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Research Article
Hematological Effects of Palm Kernel Oil, Olive Oil, Crude Oil and Honey in Male Albino Rats

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Abstract
Background and Objectives: This study evaluated the haematological effects of palm kernel oil, olive oil, crude oil and honey in male albino rats. The chemical substances are commonly used as antidote for poisons. **Materials and Methods:** Thirty healthy male albino rats were used in this study. They were randomly placed into five groups of six animals each and were administered the corresponding chemical substances for 21 days. They were sacrificed and blood sample collected for haematological analysis. The haematological analysis was carried out using Abacus 380. **Results:** The WBC increased significantly ($p<0.05$) in all the test groups compared to the control. The RBC, Hb, HCT and MCHC increased non-significantly ($p>0.05$) in all the test groups compared to the control. The MCV and MCH reduced non-significantly ($p>0.05$) in groups 2 and 3 and significantly ($p<0.05$) in group 4, but increased non-significantly ($p>0.05$) in group 5 compared to the control. The RDWc reduced non-significantly ($p>0.05$) in groups 2 and 3, but increased non-significantly ($p>0.05$) in groups 4 and 5 compared to the control. The PLT, MPV and PDWc increased non-significantly ($p>0.05$) in all the test groups compared to the control. PCT increased non-significantly ($p>0.05$) in groups 2, 3 and 4, but increased significantly ($p<0.05$) in group 5 compared to the control. **Conclusion:** This study showed that administration of palm kernel oil, olive oil, crude oil and honey supports the synthesis of haemoglobin, PCV, platelets and RBC, but also showed evidence of toxicity as indicated by increased WBC count.

Key words: Crude oil, haematological effects, honey, palm kernel oil, olive oil

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Several chemical substances are used in traditional medicine for the treatment of different ailments, while some, such as; palm kernel oil, olive oil, crude oil and honey are also used as antidote of poison.

Palm kernel oil is a fat[1] extracted industrially as a yellow coloured liquid from the kernel of the tropical palm tree (*Elaeis guineensis*) using mechanical press[2] or with solvents like n-hexane[3]. The oil is also extracted traditionally as a dirty brown liquid by heating palm kernels in frying pan[1,2,4] over firewood flames. The traditionally extracted palm kernel oil can be mixed with herbs for the treatment of febrile seizures, infections and also used as liniment for indolent tumours in folklore medicine[1]. The atherogenicity of palm kernel oil containing diet has been reported by Ibegbulem and Chikezie[5]. It increased the serum concentrations of Low Density Lipoprotein (LDL) and decreased serum High Density Lipoprotein (HDL) levels, thereby increasing the total cholesterol/HDL and LDL/HDL ratios[1]. Ibegbulem[1] also reported that palm kernel oil treated diets did not significantly affect haematological indices when administered to albino rats.

Olive oil is gotten from the fruit of olive tree. Olives are a traditional crop of the Mediterranean region. Olive oil is known to be rich in monounsaturated fat and antioxidants like carotenoids and vitamin E. It has been reported to prevent the LDL cholesterol from oxidizing. It is the oxidized cholesterol that sticks to the walls of the arteries and forms plaque[6,7]. The nutritional and medicinal importance of olive leaves, fruit and its oil have been exploited in several households long ago[8]. The consumption of the fruits and liquid extractions of olive tree was evident in the copper age (6th millennium BC) and in the 8th and 9th century BC, the oil was used for food as well as to take care of burnt skin, dermatitis, stomach and intestinal problems[9]. Several studies have implicated the consumption of olive oil in decreasing the risk of malignant neoplasms, especially cancers of breast, stomach, ovary, colon and endometrium[10] as well as prevention of cardiovascular and thrombotic diseases[11].

Crude oil also known as petroleum is a complex mixture of hydrocarbon which can exist in several forms such as; aliphatic, alicyclic and aromatic compounds. Most of these compounds when exposed to at a given lethal dose are known to be toxic to different biomass in the ecosystem[12-13]. It is well known to inflict several deleterious impacts on humans, other animals, plants and micro-organisms. Despite its acclaimed toxic effects, many people use crude oil in traditional medicine for the treatment of various ill-healths.

Honey is widely used for both nutritional and medicinal purposes. It has been proven to be rich in both enzymatic and non-enzymatic antioxidants such as; catalase, flavonoids and other polyphenols, as well as vitamins such as thiamine, riboflavin, pyridoxine, pantothenic acid, ascorbic acid and nicotinic acid[14-16].

These four chemical substances are commonly used in traditional medicine, especially, in Nigeria. Therefore, this study investigated the haematological effects of palm kernel oil, olive oil, crude oil and honey in male albino rats

MATERIALS AND METHODS

Duration of study: This study was carried out from February-July, 2019, at Federal University Wukari, Nigeria.

Chemical substances used: Crude oil was obtained in Port Harcourt, Nigeria. The olive oil was purchased in Wukari, Nigeria. Honey was obtained in Kurmi L.G.A. of Taraba State, Nigeria, while palm kernel oil was obtained in Umuahia, Nigeria.

Experimental animals: Thirty healthy male albino rats of 7 weeks of age were used in this study. The animals were purchased and kept at the animal house, Department of Biochemistry, Federal University Wukari, Nigeria. All the rats were allowed access to water and feed *ad libitum* throughout the period of the experiment.

Experimental design: The method of Imo *et al.*[17] was used. The animals were randomly placed into five groups of six animals each. Group 1 animals served as normal control (they were administered a placebo of normal saline), while animals in groups 2, 3, 4 and 5 served as test animals. Animals in group 2, 3, 4 and 5 received palm kernel oil (5 mL kg^{-1} b.wt.), olive oil (5 mL kg^{-1} b.wt.), crude oil (5 mL kg^{-1} b.wt.) and honey (5 mL kg^{-1} b.wt.), respectively for 21 days. The animals received the corresponding chemical substance once daily through oral route.

Blood collection: Following administration of the chemical substances to the test animals, all the animals were starved overnight, anaesthetized with chloroform and sacrificed by cervical dislocation. Blood samples were collected from each animal through cardiac puncture using a hypodermic syringe and dispensed into sample tubes containing an anti-coagulant.

Haematological analysis: The levels of WBC count, LYM, MID, GRA, RBC count, Hb, PCV, MCV, MCH, MCHC, RDWc, PLT, PCT, MPV and PDWc were determined using haematological auto-analyzer (Abacus 380).

Statistical analysis: The biochemical results were analyzed statistically with the use of One-Way Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS) version 21. The means were compared for significance at $p \leq 0.05$ and the group results were presented as mean±SD (n = 6).

RESULTS

The WBC increased significantly (p<0.05) in all the test groups compared to the control. The LYM reduced non-significantly (p>0.05) in groups 2 and 5, but increased non-significantly (p>0.05) in groups 3 and 4 compared to the control. The MID reduced non-significantly (p>0.05) in groups 2 and 4, but increased non-significantly (p>0.05) in groups 3 and 5 compared to the control. The GRA increased significantly (p<0.05) in group 2, but reduced non-significantly (p>0.05) in groups 3, 4 and 5 compared to the control (Table 1).

Red Blood Cell (RBC), Hb, HCT and MCHC increased non-significantly (p>0.05) in all the test groups compared to the control. The MCV and MCH reduced non-significantly (p>0.05) in groups 2 and 3 and significantly (p<0.05) in group 4, but increased non-significantly (p>0.05) in group 5 compared to the control. The RDWc reduced non-significantly (p>0.05) in groups 2 and 3, but increased non-significantly (p>0.05) in groups 4 and 5 compared to the control (Table 2).

The PLT, MPV and PDWc increased non-significantly (p>0.05) in all the test groups compared to the control. The PCT increased non-significantly (p>0.05) in groups 2, 3 and 4, but increased significantly (p<0.05) in group 5 compared to the control (Table 3).

Table 1: Concentration of white blood cells in rats administered palm kernel oil, olive oil, crude oil and honey

Parameters	Group 1 (Normal control)	Group 2 (Palm kernel oil: 5 mL kg^{-1} b.wt.)	Group 3 (Olive oil : 5 mL kg^{-1} b.wt.)	Group 4 (Crude oil : 5 mL kg^{-1} b.wt.)	Group 5 (Honey : 5 mL kg^{-1} b.wt.)
WBC (×10^9 L^{-1})	3.38±0.83^a	9.24±0.62^b	8.37±0.38^b	10.16±1.32^b	8.62±2.20^b
LYM (%)	66.40±3.06^a	56.97±3.42^a	67.80±4.07^a	68.83±7.55^a	59.57±16.20^a
MID (%)	11.87±1.46^a	10.47±4.83^a	14.40±3.84^a	11.17±2.87^a	12.90±0.60^a
GRA (%)	21.76±1.72^a	32.57±3.35^b	17.87±7.92^a	20.00±5.97^a	17.53±2.44^a

Result represent mean±standard deviation of group result obtained (n = 6), mean in the same row having different letters of the alphabet are statistically significant at (p<0.05), WBC: White blood cell, LYM: Lymphocyte, MID: Mid-size cells, GRA: Granulocyte

Table 2: Concentration of selected haematological parameters in rats administered palm kernel oil, olive oil, crude oil and honey

Parameters	Group 1 (Normal control)	Group 2 (Palm kernel oil: 5 mL kg^{-1} b.wt.)	Group 3 (Olive oil : 5 mL kg^{-1} b.wt.)	Group 4 (Crude oil : 5 mL kg^{-1} b.wt.)	Group 5 (Honey : 5 mL kg^{-1} b.wt.)
RBC (10^{12} L^{-1})	7.24±0.32^a	8.71±1.56^a	8.30±0.58^a	8.19±1.51^a	8.04±0.44^a
Hb (g dL^{-1})	12.53±0.35^a	14.70±2.00^a	14.30±0.98^a	13.37±2.24^a	14.27±0.91^a
HCT (%)	39.02±2.06^a	45.50±7.12^a	44.18±2.91^a	41.31±6.79^a	44.08±3.50^a
MCV (fl)	53.67±0.58^a	52.33±1.15^{a,b}	53.00±1.00^{a,b}	50.67±2.31^b	54.66±1.15^a
MCH (pg)	17.33±0.29^a	16.93±0.72^{a,b}	17.27±0.45^a	16.33±0.46^b	17.73±0.15^a
MCHC (g dL^{-1})	32.13±0.90^a	32.37±0.66^a	32.40±0.50^a	32.30±0.66^a	32.37±0.50^a
RDWc (%)	21.46±0.91^{a,b}	20.13±1.19^a	21.13±0.55^{a,b}	22.57±1.82^b	21.57±0.21^{a,b}

Result represent mean±standard deviation of group result obtained (n = 6), mean in the same row, having different letters of the alphabet are statistically significant at (p<0.05), RBC: Red blood cell, Hb: Haemoglobin, HCT: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular haemoglobin, MCHC: Mean corpuscular haemoglobin concentration, RDWc: Red blood cell distribution width count

Table 3: Concentration of platelets in rats administered palm kernel oil, olive oil, crude oil and honey

Parameters	Group 1 (Normal control)	Group 2 (Palm kernel oil: 5 mL kg^{-1} b.wt.)	Group 3 (Olive oil : 5 mL kg^{-1} b.wt.)	Group 4 (Crude oil : 5 mL kg^{-1} b.wt.)	Group 5 (Honey : 5 mL kg^{-1} b.wt.)
PLT (10^9 L^{-1})	293.33±21.36^a	432.33±49.07^a	427.32±98.33^a	350.67±36.66^a	444.00±42.00^a
PCT (%)	0.23±0.03^a	0.32±0.05^{a,b}	0.33±0.13^{a,b}	0.29±0.01^{a,b}	0.37±0.05^b
MPV (fl)	7.53±0.55^a	7.60±0.44^a	7.77±0.15^a	8.03±0.95^a	8.00±0.46^a
PDWc (%)	34.33±2.25^a	35.40±2.71^a	34.93±1.10^a	36.47±2.00^a	34.67±0.76^a

Result represent mean±standard deviation of group result obtained (n = 6), mean in the same row, having different letters of the alphabet are statistically significant at (p<0.05), PLT: Platelet, PCT: Plateletcrit, MPV: Mean platelet volume, PDWc: Platelet distribution width count

DISCUSSION

Haematological investigation provides essential information on the entire pathophysiology of the blood and reticuloendothelial system[18]. Administration of honey, palm kernel oil, olive oil and crude oil significantly ($p<0.05$) increased WBCs count as compared to the normal rats. On a contrast, none of the chemicals did significantly ($p<0.05$) affect the other haematological parameters negatively, including the RBC, HB and PLT as compared to the normal rats which may be an indication of absence of any form of haemolysis.

The WBC is a defensive mechanism that fights against foreign bodies that could possibly initiate deleterious effects on the tissues. Most often, upon detection of such foreign materials, the immune response is triggered, leading to an increase proliferation of these cells in order to combat or mop up the actions of such xenobiotic. The significant rise in WBC count in this study may be a case of immune response to the presence of these chemical substances by the body's immune system in order to neutralise the potential damaging effects of these chemical antigens[19]. Similarly, known harmful chemicals such as; carbon tetrachloride and diethylnitrosamine have been recorded to increase WBC counts in rats at minimal exposure but however, they tend to deplete the level of WBC after chronic exposure. Yakubu *et al.*[20] reported that diethylnitrosamine significantly raised the level of WBC in rats after an acute exposure while Famurewa *et al.*[21] revealed such effect on white blood cells using carbon tetrachloride. On a contrary, these chemical agents may not necessarily have been intended to cause destructive effects to the tissue but probably serve as means of triggering immune response pathways that could be useful in terms of body response to harmful agents and hence, they could be administered to an organism to boost the immune signalling pathways in times of dangerous infections or infiltrations of harmful chemical substances to support the body in mobilising some immune molecules to effectively fight them.

The effect of administration of the chemical substances used in this study on the RBC, HB and PLT as compared to the normal rats is not statistically significant ($p>0.05$). However, reports are available on certain substances such as alcohol, carbon tetrachloride and diethylnitrosamine tendencies to especially reduce the concentrations of these parameters. Igboh *et al.*[22] ascribed the decline in such indices to the generation of reactive oxygen species, through the microsomal metabolism by cytochrome P_{450} whose effects eventually deplete endogenous antioxidants and cause fragility of blood cells, thereby causing characteristic destruction of the cells. It can then be possibly hypothesised that, the non-significant impact of these chemical substances on RBC, HB and PLT could be probably that they were not in their lethal doses to have caused oxidative damage or that the increase in the WBC combined with the effect of endogenous antioxidant enzymes such as superoxide dismutase and catalase would have mopped up the oxidative stress generated and hence no significant alteration in those parameters was recorded.

Similarly, other parameters such as; LYM, MID, HCT, MCHC, MPV and PDWc were not significantly altered by the administered chemical substances in the test animals except for MCV and MCH values that were significantly lowered in the group that was administered crude oil as compared to the normal rats. The non-significant alteration of the RDWc in the test animals when compared with the normal control showed that none of the chemical substances induced anisocytosis in the animals. This non-significant ($p>0.05$) increase in RDWc also implies that the size of red blood cells is normal in the test animals which corroborates the results of haemoglobin and red blood cell counts that were not significantly ($p>0.05$) altered by these chemical substances in the experimental animals. Meanwhile, elevated erythrocyte mean cell distribution width count (RDWc) has been previously implicated in anisocytosis by Das and Vasudevan[23], however, the present study did not record significant rise in RDWc and hence, there was no case of anisocytosis in the test animals. Administration of these substances showed the potency of stimulating the production of platelets, hence, may not induce thrombocytopenia in animals. Thrombocytopenia has been reported by Golwala *et al.*[24] to predict mortality. Furthermore, the result of MPV in the test animals when compared to the normal control implies that the blood platelet counts of the test animals were not lower than those of the normal animals and thus, correlates with the result of PLT.

CONCLUSION

This study showed that administration of palm kernel oil, olive oil, crude oil and honey in the animals supported the synthesis of parameters such as hemoglobin, PCV, platelets and RBC, but also showed evidence that the chemical substances may induce toxicity as indicated by the increased WBC count. Crude oil induced higher toxicity when compared to the other chemical substances used.

SIGNIFICANCE STATEMENT

These four chemical substances are commonly used in traditional medicine, especially, in Nigeria. It is therefore necessary in this study to investigate the haematological effects of palm kernel oil, olive oil, crude oil and honey in male albino rats. This will give information on the possible haematological effects of these substances in human.

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