moreso, there is a direct relationship among the hematological indices. For example, increase in RBC count may lead to the corresponding increase in Hb and Hematocrit (Agiang *et al*., 2017) which could be attributed to the presence of flavonoids and phenols observed in this study. This is in accordance with the study of Alkatan *et al*. (2009) who reported that the Sesame seeds in breeder diet enhances the erythropoiesis as shown by a significant increase in the RBC

count, Hb and PCV compared with the control group.

Elevated amounts of these enzymes in the blood may signal a health problem (Malakouti, 2017). ALP, AST and ALT test are commonly used to monitor liver disorder/diseases, to ascertain treatment efficacy and to make sure that medications are not causing liver damage. After feeding with *Sesamum indicum* formulated feed, it was observed that there was significance difference ($p<0.05$) in the levels of ALP, AST and ALT among treatment groups where group D (100 % *Sesamum indicum*) recorded significantly ($p<0.05$) lower values when compared with the negative control. The decreases in enzymes concentration may not necessarily indicate a compromised liver function in the appropriate clinical context but an indication that *Sesamum indicum* could serve to ameliorate the effect of drug toxicity and disease conditions. This is because it has been established that AST activities are elevated when there is injury to the liver or other organs such as heart, muscle, brain and kidneys (Teschke, 2009 and Mumivand *et al*. 2017). Which is similar to the work of Teofilović *et al*. (2021) who reported that basil extract decreased AST and ALP levels in rats with acetaminophen-induced liver damage

The kidneys play a vital role in the excretion of waste products and toxins such as urea, creatinine and uric acid, regulation of extracellular fluid volume, serum osmolality and electrolyte concentrations. Tests of renal function have utility in identifying the presence of renal disease, monitoring the response of kidneys to treatment, and determining the progression of renal disease (Gounden *et al*., 2023). The results of the kidney function test showed that there was significant difference between treated groups fed with ration of formulated *Sesamum indicum* feed. Suggesting that intake of *Sesamum indicum* may not cause any alteration or increment in the renal function parameter but maintain the integrity of the kidney.

CONCLUSION

The hematological and biochemical indices indicate that these diets can support effective growth and development in rats, and consumption of these diets has no detrimental effects on the liver and renal function. In addition, Sesame seed has the prerequisites for production and function of red blood cells., which could be attributed it antioxidant capacity proffered by the presence bioactive components.

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