

Africa Center of Excellence (CoE) for Mycotoxin and Food Safety

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Vision

To be a global food safety training and research center to realize sustainable and secure health for humanity.

Mission

The creation of the Africa Center of Excellence (CoE) for Mycotoxin and Food Safety will create learning opportunities and research results to address Africa's shortage of expertise and applicable solutions to ensure a safe, controlled and sufficient food supply that will support economic growth and public health.

10



FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

School of Life Science

BOOK

OF

PROCEEDINGS

Theme:

WEALTH CREATION FROM TRANSLATIONAL RESEARCH:

THE ROLE OF LIFE SCIENCE

CONTENTS Volume I

Microbial remediation of industrial effluents using indigenous isolates. Adakole, C. A., Binuyo, O. A., Joda, J. F., Kawthar, O., Olawale, B. T., Oyewole, O. A. and Nabara, H. Y.	1
Isolation and screening of xylanase-producing microorganisms. Oyewole, O. A., Binuyo, O. A., Joda, J. F., Nabara, H. Y., Tsado, P. Y., Musa, F. and Akinpelu, O. J.	10
Assessment of aquatic macrophytes abundance and physico-chemical parameters of Kpata River, Kogi State. Odoh, V. U, Dauda, T and Odoh, S. S.	20
Prevalence of protozoans in drinking and recreational water sources around the Federal Capital Territory (FCT), Nigeria., Hanis, B., Ezeofor, A. O., Egbulefu, C. S., Ajaegbu, E. C., Uzor, O. S., and Owie, P. A.	28
Sub-lethal effects of cypermethrin on weight and haematological indices of <i>Clarias gariepinus</i> (Burchell, 1822) Fingerlings. Ayanwale, A. V., Fawunmi, F. B., Samuel, P. O. and Auta, Y.	36
The effects of pH and temperature on amylase and protease production by <i>Bacillus subtilis</i> and <i>Pseudomonas aeruginosa</i> isolated from soil. Abdulmalik, S. U., Adamu, B. B., Jumoke, F. J., Ismail, A. M., Oyewole, A. O.	45
Collection and evaluation of <i>Phaseolus</i> species germplasm in Northern Nigeria. Ikani, V. O., Falusi, O. A., Daudu, O. A. Y., Abubakar, A., Ndayankpa, N. M. and Upahi, L	54
Resistance profile of <i>Klebsiella pneumoniae</i> isolated from different sachet water Okoye, U.M., Olamide, E. and Unimke, F.	62
Effect of Gamma Irradiation and Ethyl Methane Sulphonate on yield attributes of three Nigerian Cowpea [<i>Vigna unguiculata</i> (L.) Walp.]. Ibikunle, K., Falusi, O. A., Daudu, Y. A. O. and Abubakar, A.	70
Heavy metal assessment of water, fish (<i>Citharus citharus</i>) and sediment pollution in Musawa Area of South Kainji Lake, New Bussa, Niger State, Nigeria. Abdulazeez, M., Abdulkadir, A., Abdurasheed-Adeleke, T., Ajayi, O., Hashimu, A., Muhammad, N., Mohammed, M. Y., Aliyu, R., Mubarak, U., and Salihu, S. C.	77
Screening, isolation and identification of microorganisms for chitosan production. Raji, R. O., Abdulazeez, H. O., Aromeh, L. O., Tanko, T. S., Raji, J., Oyewole, O. A., Auta, H. S. and Abioye, O. P.	83
Protein profile and free radical scavenging activity of scorpion venom <i>Pandinus imperator</i> . Boyi, A. A., Omalu, I. C. J., Abubakar, A., Abolarinwa, S. O., Oaikhena, E. E., Waziri, Z. I., Ismail, A. and Abdullahi, M. Eke, S. S.	95

Investigation of gastrointestinal parasites of solid waste from dumpsites in Bosso Local Government Area, Minna, Niger State, Nigeria. Ismail, A., Ogbe, M. E., Omalu, I. C. and Abolarinwa, S. O., Abdullahi, M., Faisal, A.	106
Screening of bacteria for polyhydroxyalkanoates production using plastic wastes as carbon sources. Chimbekujwo, K. I., Ijah, U. J. J., Oyewole, O. A., Abioye, O. P. and Egwim, E. C.	110
Occurrence of Aflatoxin in Three Selected Smoked- dried Fish Species and its Risks on Human Health from Niger South, Niger State, Nigeria. Jibrin, Y. H., Adama, B. S., Mohammed, L. H. Baba, A. A., Suleiman T. M. and Auta Y. I.	122
Effect of gamma radiation on some agro-morphological traits of m1 generation of two lowland rice (<i>Oryza sativa</i> L.) varieties. Haruna, H. B., Falusi, O. A., Daudu, O. A. Y. and Gado, A. A.	133
Screening and identification of lactic acid bacteria isolated from selected fermented foods for bacteriocin production. Nathaniel, V., Ijah, U. J. J., Oyewole, O. A. and Anuoye, J. C.	141
Evaluation of the Anti- Inflammation Properties of <i>Calotropis Procera</i> . Odu, N. M., Ogunasanya, M. U., Umar, M. B., Ossamulu, I. F. Abubakar, A. N., Alade, H. B. and Adebayo, A.	154
Antibacterial and phytochemical screening of orange (<i>Citrus sinensis</i>) and pineapple (<i>Ananas comosus</i>) peels against some bacterial isolates in Dutse metropolis. Abubakar, A. W. Aliyu, S., Zakari, S. M., Aliko, A. A., Magami, I. M. Musa, A. O., and Umar, K. M.	163
Effect of preservative methods on proximate composition of marketed tomatoes (<i>Solanum lycopersicum</i> Linn.) varieties in Minna. Dangana, M. C., Bello, I. M., Daudu, O. A. Y., Gado, A. A., Abdulsalami, H., and Musa, M. L.	173
Preliminary Phytochemistry and Acute toxicity of ethanol leaves extracts of <i>Ficus ingens</i> and <i>Ficus sur</i> (Forssk) in broiler chickens. Gbise, D. S., Omalu, I. C. J., Abolarinwa, S. O., Abubakar, A., Usman, J. and Gotep, J.	179
Effect of Methanol Extract of <i>Calotropis procera</i> Flower on Blood Glucose and Selected Biochemical parameters in Alloxan-Induced Diabetic Rats. Hamzah, R. U., Busari, M. B., Umar, M. B., Sani, Y. A., Abubakar, A. N., Olajugba, J. O. and yinlola, P. H.	186
Nutritional and Antinutritional Composition of Whole and Defatted Cassava Seed Flour. Gana, B. K., Akanya, H. O. and Egwim, E. C.	194
Heavy metal contamination in soils around cement factories: A Review. Abdulsalam, S., Abdulsalami, H., Yahaya, R. A, Aina, O. A, Ugbenyo, N. O. and Yahaya, M. K.	201

Antihyperlipidaemic Effect of Crude Extract and Partitioned Fractions of <i>Newbouldia laevis</i> Leaves in Alloxan-induced Diabetic Rats. Umar, M. B., Abdulkadir, A., Hamzah, R. U., Odu, N. M., 1, Abubakar, A. N., Musa, A. L. and Ibrahim, Y. O	208
Phytochemical and antimicrobial activity of <i>Hyptis suaveolens</i> (L) Poit. Abdulsalami, H., Kosarachi H. O., Abdulsalam, S., Adams, F. O., Abdulsalam, R. and Abdullahi, H.	217
Effectiveness of changing water in rearing <i>Clarias gariepinus</i> (burchell, 1822) fingerlings. Kutwal, Y. B.....	224
Phytochemical screening of <i>Opuntia ficus-indica</i> (L.) bark extract and it's <i>in-vitro</i> cercaricidal activity on the larval stage of <i>Schistosoma mansoni</i> . Ibeh, E. O., Ibeh, H. C., Ibeh, E. N., Uwaechia, F. C., Ndukwe, J., Okechukwu, A., Esumeh, C. O., Omalu, I. C. J. and Abolarinwa, S. O.....	231
Antitrypanosomal Activity of <i>Piliostigma thoningii</i> and <i>Calotropis procera</i> Ethanol Leaves Crude Extracts Singly and in Combination in Mice. Abdulrahman, I., Madaki, M. F., Abdulkareem, A. S., and Abubakar A.	241
Occurrence of gastrointestinal helminths of cattle slaughtered in Bwari Abattoir, Bwari Area Council, Abuja. Ibeh, H. C., Okechukwu, A., Ibeh, E. O., Ibeh, E. N., Uwaechia, F. C., Ndukwe, J. and Esumeh, C. O.	250
Effect of Sesame Seeds on Biochemical and Haematological Parameters in Wistar Rat. Madaki, F. M., Muhammad, L. M., Alhassan, S. I., Abdulrahman, M. and Tanimu, N. A.....	260
Evaluation of microorganisms and hygiene practices of selected fruit and vegetable vendors in Kubwa, Abuja, Nigeria. Ibeh, E. N., Esumeh, C. O., Ibeh, H. C., Uwaechia, F. C., Okechukwu, A., Ndukwe, J. and Ibeh, E. O	268
<i>In vitro</i> Alpha-amylase Inhibitory and Antioxidant Activities of Crude Saponins and Flavonoids Extracts from <i>Vernonia amygdalina</i> Leaves. Abubakar, A. N., Busari, M. B., Ibrahim, Y. O., Odu, M. U., Umar, M. B., Hamzah, R. U. and Eferhire, L.....	275
Biological control model for toxicants affecting organisms in aquatic habitats: A Case Study of Tagwai Lake. Chukwuemeka, V. I., Hemen, V., Adedayo, P. T., Yusufu, F. O.....	282
Occurrence and Risk Assessment of Lead, Arsenic, Mercury and Cadmium in Local and Exotic Layer Chicken Eggs in Niger State. Muhammad, H. K., Salubuyi, S. B., Ossamulu, I. F., Odebiyi, D. M., Christopher, C. C. and Makun, H. A.....	291
Relative abundance of weaver ant trail from different host plants within IBB University Lapai permanent site. Olayemi, I.K., Salihu, I.M., Abolarinwa, S.O., Ukubuiwe, A.C., Usman, A., Shittu, K.O., Salaudeen, M.T., Adebola, M.O., Adeniyi, K.A., Oyibo-Usman, K.A., Mustapha, O.M., Sodangi, C.J., Jacob, J.O., Usman, M.D., Aliyu, M.A and Silace, P.....	301

Study for Relationship Between the Presence of Mid-Gut Bacteria and the Age of Pregnant and Non-Pregnant <i>Glossina morsitans submorsitans</i> . Ibrahim, L. J., Andrew, T. and Itodo, J.	30
Evaluating the Effectiveness of Molecular Xeno Monitoring for Lymphatic Filariasis Surveillance in Low-Prevalence Areas of Kaduna South LGA, Kaduna State, Nigeria. Luka, N. E., Adamani, W., Dikwa, B., Omalu, I. C. J. and Ewoferem, E. N.	317
Microbiological assessment of Lactobacillus species isolated from locally fermented drinks (kindrimo and nono) sold in Minna, Niger State. Akinleye, A., Adabara, N. U., Adelere, I. A. Aboyeji, D. O. and Abubakar, A. N.	324
Biochemical Diversity of Honeybee (<i>Apis Mellifera</i>) Population in Commercial Apiaries in Minna, Nigeria. Maduegbuna, E. N., Olayemi, I. K., Shittu, K. O., Ukwubuiwe A. C., and Adeniyi, K. A.	336
Snake venoms: Valuable therapeutic weapon to combat infectious and non-infectious diseases. Abdullahi, A., Ibrahim, Y. O., Abdurashed-Adeleke, T., Umar, M. B.	343
Mining impact on plant population and soil macrofauna in Paikoro Local Government Niger State, Nigeria. Tanko, T., Passi, A. D., Baba, G. and Abdulhakeem, A.	353
Prevalence of soil transmitted helminth amongst pre-primary school age children in Lafia Local Government Area of Nasarawa State, Nigeria. Aimankhu, P. O., Abdusalam, N., Adejoh, V. A., Ombugadu, A., Ahmed, H. O. and Omalu, I. C. J.	363

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

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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 rats 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 mg/dL) from group B and D, Urea ranged from (20.84 ± 1.36 - 30.44 ± 1.76 mg/dL) from group C and Control, Uric acid, (4.49 ± 0.25 - 5.13 ± 0.30 mg/dL) from group C and Control, Na (143.19 ± 276 - 157.23 ± 2.47 mEq/L) from group B and Control, K, (7.04 ± 0.29 - 8.21 ± 0.34 mEq/L) from group D and C, Bicarbonate (22.02 ± 0.94 - 28.00 ± 1.42 mg/dL). Significant ($P < 0.05$) were recorded in the biochemical component of Liver in the following parameters Total protein (TP), Albumin (ALB), Alkaline phosphatase (ALP), Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Cholesterol (CHO), Low density lipoproteins (LDL), High density lipoproteins (HDL), Triglycerides (TRIGS) and Total bilirubin (TB). There was significant ($P < 0.05$) difference in haematological parameters like Hemoglobin (HB) with the value ranged, (7.30 ± 0.52 - 9.03 ± 0.29), and Red blood cells (RBC) (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.

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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.

MATERIALS AND METHODS

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.

Reagents and chemicals

Sulfuric acid, mix catalyst, distilled water, 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.

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.

Experimental designed

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

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

commercial kit (AGAPE, Switzerland) with the help of UV-visible spectrophotometer at wavelength specified as described Kraus, 2006 and Ominia *et al* 2020.

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.

RESULTS

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 g/L) 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 g/L), 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 U/L), 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 U/L), 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 mmol/L), 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 mmol/L) 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 mmol/L) recorded from least value. In the TRIGS the value ranged from (125.55 ± 1.96 - 157.45 ± 2.87 mmol/L) 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 mg/dL), 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 U/L) 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^a	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 \pm Standard Deviation of three replicates. Superscripts with different values on same columns are $p < 0.05$ (significantly different). Define the Acronyms please

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 wistar rat. There was significant ($P < 0.05$) difference in the

creatinine and Urea with their values ranged as following creatine ($5.47 \pm 0.31 - 7.53 \pm 0.43$ mg/dL) where the highest value was documented from group D and the least value from group C. For the Urea the value ranged between ($20.84 \pm 1.36 - 30.44 \pm 1.76$ mg/dL)

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

Haematological parameters of rats fed with *Sesamum indicum*

The result presented in table 3.3 shows the effect of sesame seed on haematological parameter of wistar rat. There were significant ($p < 0.5$) difference in the HB and RBCs with their values ranged as

follow, HB ($7.08 \pm 0.13 - 9.03 \pm 0.29$ g/dL) recorded from D as the highest value. However, RBCs value ranged from ($6.96 \pm 0.37 - 8.37 \pm 0.39$ $10^{12}/L$) 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 ± 1.00^a	37.00 ± 1.00^a	38.00 ± 1.00^a	37.00 ± 1.00^a
MCV (fl)	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 \pm Standard Deviation of determination of three replicates. Superscripts with different values on same columns are $p < 0.05$ (significantly different)

Where, HB- Hemoglobin, PCV- Packed cell volume, MCV-Mean cell volume, MCH-Mean corpuscular hemoglobin MCHC-Mean corpuscular hemoglobin concentration, PLT- Platelets, RBCs -Red blood cells, TWBCs- Total white blood cells, L-Lymphocytes

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 tests 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 significant 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 normal 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 to its antioxidant capacity proffered by the presence of bioactive components.

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