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Comparative Benefits of *Cocos nucifera* L. Husk, Milk and Shell Extracts on Body Weight Changes and Haematological Indices in Male Rats

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ABSTRACT

Medicinal plants are often used in treating life threatening ailments, hence we compared the beneficial effect of *Cocos nucifera* L. husk, milk and shell extracts on body weight and haematology indices in male Albino rats. Aqueous extraction of coconut husks (maceration apparatus), milk (spray drying process), and shell (rotary evaporator) was conducted. Sixty-five (65) rats were grouped into A to L (n=5) per cage and (M) as control. Rats adapted to the sanitized animal room condition for 7 days while adequate water and pelletized rat feeds were provided. Groups: (A, E, and I received 250mg/kg); (B, F and J = 500 mg/kg); (C, G, and K =750mg/kg); and (D, H, and L = 1000 mg/kg b.w.) of husk, flesh (milk) and shell extracts respectively. Group M received distilled water while groups (A to L) were orally gavaged daily for 30 days with graded doses. Physical activities, body weight changes and daily dietary intakes were recorded. Blood samples were collected for haematology analyses before, during and after treatment and analysed with an automatic hematology analyzer. Coconut husk and shell extracts showed remarkable body weight changes with reduced feeds consumption and increased physical activities. Coconut husks and milk improved haematology indices (WBC, RBC, PCV, Hb and platelets). Before experimentation neutrophils count was particularly higher in treated groups: 59.23±0.62%; 60.0±1.22%; 60.3±0.67%; 60.6±2.74% than controls (49.4±1.59%) but reduced markedly after experimentation (50.1±0.58%, 49.7±1.56%; 48.3±0.38%; 49.5±1.75%). Coconut husk and shell extracts facilitated body weight changes while milk and husk supported haematology indices in this study.

Keywords: *Cocos nucifera,* Haematopoesis, Haematology indices, Weight management.

Introduction

Cocos nucifera (Linn.) is from the family Arecaceae known as coconut, coco, coco-da-bahia, or coconut-of-the-shoreline and is ordinarily a widespread organic product known to man.[1] *Cocos nucifera* is called Kwakwa in Hausa, Agbon in Yoruba, Aki in Igbo and famously known as coconut in English. The term coconut can allude to the entire coconut palm or the seed, or the natural products, which, organically, is a drupe, not a nut.[2] Coconut is composed of an external epicarp, a mesocarp, an internal endocarp, embryo and endosperm.[3] The epicarp is the external skin, the mesocarp is sinewy and tanned when dry (husks), the endocarp is the hard dim center (shell), and embryo is the whitish edible substance housing the endosperm, which is the sweet slightly acidic water.[4] Coconut husk is full of long, coarse fibres, all running in one direction and embedded in coir dust-like matrix of material.[5] The husks absorb and retain water due to their porous nature consisting of cellulose, lignin, pyroligneous acid, gas, charcoal, tar, tannin, and potassium, while the coconut dust content is rich in lignin and cellulose.[5] Coconut milk, on the other hand, contained a high amount of protein, and amino acids as glutamine, arginine, lysine, leucine and proline.[6] It also contains water, sugars as lactose, fats, nutrients in form of ascorbic acid, nicotinic acid and biotin pantothenic acid including minerals as nitrogen, calcium, iron and phosphorus.[6] Coconut shell contains about eleven compounds including dodecanoic acid, tetradecanoic acid, pentadecanoic acid, hexadecanoic acid and squalene.[7] Coconut shell also possesses anti-hyperglycemic and anti-hyperlipidemic effects in animals.[8]

Medicinal plants are increasingly being used in most parts of the world to treat varying diseases and medical complications.[9] Plants in medicine have been investigated for the treatment of common and uncommon diseases but are yet to explore natural medicine treatment for hematology related conditions. As far as we know, there exist a few documented traditional treatments for blood related disorders; the trio components have industrial, commercial, household and agricultural uses[5] but not so much is known in health apart from the milk content.[1] The impacts particularly on body weight have not been fully examined if at all there is any. Coconut husk, milk and shell derived from the mesocarp, endosperm and endocarp may not have been attributed to any medicinal values with scientific proofs.[3-5] There are literatures relating to the usefulness of coconut milk, while coconut shell and husks are of less importance to native users.[5, 6, 7] Coconut fibre and shell have several economic importance in other sectors while, their medicinal values are yet to be harness as much as we are aware.[8] Our aim therefore, was to compare the beneficial effects of husk, milk and shell extracts derived from native coconut palm fruit on body weight changes and haematological indices in rats.

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Materials and Methods

Plant materials
Five (5) fully developed coconut palm fruits were purchased from new Benin market in Benin City, Nigeria. The crops were identified and authenticated by a botanist in the Department of Plant Biology and Biotechnology, University of Benin, Nigeria. Voucher number (UBH_C418) was assigned and samples deposited at the departmental herbarium for future references.

Preparation of extracts
Experiment I: dried coconut husks weighing 1.2 kg were pulverized uniformly with an electric blender (Kenwood 1.6L, BL480 Prestons, Australia) for 7 minutes. Grounding was repeated on the coarse and rough blend until a fine uniform powder was achieved. It was soaked in maceration apparatus (*Sam teck* Extrakions Technik GmbH, Austria) at 39^{o}C with 1 L of water for 24 h. The macerate was filtered with a Whatman® Grade 1 filter paper and left to settle after filtration, supernatant decanted, and oven-dried at 50°C to obtain a brownish paste.

Experiment II: Coconut mesocarp was pealed-off while the nuts were removed and water content discarded. The palm fruit was then grated using a stainless steel grater to obtain the shredded coconut, which was uniformly blended as described earlier with 750 ml of water to reduce friction. It was then heated to 65^{o}C and the residues filtered to obtain a solution. The milk was boiled for 20 minutes while the curd was scooped to remove the coconut oil. The coconut milk was later cooled to room temperature and was passed through the spray drying process (TP-S30 Mini Spray Dryer, SiccaDania, China) to obtain a hardened skimmed milk powder.

Experiment III: Coconut hard shell weighing 1.96 kg was crushed and pulverized into uniform powder using the coconut shell powder making machine TW-IP-12 (Shanghai Yuke Industrial Co., Ltd.). The powderred shell was soaked in a liter of water, mixed vigorously with the GFL shaker (Fisher Scientific Sweder, Switzerland) for 24 h. The watery concentrate was sieved with a Buchner channel and Whatman® Grade 1 filter paper. The filtrate was then evaporated to dryness under reduced temperature and pressure using Rotary evaporator (Heidolph, Schwabach, Germany). The brownish extract was stored in an air-tight container and kept in the refrigerator at 4°C until it was needed.

Experimental animals
Sixty-five (65) Albino male rats with mean weight (199 ± 1.24 g), ranged (164 g to 234.5 g), and about 3-5 months old were obtained from the University of Nigeria Teaching Hospital (old site) animal facility. Since we are more interested in body weight changes and haematological indices in rats, it is advisable to use male rats alone as the females may undergo physiological changes before and or during the experiment, which may alter our result unknowingly. Animals were restrained in clean metallic gauze cages with saw-dust beddings in a ventilated room with optimum condition of temperature 25 ± 5°C, humidity 45-50% and photoperiod 12:12 hour light/dark cycle. The animals adapted to the room condition for 7 days prior to the experiment. Rats were selected into three experimental parts (1 to III) with 4 groups each (A to D; E to H; I to L) of n = 5 rats per cage and another group M, which served as the control. Animals were fed with rat chow having a standard composition and adequate water provision in a sanitized environment. All conditions for maintaining laboratory animals were the same for all groups throughout the experiment. Approval was obtained from the ethics committee, College of Medicine, University of Nigeria, Enugu campus with protocol number: COMREC 032/02/2017. The study complied fully with policies outlined in the guide for the care and use of laboratory animals.[10]

Experimental design
Prior to experimentation, acute toxicity (LD_{50}) study of coconut husk, milk and shell were conducted in accordance with the modified Lorke's method.[11] Graded doses (500, 1000 and 2000 mg/kg b.w.) were administered daily for 3 months. The three components were found to be non-lethal with a wide safety margin. Control group (M) received distilled water only while treated groups (A to L) received graded doses in mg/kg body weight (b.w.): 250 mg/kg b.w., 500 mg/kg b.w., 750 mg/kg b.w. and 1000 mg/kg b.w. of *C. nucifera* husk, milk and shell extracts. All substances were administered once daily for 30 days by Oro-gastric tube. The study was divided into three phases (Experiment I to III) representing extract of coconut husk, milk and shell. Empirical measurements with the standard electronic balance (Gilbertini, Italy; sensitivity = 0.001 g) were recorded before and after treatment in g, while food consumption per day was measured and calculated in g/day. Physical activities like restlessness, dullness and anxiety were monitored few hours after treatment on daily basis. Blood sample was collected from the marginal ear vein of each rat using a 2 ml needle and syringe before and during treatment. At termination of experimental procedures, blood was collected via cardiac puncture after sacrificing the animals by cervical dislocation. Blood was immediately dispensed aseptically into EDTA test tubes and transported to the laboratory where haematology indices were analyzed.

Haematological analysis
Blood samples were analyzed using an automatic hematological analyzer (CELL-DYN3700, Abbott Laboratories, Santa Clara, CA, USA). The indices evaluated were: red blood cell (RBC) counts, hemoglobin (HB), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), platelets count and white blood cell (WBC) count and differential leukocyte.

Statistical analysis
Statistical analysis was performed using IBM SPSS version 20. Data were analyzed utilizing One-way analysis of variance (ANOVA) and result presented as means ± SEM (standard error of mean). Mean difference was considered significant at p-value less than 0.05 ($p < 0.05$). Tukey,s post-hoc was used where the assumption of homogeneous of variance was assumed for pairwise comparison between groups. Values with the same superscript were not statistically significantly different while the values with difference in superscript were considered significantly different at p-value less than 0.05.

Results and Discussion

Experiment I (coconut husk) showed a remarkable loss in body weight (8.69 ± 1.7 g↓↓) of animals treated with 1000 mg/kg b.w. while 750 mg/kg b.w. treated rats (4.72 ± 1.4 g↓) were moderate. However, negligible weight losses (0.93 ± 0.2 g↓ and 0.58 ± 0.1 g↓) were observed in low doses (250 mg/kg b.w. and 500 mg/kg b.w.) treated rats. Differences in weight loss reflected in the amount of food consumed (250 mg/kg b.w. = 23.4 ± 6.6 g ; 500 mg/kg b.w. = 21.2 ± 7.7 g; 750 mg/kg b.w. = 19.2 ± 5.1 g and 1000 mg/kg b.w. = 18.9 ± 8.6 g) per day by animals. Irrespective of reduced cravenness for food, activities were observed in rats treated with 500 mg/kg b.w. to 1000 mg/kg b.w. except for animals administered 250 mg/kg b.w. of extract (Table 1).
Experiment II (coconut milk) indicated a negligible loss in body weight (0.78 ± 0.2 g↓) in the 500 mg/kg b.w. treatment to experimental rats. Loss in weight differences (2.29 ± 0.6 g↓ and 2.61 ± 1.1 g↓) were observed in high dose treated rats (750 mg/kg b.w. and 1000 mg/kg b.w.) and a slight gain (1.03 ± 0.4 g↑) in animals on low dose (250 mg/kg b.w.) compared to the control (4.91 ± 1.3 g↑↑). This result corresponded with the amount of food consumed by the rats (250 mg/kg b.w. = 21.3 ± 3.3 g; 500 mg/kg b.w. = 20.1 ± 3.1 g; 750 mg/kg b.w. = 19.8 ± 2.7 g and 1000 mg/kg b.w. = 20.6 ± 1.9 g) according to the dosage administered compared to the control (22.8 ± 2.5 g). The level of physical activities by the rats increased according to increment in the administered dosages (Table 1).
Experiment III (coconut shell) revealed that there was a slight drop in body weight in rats treated with 500 mg/kg b.w. (1.62 ± 0.3 g↓) and

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750 mg/kg b.w. (2.19±0.5 g↓), and a remarkable weight loss in animals treated with 1000 mg/kg b.w. (8.57 ± 1.5g↓↓) of *C. nucifera* shell extracts. However, the low dose treated animals showed a negligible weight loss (0.64±0.8 g↓). The amount of food consumed per day dropped as doses increases, while physical activities were moderate in all treated rats (Table 1).

Prolonged consumption of coconut husk extracts (fibre) in our study is presumed to regulate weight in rats considering the differences in weight prior to treatment and thereafter, which is suspected to be dose-related. This finding is in consonance with the report of Emojevwe,[5] in which *C. nucifera* extract was administered to diabetic rats and noticed gross decreases in weight of experimental animals. The reduction was attributed to high release of glucose far beyond expectation consequent to the breakdown and fast conversion of stored fats in tissue to glucose in order to compensate for the rapid energy utilized thus resulting to reduced body weight. Association between glucose utilization and weight loss was not substantiated in our study, and the explanation that Emojevwe[5] gave was not fully elucidated. Nonetheless, coconut husk is rich in fibre; and we are aware that fibre containing diets helps to ease digestion and prevents accumulation of fats in the system. Therefore, we suggest that the fibre contained in coconut husks may be partly responsible for the loss in body weight that has been observed in this study. This study disagree with Coasta *et al.*[12] who observed a significant increase (185.0±5.09 g to 213.33 ± 5.58 g) in body weights of animals treated with green coconut husks fibre decoction for 30 days. We suggest that the disparity may result from the extraction solvent going by the negligible results (204.80 ± 4.41g to 211.30 ± 4.28 g) obtained for butanol extracts compared to controls (217.40 ± 5.59 g to 222.50 ± 5.59 g) from the same authors. Note that aqueous solvent was used for extraction in our study while the former (Coasta *et al.*[12]) utilized butanol and decoction. Again, we used brown coconut compared to the green coconut species that was used by the former,[12] which may be the reasons for the disparity. In the past, differences in plant species have been reported to play vital roles in experimental studies involving plant derivatives.[13]

In the present study, coconut flesh extract (milk) was observed to have remarkable increases in body weight of rats when consumed in high doses for a long duration, and so, does not support consistent use for managing weight loss. We suggest that *C. nucifera* milk extract also has effect on appetite as demonstrated in the amount of daily food consumption by the animals. This is in agreement with the report of Nwangwa,[14] in which increased weight was observed in group V (184 ± 3.70 g) animals fed with coconut milk for 28 days while the resultant effect was insufficient to establish any significance in body weight changes. Our finding contradicts the report of Loperito and Rajamohan,[15] where it was reported that coconut milk further reduced the weight of diabetic rats rather than improving it. Weight loss in diabetic rats may be due to increased catabolism, while a gain in body weight may experience decrease in catabolic activities.[16] Weight loss has been well acknowledged as a clinical feature of diabetes mellitus, which may result from degeneration of adipocytes and muscle tissues to produce energy in addition to excessive conversion of glycogen to glucose.[17,18] It has also been reported that an animal's body mass may be used to monitor and assess the toxicity of any substance, which is a vital indicator in toxicity study.[19] Lack of statistical difference in weights of treated groups in comparison to controls is an indicant to buttress that coconut milk extract is non-injurious to humans.[12] In another development, Prakash *et al.*[20] reported that ceric sulphate treated rats significantly decreased the bodyweight of experimental rats compared to controls. The action was attenuated upon administration of coconut milk extract in a large quantity. It was suggested that the reversal action was due to anabolic effects evidenced by increased body weight, which was made possible by means of steroid and saponins content in the extract including testosterone intervention.[21] In our own opinion, a low dose of *C. nucifera* milk is better used in maintaining weight rather than high doses and is thought to be dose and duration-dependent. Low doses of coconut shell extract did not show remarkable reductions in body weights of experimental rats compared to the high dose (8.57±1.5 g↓↓). This study suggests that low doses may not be useful in managing body weight changes while high doses may be beneficial. The ability for coconut shell extract to reduce or affect body weight may be due to its conversion to activated charcoal after applying heat during the extraction process. Activated charcoal is widely used to neutralize poisons or overdose in orthodox medicine. On the other hand, if consumed too frequently for a long duration, the body may become malnourished because it may prevent absorption of minerals, micronutrients and vitamins needed for growth.[22] In addition; activated charcoal attaches to chemicals in the body thereby preventing absorption of those chemical substances into cells and tissues and as such acts as detoxifying agents. Prakash *et al.*[20] reported that coconut shell is naturally rich in polyphenols, which is the leading sources of antioxidant and have been the best detoxification process known to science. Data obtained for haematological indices: RBC, Hb, PCV and Platelets all increased while, WBC counts reduced in experiment I (husk) and were statistically significant ($P \leq 0.05$) during and after treatment compared to controls and the results before treatment (Table 2, Table 3 and Table 4).

In experiment II (milk), RBC, Hb, PCV and Platelets were expressed significantly ($P \leq 0.05$) with increments during and after treatment excluding WBC, which showed initial rise prior to the experiment and decreased thereafter. This effect was particularly demonstrated in neutrophils prior to treatment regimen but reduced during and after the experiment ended (Table 5, Table 6 and Table 7).

Table 1: Empirical Measurements and Physical Activities in Experimental Rats

Groups	Conc. (mg/kg)	Doses (mL)	Initial Average Weight (g)	Final Average Weight (g)	Difference in Weights (g)	Food intake in g/day	Physical Activities
A	250	0.5	191.36 ± 1.4	192.21 ± 3.1	0.85 ± 0.2↑	23.4 ± 6.6	±
B	500	1	203.31 ± 1.6	202.73 ± 2.6	0.58 ± 0.1↓	21.2 ± 7.7	+
C	750	1.5	221.28 ± 2.3	216.56 ± 4.2	4.72 ± 1.4↓	19.2 ± 5.1	+
D	1000	2	234.33 ± 3.7	225.64 ± 3.6	8.69 ± 1.7↓↓	18.9 ± 8.6	+
E	250	0.5	189.74 ± 2.6	190.29 ± 5.3	0.55 ± 0.4↑	21.3 ± 3.3	+
F	500	1	202.21 ± 0.4	201.37 ± 6.2	0.84 ± 0.2↓	20.1 ± 2.2	++
G	750	1.5	222.52 ± 1.7	225.16 ± 5.2	2.64 ± 0.6↑	19.4 ± 1.9	++
H	1000	2	234.66 ± 2.9	239.08 ± 3.8	4.42 ± 1.1↑	21.1 ± 0.3	++
I	250	0.5	190.49 ± 3.4	191.13 ± 6.2	0.64 ± 0.8↓	23.5 ± 4.6	+
J	500	1	200.76 ± 4.7	199.14 ± 5.5	1.62 ± 0.3↓	20.2 ± 9.3	++
K	750	1.5	222.11 ± 2.6	219.92 ± 1.7	2.19 ± 0.5↓	20.6 ± 3.2	++
L	1000	2	235.36 ± 9.4	226.79 ± 6.3	8.57 ± 1.5↓↓	21.7 ± 1.3	+
M	0	0	166.72 ± 2.8	171.75 ± 0.5	4.91 ± 1.3↑	24.6 ± 2.1	±

All values are expressed as mean ± standard error of the mean, while distilled water (0 mg/kg) served as the control. Negligible (±); present (+);

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Experiment III (shell), however, indicated that differences in major parameters (RBC, WBC, PCV and Platelets) were not sufficient to establish significance in values ($P \geq 0.05$) during and after investigations compared to results before treatment. This excluded haemoglobin ($P \leq 0.05$), which had a consistent increment that was compatible with normal values (Table 8, Table 9 and Table 10). Effect of husks extract on haematological parameters showed that the values: WBC, RBC, PCV, Hb and platelets were regulated; looking at the results during and after protracted treatments in rats compared to initial results before extract administration as well as the controls (Table 2 - Table 4). This finding corroborates the report of Costa *et al.*[12] wherein coconut husks extracts was not injurious to circulating blood cells. In another development following treatment with coconut milk; the effect on full blood count was suggestive of the regulatory roles of *C. nucifera* milk on hematological parameters. It has been reported that haematology investigations provide information on the general state of blood including the reticulendothelial system.[23] Our study is consistent with the findings of Abdul-Rahman *et al.*[24]; in which white blood cell (WBC) counts were significantly increased during the experimental process especially neutrophils. In the present study, coconut milk showed counts of neutrophils higher in all groups: 59.23 ± 0.62%; 60.0±1.22%; 60.3±0.67%; 60.6 ± 2.74%than untreated rats (49.4 ± 1.59%) before experimentation. They were however reduced during (57.6 ± 1.98%; 58.2 ± 1.38%; 59.2 ± 0.46%; 59.0±0.21%) and after experimentation (50.1 ± 0.58%, 49.7 ± 1.56%; 48.3 ± 0.38%; 49.5 ± 1.75%) in comparison to controls (48.1 ± 1.47%; 49.6 ± 1.73%), which is a possible indication of immunomodulatory activity of the crop.[12] The reason for the increase in neutrophils in all treated animals has not been fully understood. We suggest that animals may have been infected before experimentation, and was observed across all treatment groups excluding the controls, which calls for concerns. However, neutrophil counts were mildly reduced during treatment and fully at the end of the experiment (Table 5 - Table 7). Neutrophils are known to be the primary white blood cells that respond to bacterial infections in particular. Hence, the present study corroborates the claim that *C. nucifera* milk has antibacterial properties[22] going by the inhibitory action of coconut milk on neutrophil counts at the end of the experiment. The present study suggests that coconut shell may have increasing effects on haemoglobin levels when consumed in large proportion for a long duration (Table 8 - Table 10). This claim has no substantial backings at the moment; as there are no studies as far as we know either in support or against our line of thought. We suggest that further research on the health benefits of coconut shell be looked into by researchers.

Table 2: Full Blood Counts in Experimental Rats before Administration of *C. nucifera* Husks Extract

Parameters	Group M	Group A	Group B	Group C	Group D	P-value
PCV (%)	35.1 ± 0.52	36.0 ± 0.62	36.0 ± 0.72	35.0 ± 0.46	36.2 ± 0.99	0.102
WBC (x 10^3cells/µL)	7011 ± 17.56	7113 ± 7.67	7334 ± 7.68	7896 ± 7.69	8295 ± 7.68	0.314
N%	49.4 ± 1.59	48.8 ± 1.34	49.7 ± 0.99	48.9 ± 0.79	48.3 ± 0.79	0.125
L%	40.1 ± 1.40	39.6 ± 1.40	40.3 ± 1.50	38.9 ± 1.70	42.4 ± 1.51	0.101
M%	6.5 ± 0.51	6.2 ± 0.61	5.6 ± 0.71	6.2 ± 0.81	5.3 ± 0.91	0.104
E%	3.2 ± 0.22	4.1 ± 0.63	3.6 ± 0.66	4.9 ± 0.54	3.1 ± 0.90	0.112
B%	0.8 ± 0.21	0.9 ± 0.22	0.8 ± 0.31	1.1 ± 0.13	0.9 ± 0.21	0.119
RBC (x 10^6cells/µL)	7.11 ± 0.54	6.96 ± 0.75	7.13 ± 0.31	7.09 ± 0.11	7.27 ± 0.68	0.101
Hb (g/dL)	12.3 ± 0.19	12.3 ± 0.62	12.1 ± 0.65	12.4 ± 0.33	12.3 ± 0.81	0.154
HCt (%)	36.11 ± 0.27	37.19 ± 0.25	38.46 ± 0.81	37.66 ± 0.47	39.73 ± 0.66	0.125
MCV (fL)	54.24 ± 0.36	55.53 ± 0.06	54.52 ± 0.86	55.62 ± 0.18	55.88 ± 0.9	0.101
MCHC (g/dL)	36.52 ± 0.32	38.11 ± 0.36	36.73 ± 0.08	37.05 ± 0.15	38.64 ± 0.71	0.104
Plat (x10^3cells/µL)	805.9 ± 62.57	755.7 ± 41.72	805.3 ± 12.56	788.7 ± 36.49	801.6 ± 26.73	0.132

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume

Table 3: Full Blood Counts in Experimental Rats during Administration of *C. nucifera* Husks Extract

Parameters	Group M (0mg/kg b.w.)	Group A (250mg/kg b.w.)	Group B (500mg/kg b.w.)	Group C (750mg/kg b.w.)	Group D (1000mg/kg b.w.)	P-value
PCV (%)	35.3 ± 0.31^a	36.8 ± 0.92^b	37.4 ± 0.50^{bc}	37.8 ± 0.01^{bc}	38.9 ± 1.2^c	0.004
WBC (x 10^3cells/µL)	7009 ± 65.66^a	8833 ± 19.82^b	8782 ± 51.35^{ab}	9023 ± 41.56^c	8995 ± 23.44^{bc}	0.014
N%	48.1 ± 1.47	57.6 ± 1.98	58.2 ± 1.38	59.2 ± 0.46	59.0 ± 0.2	0.262
L%	42.8 ± 1.33^a	36.0 ± 1.82^{bc}	35.1 ± 1.17^b	38.6 ± 1.12^c	36.0 ± 1.17^{bc}	0.011
M%	5.3 ± 0.34^a	3.2 ± 0.19^b	3.4 ± 0.22^{bc}	4.8 ± 0.44^{ab}	2.5 ± 0.33^c	0.001
E%	3.1 ± 0.17^a	2.6 ± 0.25^{ab}	2.6 ± 0.12^{ab}	2.9 ± 0.20^a	2.0 ± 0.11^c	0.002
B%	0.7 ± 0.3^a	0.6 ± 0.11^b	0.7 ± 0.14^c	0.6 ± 0.23^b	0.5 ± 0.21^c	0.003
RBC (x 10^6cells/µL)	6.81 ± 0.11^a	7.54 ± 0.73^{ab}	7.91 ± 0.26^b	8.04 ± 0.17^{bc}	8.79 ± 0.84^c	0.005
Hb (g/dL)	12.9 ± 0.61	13.3 ± 0.38	13.9 ± 0.28	14.0 ± 0.13	14.7 ± 0.36	0.062
HCt (%)	38.53 ± 0.39^a	37.53 ± 0.39^{ab}	38.96 ± 0.59^a	36.47 ± 0.44^b	36.47 ± 0.44^b	0.014
MCV (fL)	55.76 ± 0.85^a	55.76 ± 0.85^a	55.29 ± 0.26^a	55.76 ± 0.85^a	56.26 ± 0.33^b	0.031
MCHC (g/dL)	36.03 ± 0.25	37.23 ± 1.43	37.42 ± 1.78	38.66 ± 1.87	38.68 ± 1.31	0.101
Plat (x10^3cells/µL)	773.6 ± 41.72^a	792.7 ± 73.25^{ab}	838.8 ± 16.34^{bc}	871.5 ± 58.81^c	892.8 ± 62.99^c	0.002

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

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Table 4: Full Blood Counts in Experimental Rats after Administration of *C. nucifera* Husks Extract

Parameters	Group M (0 mg/kg b.w.)	Group A (250 mg/kg b.w.)	Group B (500 mg/kg b.w.)	Group C (750 mg/kg b.w.)	Group D (1000 mg/kg b.w.)	P-value
PCV (%)	35.9 ± 0.19^{a}	35.6 ± 0.51^{a}	37.0 ± 0.31^{ab}	39.7 ± 0.49^{b}	40.5 ± 1.47^{b}	0.003
WBC (x 10^3cells/μL)	7001 ± 42.98^{a}	7910 ± 23.11^{bc}	7622 ± 46.63^{b}	8619 ± 26.87^{c}	7881 ± 39.13^{bc}	0.017
N%	49.6 ± 1.73	50.1 ± 0.58	49.7 ± 1.56	48.3 ± 0.38	49.5 ± 1.75	0.268
L%	39.2 ± 1.69^{a}	39.2 ± 1.57^{a}	40.5 ± 1.71^{ac}	40.2 ± 1.50^{ac}	41.1 ± 1.19^{b}	0.001
M%	5.7 ± 0.24^{a}	5.5 ± 0.50^{ab}	5.7 ± 0.29^{a}	6.3 ± 0.38^{c}	5.6 ± 0.28^{ab}	0.048
E%	4.4 ± 0.95^{a}	4.2 ± 0.10^{ab}	3.2 ± 0.21^{b}	4.1 ± 0.20^{ab}	3.0 ± 0.13^{c}	0.002
B%	1.1 ± 0.31	1.0 ± 0.22	0.9 ± 0.11	1.1 ± 0.11	0.8 ± 0.13	0.144
RBC (x 10^6cells/μL)	6.35 ± 0.53^{a}	7.96 ± 0.33^{b}	8.03 ± 0.72^{b}	8.77 ± 0.58^{bc}	9.21 ± 1.55^{c}	0.005
Hb (g/dL)	13.7 ± 1.46	13.9 ± 0.35	14.6 ± 0.91	15.4 ± 0.16	15.8 ± 0.88	0.053
HCt (%)	40.07 ± 0.52^{b}	37.53 ± 0.39^{a}	39.96 ± 0.59^{ab}	40.17 ± 0.52^{b}	42.26 ± 1.83^{b}	0.017
MCV (fL)	56.99 ± 0.28	58.24 ± 1.63	58.88 ± 1.83	59.42 ± 1.74	58.75 ± 1.24	0.051
MCHC (g/dL)	34.26 ± 1.32^{a}	37.56 ± 1.67^{b}	38.41 ± 1.36^{bc}	37.66 ± 1.53^{b}	38.94 ± 1.13^{c}	0.001
Plat (x10^3cells/μL)	745.4 ± 52.81^{a}	811.3 ± 16.87^{b}	844.1 ± 74.28^{bc}	880.3 ± 17.15^{c}	898.9 ± 26.66^{c}	0.032

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

Table 5: Full Blood Counts in Experimental Rats before Administration of *C. nucifera* Milk Extract

Parameters	Group M	Group E	Group F	Group G	Group H	P-value
	35.1 ± 0.52	35.0 ± 0.42	36.0 ± 0.22	35.1 ± 0.62	35.4 ± 0.02	0.272
WBC (x 10^3cells/μL)	7011 ± 17.56	7111 ± 39.21	7022 ± 41.19	7193 ± 31.12	7048 ± 31.12	0.176
N%	49.4 ± 1.59	59.23 ± 0.62	60.0 ± 1.22	60.3 ± 0.67	60.6 ± 2.74	0.035
L%	40.1 ± 1.40	39.4 ± 0.99	39.7 ± 1.52	40.0 ± 0.45	40.1 ± 1.53	0.301
M%	6.5 ± 0.51	5.5 ± 0.53	5.9 ± 1.29	6.1 ± 0.26	6.4 ± 0.65	0.113
E%	3.2 ± 0.22	3.4 ± 0.01	3.7 ± 0.40	3.8 ± 1.22	4.2 ± 0.27	0.231
B%	0.8 ± 0.21	0.8 ± 0.73	0.8 ± 0.51	0.8 ± 0.61	0.9 ± 0.33	0.347
RBC (x 10^6cells/μL)	7.11 ± 0.54	6.94 ± 0.15	7.05 ± 0.12	7.11 ± 0.22	7.19 ± 0.52	0.101
Hb (g/dL)	12.3 ± 0.19	12.8 ± 0.18	13.0 ± 0.23	13.3 ± 0.42	13.9 ± 0.88	0.291
HCt (%)	36.11 ± 0.27	37.53 ± 0.39	39.62 ± 0.73	37.53 ± 0.39	39.62 ± 0.73	0.125
MCV (fL)	54.24 ± 0.36	55.16 ± 0.15	54.23 ± 0.25	55.76 ± 0.85	54.58 ± 0.84	0.101
MCHC (g/dL)	36.52 ± 0.32	38.00 ± 0.25	36.52 ± 0.32	38.00 ± 0.25	36.52 ± 0.32	0.104
Plat (x10^3cells/μL)	805.9 ± 62.57	754.4 ± 41.32	805.9 ± 79.57	755.6 ± 41.72	805.9 ± 79.57	0.222

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

Table 6: Full Blood Counts in Experimental Rats during Administration of *C. nucifera* Milk Extract

Parameters	Group M (0mg/kg b.w.)	Group E (250mg/kg b.w.)	Group F (500mg/kg b.w.)	Group G (750mg/kg b.w.)	Group H (1000mg/kg b.w.)	P-value
PCV (%)	35.3 ± 0.31^{a}	36.8 ± 0.92^{b}	37.4 ± 0.50^{bc}	37.8 ± 0.01^{bc}	38.9 ± 1.32^{c}	0.004
WBC (x 10^3cells/μL)	7009 ± 65.66^{a}	8833 ± 19.82^{b}	8782 ± 51.35^{ab}	9023 ± 41.56^{c}	8995 ± 23.44^{bc}	0.014
N%	48.1 ± 1.47	57.6 ± 1.98	58.2 ± 1.38	59.2 ± 0.46	59.0 ± 0.22	0.262
L%	42.8 ± 1.33^{a}	36.0 ± 1.82^{bc}	35.1 ± 1.17^{b}	38.6 ± 1.12^{c}	36.0 ± 1.17^{bc}	0.011
M%	5.3 ± 0.34^{a}	3.2 ± 0.19^{b}	3.4 ± 0.22^{bc}	4.8 ± 0.44^{ab}	2.5 ± 0.33^{c}	0.001
E%	3.1 ± 0.17^{a}	2.6 ± 0.25^{ab}	2.6 ± 0.12^{ab}	2.9 ± 0.20^{a}	2.0 ± 0.11^{c}	0.002
B%	0.7 ± 0.13^{a}	0.6 ± 0.11^{b}	0.7 ± 0.14^{c}	0.6 ± 0.23^{b}	0.5 ± 0.21^{c}	0.003
RBC (x 10^6cells/μL)	6.81 ± 0.11^{a}	7.54 ± 0.73^{ab}	7.91 ± 0.26^{b}	8.04 ± 0.17^{bc}	8.79 ± 0.84^{c}	0.005
Hb (g/dL)	12.9 ± 0.61	13.3 ± 0.38	13.9 ± 0.28	14.0 ± 0.13	14.7 ± 0.36	0.062
HCt (%)	38.53 ± 0.39^{a}	37.53 ± 0.39^{ab}	38.96 ± 0.59^{a}	36.47 ± 0.44^{b}	36.47 ± 0.44^{b}	0.014
MCV (fL)	55.76 ± 0.85^{a}	55.76 ± 0.85^{a}	55.29 ± 0.26^{a}	55.76 ± 0.85^{a}	56.26 ± 0.33^{b}	0.031
MCHC (g/dL)	36.03 ± 0.25	37.23 ± 1.43	37.42 ± 1.78	38.66 ± 1.87	38.68 ± 1.31	0.101
Plat (x10^3cells/μL)	773.6 ± 41.72^{a}	792.7 ± 73.25^{ab}	838.8 ± 16.34^{bc}	871.5 ± 58.81^{c}	892.8 ± 62.99^{c}	0.002

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

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Table 7: Full Blood Counts in Experimental Rats after Administration of *C. nucifera* milk Extract

Parameters	Group M	Group E	Group F	Group G	Group H	P-value
	(0 mg/kg b.w.)	(250 mg/kg b.w.)	(500 mg/kg b.w.)	(750 mg/kg b.w.)	(1000 mg/kg b.w.)	
PCV (%)	35.9 ± 0.19^{a}	35.6 ± 0.51^{a}	37.0 ± 0.31^{ab}	39.7 ± 0.49^{b}	40.5 ± 1.47^{b}	0.003
WBC (x 10^3cells/μL)	7001 ± 42.98^{a}	7910 ± 23.11^{bc}	7622 ± 46.63^{b}	8619 ± 26.87^{c}	7881 ± 39.13^{bc}	0.017
N%	49.6 ± 1.73	50.1 ± 0.58	49.7 ± 1.56	48.3 ± 0.38	49.5 ± 1.75	0.268
L%	39.2 ± 1.69^{a}	39.2 ± 1.57^{a}	40.5 ± 1.71^{ac}	40.2 ± 1.50^{ac}	41.1 ± 1.19^{b}	0.001
M%	5.7 ± 0.24^{a}	5.5 ± 0.50^{ab}	5.7 ± 0.29^{a}	6.3 ± 0.38^{c}	5.6 ± 0.28^{ab}	0.048
E%	4.4 ± 0.95^{a}	4.2 ± 0.10^{ab}	3.2 ± 0.21^{b}	4.1 ± 0.20^{ab}	3.0 ± 0.13^{c}	0.002
B%	1.1 ± 0.3	1.0 ± 0.2	0.9 ± 0.1	1.1 ± 0.1	0.8 ± 0.1	0.144
RBC (x 10^6cells/μL)	6.35 ± 0.53^{a}	7.96 ± 0.33^{b}	8.03 ± 0.72^{b}	8.77 ± 0.58^{bc}	9.21 ± 1.55^{c}	0.005
Hb (g/dL)	13.7 ± 1.46	13.9 ± 0.35	14.6 ± 0.91	15.4 ± 0.16	15.8 ± 0.88	0.053
HCt (%)	40.07 ± 0.52^{b}	37.53 ± 0.39^{a}	39.96 ± 0.59^{ab}	40.17 ± 0.52^{b}	42.26 ± 1.83^{b}	0.017
MCV (fL)	56.99 ± 0.28	58.24 ± 1.63	58.88 ± 1.83	59.42 ± 1.74	58.75 ± 1.24	0.051
MCHC (g/dL)	34.26 ± 1.32^{a}	37.56 ± 1.67^{b}	38.41 ± 1.36^{bc}	37.66 ± 1.53^{b}	38.94 ± 1.13^{c}	0.001
Plat (x10^3cells/μL)	745.4 ± 52.81^{a}	811.3 ± 16.87^{b}	844.1 ± 74.28^{bc}	880.3 ± 17.15^{c}	898.9 ± 26.66^{c}	0.032

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

Table 8: Full Blood Counts in Experimental Rats before Administration of *C. nucifera* Shell Extract

Parameters	Group M	Group I	Group J	Group K	Group L	P-value
PCV (%)	35.1 ± 0.52	35.6 ± 1.14	36.0 ± 0.32	36.7 ± 0.50	36.9 ± 0.62	0.222
WBC (x 10^3cells/μL)	7011 ± 17.56	7017 ± 22.18	7238 ± 21.16	7112 ± 33.71	7099 ± 7.27	0.431
N%	49.4 ± 1.59	47.2 ± 1.91	46.5 ± 1.77	47.9 ± 1.34	48.3 ± 1.16	0.721
L%	40.1 ± 1.40	42.3 ± 1.13	43.0 ± 1.06	42.4 ± 1.65	39.6 ± 1.68	0.801
M%	6.5 ± 0.51	5.3 ± 0.32	5.5 ± 0.73	4.8 ± 0.33	6.3 ± 0.19	0.222
E%	3.2 ± 0.22	4.1 ± 0.15	4.2 ± 0.61	4.0 ± 0.41	4.6 ± 0.73	0.601
B%	0.8 ± 0.2	1.1 ± 0.41	0.8 ± 0.32	0.9 ± 0.41	1.2 ± 0.13	0.211
RBC (x 10^6cells/μL)	7.11 ± 0.54	6.79 ± 0.14	7.15 ± 0.99	7.46 ± 0.28	7.93 ± 0.78	0.134
Hb (g/dL)	12.3 ± 0.19	12.3 ± 1.15	12.6 ± 1.27	12.5 ± 1.24	12.9 ± 1.86	0.261
HCt (%)	36.11 ± 0.27	36.02 ± 1.44	38.37 ± 0.87	37.53 ± 0.39	37.62 ± 0.73	0.125
MCV (fL)	54.24 ± 0.36	51.25 ± 1.53	52.38 ± 1.29	55.76 ± 0.85	54.58 ± 0.84	0.101
MCHC (g/dL)	36.52 ± 0.32	36.21 ± 1.17	36.11 ± 1.48	35.68 ± 0.92	38.16 ± 0.47	0.122
Plat (x10^3cels/μL)	805.9 ± 62.57	769.3 ± 26.11	795.3 ± 23.34	801.3 ± 52.08	799.4 ± 42.41	0.513

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

Table 9: Full Blood Counts in Experimental Rats during Administration of *C. nucifera* Shell Extract

Parameters	Group M (0mg/kg b.w.)	Group I (250mg/kg b.w.)	Group J (500mg/kg b.w.)	Group K (750mg/kg b.w.)	Group L (1000mg/kg b.w.)	P-value
PCV (%)	35.3 ± 0.31	35.9 ± 0.51	36.7 ± 0.54	36.6 ± 0.58	37.0 ± 0.99	0.333
WBC (x 10^3cells/μL)	7009 ± 65.66	7012 ± 7.62	7013 ± 7.60	7016 ± 6.66	7017 ± 7.69	0.602
N%	48.1 ± 1.47	50.1 ± 0.58	49.7 ± 1.56	48.3 ± 0.38	49.5 ± 1.75	0.268
L%	42.8 ± 1.33^{a}	39.2 ± 1.57^{c}	40.5 ± 1.71^{c}	40.2 ± 1.50^{c}	41.1 ± 1.19^{c}	0.001
M%	5.3 ± 0.34^{a}	5.5 ± 0.50^{c}	5.7 ± 0.29^{c}	6.3 ± 0.38^{c}	5.6 ± 0.28^{c}	0.048
E%	3.1 ± 0.17^{a}	4.2 ± 0.10^{ab}	3.2 ± 0.21^{ab}	4.1 ± 0.20^{ab}	3.0 ± 0.13^{ab}	0.002
B%	0.7 ± 0.3^{a}	1.0 ± 0.2^{bc}	0.9 ± 0.1^{b}	1.1 ± 0.1^{bc}	0.8 ± 0.1^{ab}	0.001
RBC (x 10^6cells/μL)	6.81 ± 0.11	6.74 ± 0.15	7.05 ± 0.12	7.05 ± 0.12	7.05 ± 0.12	0.071
Hb (g/dL)	12.9 ± 0.61	12.9 ± 1.92	13.4 ± 0.99	13.7 ± 1.18	14.5 ± 0.94	0.057
HCt (%)	38.53 ± 0.39	37.53 ± 0.39	38.96 ± 0.59	36.47 ± 0.44	36.47 ± 0.44	0.183
MCV (fL)	55.76 ± 0.85	55.76 ± 0.85	55.29 ± 0.26	55.76 ± 0.85	56.26 ± 0.33	0.082
MCHC (g/dL)	36.03 ± 0.25	38.00 ± 0.25	36.96 ± 0.27	38.24 ± 1.25	37.94 ± 0.08	0.161
Plat (x10^3cells/μL)	773.6 ± 41.72	735.6 ± 41.72	747.2 ± 33.72	771.4 ± 19.06	743.1 ± 27.66	0.402

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

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Table 10: Full Blood Counts in Experimental Rats after Administration of *C. nucifera* Shell Extract

Parameters	Group M (0mg/kg b.w.)	Group I (250mg/kg b.w.)	Group J (500mg/kg b.w.)	Group K (750mg/kg b.w.)	Group L (1000mg/kg b.w.)	P-value
PCV (%)	35.9 ± 0.19	35.1 ± 1.34	36.3 ± 1.73	36.9 ± 1.37	38.6 ± 0.65	0.322
WBC (x 10^3cells/µl)	7001 ± 42.98	7011 ± 26.57	7009 ± 13.46	7015 ± 41.26	7014±22.54	0.314
N%	49.6 ± 1.73	48.7 ± 2.68	49.9 ± 1.53	48.4 ± 2.38	48.9 ± 0.99	0.271
L%	39.2 ± 1.69	42.3 ± 1.46	41.4 ± 1.37	39.4 ± 1.22	40.7 ± 1.18	0.701
M%	5.7 ± 0.24	5.4 ± 0.32	5.6 ± 0.44	6.6 ± 0.82	6.0 ± 0.07	0.192
E%	4.4 ± 0.95	3.6±0.34	3.8 ± 0.18	4.5 ± 0.56	3.5 ± 0.11	0.211
B%	1.1 ± 0.31	0.8 ± 0.21	0.9±0.68	1.1 ± 0.32	0.9 ± 0.17	0.093
RBC (x 10^6cells/µL)	6.35 ± 0.53	6.74 ± 0.15	7.05 ± 0.12	7.05 ± 0.12	7.05 ± 0.12	0.205
Hb (g/dL)	13.7 ± 1.46	13.9 ± 1.64	14.9 ± 1.57	15.2 ± 1.28	15.8 ± 1.51	0.054
HCt (%)	40.07 ± 0.52	37.24 ± 1.58	38.11 ± 1.42	36.91 ± 1.99	37.66 ± 0.92	0.117
MCV (fL)	56.99 ± 0.28	52.45 ± 2.69	51.91 ± 1.42	56.63 ± 1.66	54.43 ± 0.79	0.082
MCHC (g/dL)	34.26 ± 1.32	36.73 ± 1.63	36.48 ± 1.72	38.91 ± 1.53	37.62 ± 1.11	0.101
Plat (x10^3cells/µL)	745.4 ± 52.81	730.4 ± 64.62	742.1 ± 36.83	765.2 ± 85.27	740.2 ± 78.27	0.212

Values are expressed as Mean ± Standard Error of the Mean, while Values with different superscript across row are significantly different at p-values less than 0.05 ($p < 0.05$) on pairwise comparison. Hb: haemoglobin, M: monocytes, RBC: Red blood cells, WBC: white blood cells, MCHC: mean corpuscular hemoglobin concentration, L: lymphocytes, B: basophils, N: neutrophils, E: eosinophils, HCt: hematocrit, MCV: mean corpuscular volume, Plat: Platelets, PCV: packed cell volume.

Conclusion

As far as we know, this study may be the first work using coconut shell extracts for experimental analysis in animals. After comparing individual effect of coconut husk, milk and shell extracts on body weight changes and haematological indices; we conclude that *C. nucifera* husk and shell extracts have higher performance ability on changes in body weight while coconut milk and husk may enhance haematological indices. We suggest that further information on relative organ weight changes, feed consumption pattern, serum biochemical markers and histopathology are required in support of the present claims being that our conclusion is solely on body weight changes and haematotological indices.

Conflict of interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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