SERUM BIOCHEMICAL AND HAEMATOLOGICAL PARAMETERS PROFILE OF WISTAR RATS FOLLOWING DAILY ADMINISTRATION OF PALM KERNEL OIL

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Received: 2nd October, 2023 **Accepted**: 10th November 2023 **Published:** 1st December, 2023

ABSTRACT
Background: Palm kernel oil, or simply PKO, is an edible oil obtain from the kernel of oil palm tree *Elaeis guinnensis.*
Aim: This study was carried out to determine the phytochemical compositions and evaluate the effects of this oil on selected biochemical and haematological parameters in Wistar rats.
Methods: Standard methods for analysis were adopted in this study. A total of 30 rats divided into three groups of 10 rats each were used; group I (control) received only distilled water and feed while group II and III (test groups) received 5ml and 10ml of palm kernel oil respectively for 21 days in addition to distilled water and feed.
Results: Phytochemical analysis of PKO showed the presence of tannins, saponins, flavonoids, steroids, terpenoids, anthraquinones, and glycosides and the absence of alkaloids in the sample. Results obtained from biochemical analysis showed both 5 ml and 10 ml palm kernel oil significantly (< 0.05) increased the three liver enzymes alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) and the total conjugated bilirubins when compared to the control group. In addition both volumes of PKO administered non – significantly (p > 005) increased Packed Cell Volume (PCV) and Haemoglobin (Hb) but significantly (p < 0.05) increased White Blood Cells (WB) and Platelets of the test group when compared to the control group.
Keywords: Biochemical, Haematological, Bilirubins, Haemoglobin, Platelet

INTRODUCTION
Palm kernel oil, or simply PKO, is a burnt smell and burnt brown (Amira *et al*., 2014) edible oil obtained from the kernel of oil palm tree *Elaeis guineensis* (Ugbogu *et al*., 2006). Oil palm tree is believed to have originated in the jungle forests of East Africa and there is some evidence that its oils were used in Egypt some 5,000 years ago during the time of the Pharaohs (Pantzaris & Mohd, 2001). PKO is produced in many villages, mostly by women, where this tree is grown for subsistence or commercial purposes. The oil is sold in plastic rubbers or transparent leathers in markets and it is purchased for its diverse uses.
The traditional oil extraction method is to fry palm kernels in old oil or simply heat the dried nuts. The fried kernels are then pounded or ground to a paste in a motorised grinder. The paste is mixed with a small quantity of water and heated to release the palm kernel oil. The released oil is periodically skimmed from the top.

Citation: Ahmad, A. I., Suleiman, A. I., and Kabir, M. S. (2023): Serum Biochemical and Haematological Parameters Profile of Wistar Rats Following Daily Administration of Palm Kernel Oil. *BJMLS 8(2): 67 - 72*

However, there are stations in villages that will accept well-dried kernels for direct extraction of the oil in mechanised, motorised expellers (Poku, 2002).

Palm kernel oil is used in alternative medicine as a drug being given to a child suffering from convulsion, a hair ointment in the treatment of dandruff, and a moisturizer mostly for new born children to prevent cold and lowering bodily temperature in a sick child and also for the prevention of scaly skin (Amira *et al*., 2014).

Palm kernel oil is useful for cooking as it has little to no cholesterol (Okpuzor *et al*., 2009). An earlier study showed that the oil contained fat/oil 42%, crude protein 7.01%, moisture 6.5%, crude fiber 11.09% and carbohydrate (by difference) 33.40% and a host of minerals (Atasie & Akinhanmi, 2009). The oil contains about 80% saturated fats and 20% unsaturated fatty acids esterified with glycerol (Mukherjee & Mitra, 2009) and can be found in a number of products, including margarine, vegetable oil, and shortening, creamers, chocolate and ice cream.

Nieman *et al*., 1992 recommended that Na/K ratio be less than one to prevent cases of high blood pressure, and earlier study by (Atasie & Akinhanmi, 2009) showed that PKO contains Na/K ratio of 0.936. This shows that PKO administration or ingestion helps control the free flow of blood from the heart to other organs of the body. And by so doing, it helps in keeping the blood pressure under control, thereby preventing the risk of hypertension.

The current research evaluates the possible effects of this oil consumption on the liver and haematological parameters. Commonly assayed liver enzymes and metabolites as well as common haematological parameters were determined to outline the effects of daily consumption of the oil on the liver and blood. The oil was subjected to phytochemical screening to determine its phytochemical compositions which could be responsible for its medicinal as well as physiological activities.

MATERIALS AND METHODS

Study Area

This study was carried out in Lokoja, the capital city of Kogi State. Lokoja has geographical coordinates situated between latitudes 7°45'N and longitude 6°45'E (Figure 1). Lokoja is a unique, being a confluence town (Pittsburgh of Africa) of the River Niger and Benue as well as link zone between the South-western, South-eastern and Abuja, the Federal Capital territory of Nigeria, with an annual rainfall between 1016 – 1524 mm and mean annual temperature of 27.7 ºC (Alabi, 2009; Adetunji, 2018). According to 2006 census, the population of Lokoja local government aborigine, made up Hausa, Nupe, Kupa, Kakanda, Oworo, Ganagana, Bassa and Egbira ethnic groups is estimated at 196, 643 (Audu, 2012). The strategic nature of the State makes Lokoja a significant centre for commercial activities.

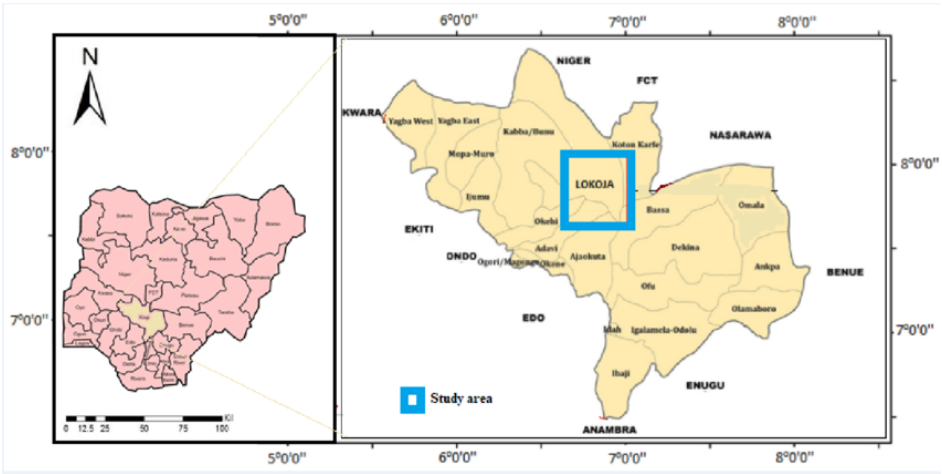

Figure 1: Location map of Nigeria showing Lokoja, Kogi State (Okolo *et al*., 2022)

Procurement of Sample

Freshly produced sample of PKO was bought from a local producer at Lokoja Local Government Area, Kogi State, Nigeria.

Phytochemical Screening Analysis

The phytochemical compositions of the oil were determined using methods variously described by Trease and Evans (1996) and Sofowara (2006).

Experimental Animals and Research Design

A total of thirty (30) male Albino rats weighing between 150 to 200 g were used for the experiment. The Albino rats were purchased from a Commercial Breeding Center in Ilorin, Nigeria. The animals were kept in standard wooden cage at the animal house under a strict compliance with the guide for animal research, as detailed in (NIH, 1985) Guidelines for the Care and Use of Laboratory Animals. The animals were fed ad libitum with commercially formulated pelletized rat feed (T.J Top Feed Ltd, Port Harcourt, Nigeria) and water under a natural light/dark cycle. The animals were allowed to acclimatize in the standard wooden cage for 2 weeks before the commencement of the study as to allow for adaptation of life in the cage.

After acclimatization period, the rats for were allocated to three groups of ten rats each designated as Control Group (Group I) and Test Groups (Groups II, and III).

The weights of the rats were equalized as nearly as possible. The rats' treatments lasted for twenty-one (21) days. The treatments given to the rats are stated as follows:

Group I: normal saline + feed + water

Group II: 5 ml/kg BW of PKO + feed + water

Group III: 10 ml/kg BW of PKO + feed + water

Blood Sample Collection

At the end of administration period (21 days), rats from various groups were anaesthetized with chloroform vapor. Blood was collected by cardiac puncture into clean anticoagulant tubes for the selected haematological indices while the one for liver function tests was collected into clean tubes. The tubes were properly labeled and used for analysis.

Serum Assay

The serum assays undertaken were those of liver function tests. The level of alkaline phosphatase (ALP) was determined by the method of Write *et al*. (1972). Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined as described by Reitman and Frankel (1957). The assay of bilirubin both total and conjugated was carried out using the method of Jendras-sik and Groff (1938). Urea estimation was done using Urease-Berthlot method.

Haematological Analysis

The White Blood Cell counts, Platelets and Hb were determined using standard methods described by Dacie and Lawis (1984). PCV was determined using Hawksley microcapillary tubes and centrifuge at 1,100 g for 5 minutes (Abudu & Sofola, 1994).

Statistical Analysis

Results were presented as mean and standard deviations of triplicate determinations. Group comparisons were done using the least significant difference (LSD). Significant difference was established at 5% level by one- way ANOVA followed by Duncan *post – hoc* test for multiple comparisons.

RESULTS AND DISCUSSION

Palm kernel oil has been used for many years (Pantzaris & Mohd, 2001) for nutritional, medicinal and industrial purposes (Chiabi *et al*., 2011). The oil is used in cooking (Chiabi *et al*., 2011) and also ingested in its naturally occurring liquid form for its various medicinal benefits. The phytochemical compositions of this oil are shown in Table 1 while the possible effects of the oil on liver and the haematological parameters of rats are shown in Table 2 and Table 3, respectively.

Table 1: Phytochemical Composition of Palm kernel oil

Phytochemical Composition	**Remark**
Tannins	+
Saponins	+
Flavonoids	+
Steroids	+
Terpenoids	+
Anthraquinones	+
Glycosides	+
Alkaloids	-

+ = Presence of phytochemical composition
- = Absence of phytochemical composition

Phytochemical analysis of PKO showed the presence of tannins, saponins, flavonoids, steroids, terpenoids, anthraquinones, and glycosides and the absence of alkaloids in the sample. These phytochemical constituents that are present in PKO are known to exhibit medicinal as well as physiological activities (Sofowora, 1993). The presence of tannins and flavonoids, which are both phenols, in PKO could be attributed to its acidic nature. Palm kernel oil is widely used as an ingredient in soap making and the presence of saponins confirms its cleansing properties. The presence of glycosides and absence of alkaloids confirm the oil ability to lower blood pressure (Atasie & Akinhanmi, 2009).

Table 2: Effects of PKO on Selected Biochemical Parameters in Wistar Albino Rats

	Biochemical Parameters				
Group	ALT	AST	ALP	TBIL	**CBIL**
Group 1	25.84 ± 0.14^{a}	29.70 ± 0.56^{a}	41.76 ± 0.02^{a}	0.76 ± 0.01^{a}	0.25 ± 0.02^{a}
Group 2	28.65 ± 0.05^{b}	32.93 ± 0.64^{b}	41.93 ± 0.01^{a}	0.83 ± 0.01^{b}	0.26 ± 0.01^{a}
Group 3	47.53 ± 0.12^{c}	60.53 ± 0.03^{c}	59.17 ± 0.15^{b}	0.92 ± 0.02^{c}	0.24 ± 0.01^{a}

Data represented as mean ± S.D of concentration of serum biochemical parameters of TBIL and CBIL (mg/dl), and AST, ALT, and ALP (U/L).Mean values having different lowercase letters as superscripts are considered significant ($p < 0.05$) down the column. ALT: Alkaline aminotransferase; AST: Aspartate aminotransferase; ALP: Alkaline phosphatase; CBil: Conjugated bilirubin; Tbil: Total bilirubin

From Table 2, apart from the alkaline phosphatase (ALP) level of group 2 (100 mg/kg bw), alanine aminotransferase (ALT), aspartate aminotransferase (AST) and ALP levels were significantly ($p < 0.05$) increased in the test groups when compared to the control group. While ALP levels of the test groups remained within the normal threshold, ALT and AST levels were raised above their upper limit of normal (ULN) (Levick, 2017), indicating a hepatocellular pattern such as metabolic liver disease (Levick, 2017). This observation is in line with the previous work of Owu *et al*. (1998) who observed that administration of fresh or oxidized palm oil significantly ($p < 0.05$) increased serum levels of ALT, AST, and ALP. The results further showed that PKO significantly increased total bilirubin levels of the test groups when compared to the control group but exacted non-linear effects on conjugated bilirubin. However, both total and conjugated bilirubin levels were still within the normal range (Levick, 2017).

The increased levels of the liver enzymes in the test groups against the control group can be attributed to daily administration of the oil in the test rats, indicating hepatotoxic potency of palm kernel oil.

Table 3: Effects of PKO on Selected Haematological Parameters in Wistar Albino Rats

	Haematological Parameters			
Group	PCV	Hb	WBC (x 10^9/l)	Platelets
Group 1	31.00 ±1.73[a]	10.07 ±0.21[a]	2.77 ±0.25[a]	371.33±5.51[a]
Group 2	34.66 ±2.08[a]	11.09 ±0.18[a]	5.07 ±0.21[b]	393.33±1.53[b]
Group 3	35.00 ±2.00[a]	11.27 ±0.31[b]	6.47 ±0.15[c]	547.00±1.00[c]

Data represented as mean ± S.D of concentration of haematological parameters of PCV (%), Hb (g/dL), WBC (x 10^9/l), and Platelets (x 10^9/l).Mean values having different lowercase letters as superscripts are considered significant ($p < 0.05$) down the column. PCV: Packed Cell Volume; Hb: Haemoglobin; and WBC: White Blood Cells

From table 3, both 5 ml/kg bw and 10 ml/kg bw of PKO non-significantly ($p>0.05$) increased packed cell volume and haemoglobin levels in the test groups when compared to the control; this is in line with earlier studies of PKO on Hb and also corresponded with the report on the effects of olive oil, crude oil, and honey on the haematological parameter (Imo & Sunday, 2020). The two samples, however, significantly ($p < 0.05$) increased the levels of white blood cells and blood platelets in the test groups when compared to the control group; these observations as well corresponded with the previous work of Imo & Sunday (2020). The current findings indicate that PKO has little to no effects on PCV and Hb, but exerted significant increase on white blood cells and platelets, indicating its possible anti-infection and coagulating potentials in living organisms.

CONCLUSION

Daily administration of palm kernel oil significantly increases the three major liver enzymes in the plasma ALT, AST, and ALP, indicating its possible hepatotoxic potential. However, while the oil has little to no effect on packed cell volume and haemoglobin, it increases white blood cells and platelets, indicating its possible anti-infection and coagulating potentials.

Recommendation

Palm kernel oil can be used to boost the immune system and increase blood coagulation. However, consumers of this oil should be wary of its daily consumption as it can lead to liver damage or metabolic liver disease.

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