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(RESEARCH ARTICLE)

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The biochemical effects of kola nitida on the renal biomarkers of lipid induced Wistar albino rats

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Abstract

The aim of the study was to access the biochemical effects of kola nitida extract on renal markers of adult albino rats induced with high lipid diet. This was a prospective longitudinal study carried out in Joseph Ayo Babalola University, Ikeji Arakeji, Osun State Students. The study was conducted within a period of 6 months (April– September 2024). The study adhered to stringent animal husbandry protocols. Rats were housed individually in standard laboratory cages with controlled environmental conditions (temperature 22±2°C, humidity 50-60%, and a 12-hour light/dark cycle) to minimize environmental variability. They had unrestricted access to standard rodent feed and water throughout the experiment to maintain optimal health and consistent metabolic conditions. The experimental design involved the administration of kola nitida extract via oral gavage at predetermined doses based on body weight, established through preliminary dose-ranging studies to ensure safety and efficacy. Animals were randomly assigned to experimental and control groups, with each group carefully monitored for behavioral changes and physical health indicators throughout the study period. Grouping of animals was done as the animals were divided into 5 groups: Group 1(Negative control), Group 2(Toxicity group), Group 3(100mg/kg), Group 4(200 mg/kg), Group 5(300mg/kg). Blood samples was collected from the marginal ear vein using a 2ml needle and syringe into lithium heparin bottles and was spun at 3500 rpm for 5 minutes to obtain plasma in order to determine the renal biomarkers using creatinine and urea diagnostic kit (Randox test kit), The results of this study clearly demonstrate that the administration of a high lipid diet and subsequent reversal with *Kola-Nitida* induces significant changes in the urea and creatinine in all the test groups when compared to toxicity group. The strong statistical evidence supports the conclusion that *Kola-Nitida* may play a role in mitigating the effects of a high lipid diet on the renal biomarkers in Wistar rats.

Keywords: Hyperlipidemia; Kola-Nitida; Kidney; Creatinine; Urea; Histopathological; Renal Biomarkers

1. Introduction

The kidneys are two bean-shaped organs, each about the size of a fist. They are located just below the rib cage, one on each side of your spine (1).

Kola nitida is a tree native to the rainforests of tropical West Africa. Common names include kola nut, cola, kola, and bitter kola (4).

High-fat diets are becoming increasingly common in many countries, and they contribute to the development of chronic non-communicable diseases (NCDs), such as obesity, hypertension, and chronic kidney disease (CKD) (2).

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In fact, people with cholesterol problems were twice as likely to have chronic kidney disease over time (3).

The World Health Organization recommends a reduction in saturated fat consumption as one of the worldwide strategies to reduce mortality from chronic NCDs (John William, 2015).

2. Materials and methods

2.1. Study area

Study was carried out in Joseph Ayo Babalola University, Ikeji-Arakeji

2.2. Ethical approval

Ethical considerations were received from the Ethical Committee for Research of the Department of Medical Laboratory science, Joseph Ayo Babalola University Osun state, Nigeria, and ensured in accordance with the guidelines and regulations approved for the use care of rats.

2.3. Scope of experimental design

This research is a controlled experiment, from the laboratory animal house of Joseph Ayo Babalola University, 20 male Wistar rats were purchased. The animals were fed with a high lipid diet.

2.3.1. Control group

This group consisted of four (4) Wistar rats that were fed with a normal diet.

2.3.2. Toxicity group

This group consisted of four (4) Wistar rats were fed with a high lipid diet.

2.3.3. Experimental group

This group consisted of fifteen (15) Wistar rats that were divided into groups of 100mg/kg, 200mg/kg and 300mg/kg

2.4. Exclusion criteria

Wistar rats with underlying illness and other conditions were not used for this study.

2.5. Specimen collection and processing

Blood samples would be collected from all animals before and halfway to the experiment from the marginal ear vein using a 2ml needle and syringe to determine the renal biomarkers using creatinine and urea diagnostic kit (Randox test kit), which serve as a pointer to whether hyperlipidemia affected the kidneys and it's reversal during experimentation using kola nitida. In the end, all animals fasted all-night and was sacrificed by cervical dislocation. The blood samples were put into lithium heparin tubes and centrifuged at 10,000rpm for 5 minutes.

2.6. Statistical analysis

For statistical analysis, data were analyzed by both one-way (for weight analysis) and two-way analysis of variance (ANOVA) (acetaminophen consumption analysis) using Graph Pad Prism (version 9.5.1) software. The results were expressed as mean standard deviation and Statistical significance was considered at a 95% confidence **interval ($P<0.05$).**

3. Results and discussion

Table 1 Results (Mean±SD) of Parameters and Organ Weights of Rats Treated with Varying Concentration of kola nitida extract

Parameters	Group 1 (100mg/kg)	Group 2 (200mg/kg)	Group 3 (300mg/kg)	Positive Control (Toxicity)	Negative control	F value	P value	Remark
Urea (mmol/L)	5.73±0.67[a]	4.47±0.21[b]	4.23±0.96[b]	6.33±0.25[c]	5.27±0.29[a]	7.336	0.0050	S
Creatinine (µmol/L)	34.33±5.13[a]	32.33±1.15[b]	25.0±5.0[c]	44.0±1.0[a]	32.67±2.52[a]	11.57	0.0009	S
U/C Ratio	0.17±0.016[a]	0.10±0.006[b]	0.17±0.01[a]	0.19±0.01[a]	0.16±0.01[a]	31.47	<0.0001	S
B. weight (grams)	120.0±0.28	135.9±2.32	127.9±0.32	141.6±0.34	129.0±0.47	231.9	<0.0001	S
A. weight (grams)	0.62±0.02[a]	0.43±0.05[b]	0.31±0.02[c]	0.72±0.02[d]	0.53±0.03[e]	114.0	<0.0001	S
R. Weight (grams)	5.175±0.15[a]	3.13±0.34[b]	2.45±0.1915[c]	5.05±0.13[a]	4.10±0.22[d]	118.7	<0.0001	S

Keys: U/C Ratio=Urea//Creatinine Ratio. B. weight= Body weight of Animal, A. Weight= Absolute weight of Organ, R. weight =Relative weight of organ, S=significant at p<0.05; **Post Hoc (Tukey's):** Values in the row with different superscripts differ significantly at p<0.05.

Table 2 Pearson's Correlation Analysis of Rats treated with 100mg/kg of kola nitida On Renal Indices and Organ Weights.

Pearsons Correlation Matrix	Urea (mmol/L)	Creatinine (µmol/L)	U/C Ratio	A. weight (grams)	R. Weight (grams)
Urea (mmol/L)	r=1 p=0				
Creatinine (µmol/L)	r= -0.73 p=0.47	r=1 p=0			
U/C Ratio	r=0.63 p=0.57	r=0.07 p=0.95	r=1 p=0		
A. weight (grams)	**r= -0.99** **p=0.02**	r=0.76 p=0.45	r=-0.34 p=0.65	r=1 p=0	
R. Weight (grams)	r=-0.96 p=0.19	r=0.50 p=0.66	r=-0.44 p=0.55	**r=0.97** **p=0.02**	r=1 p=0

Keys: U/C Ratio=Urea//Creatinine Ratio. A. Weight= Absolute weight of Organ, R. weight =Relative weight of organ, r=correlation coefficient, p=confidence interval at 95%.

Table 3 Pearson's Correlation Analysis of Rats treated with 200mg/kg of kola nitida On Renal Indices and Organ Weights

Pearsons Correlation Matrix	**Urea (mmol/L)**	**Creatinine (µmol/L)**	**U/C Ratio**	**A. weight (grams)**	**R. Weight (grams)**
Urea (mmol/L)	r=1.00 p=0.00				
Creatinine (µmol/L)	r=0.00 p=1.00	r=1.00 p=0.00			
U/C Ratio	r=0.93 p=0.25	r=0.37 p=0.75	r=1.00 p=0.00		
A. weight (grams)	r=-0.72 p=0.49	r=-0.69 p=0.51	r=-0.84 p=0.16	r=1.00 p=0.00	
R. Weight (grams)	r=-0.77 p=0.43	r=-0.63 p=0.57	r=-0.89 p=0.11	**r=0.99** **p=0.003**	r=1.00 p=0.00

Keys: U/C Ratio=Urea//Creatinine Ratio. A. Weight= Absolute weight of Organ, R. weight =Relative weight of organ, r=correlation coefficient, p=confidence interval at 95%.

Table 4 Pearson's Correlation Analysis of Rats treated with 300mg/kg of kola nitida on Renal Indices and Organ Weights

Pearsons Correlation Matrix	**Urea (mmol/L)**	**Creatinine (µmol/L)**	**U/C Ratio**	**A. weight (grams)**	**R. Weight (grams)**
Urea (mmol/L)	r=1.00 p=0.00				
Creatinine (µmol/L)	r=0.50 p=0.66	r=1.00 p=0.00			
U/C Ratio	r=0.79 p=0.40	r=-0.11 p=0.92	r=1.00 p=0.00		
A. weight (grams)	r=-0.32 p=0.78	r=0.65 p=0.54	r=-0.18 p=0.81	r=1.00 p=0.00	
R. Weight (grams)	r=0.00 p=1.00	r=0.86 p=0.33	r=-0.01 p=0.98	**r=0.98** **p=0.018**	r=1.00 p=0.00

Keys: U/C Ratio=Urea//Creatinine Ratio. A. Weight= Absolute weight of Organ, R. weight =Relative weight of organ, r=correlation coefficient, p=confidence interval at 95%.

Table 5 Pearson's Correlation Analysis of Positive Control/Toxicity on Renal Indices and Organ Weights

Pearson's Correlation Matrix	**Urea (mmol/L)**	**Creatinine (µmol/L)**	**U/C Ratio**	**A. weight (grams)**	**R. Weight (grams)**
Urea (mmol/L)	r=1.00 p=0.00				
Creatinine (µmol/L)	r=-0.50 p=0.66	r=1.00 p=0.00			
U/C Ratio	r=-0.08 p=0.94	r=0.90 p=0.28	r=1.00 p=0.00		
A. weight (grams)	r=0.92 p=0.26	r=-0.11 p=0.93	r=0.31 p=0.69	r=1.00 p=0.00	
R. Weight (grams)	r=0.94 p=0.21	r=-0.19 p=0.88	r=0.34 p=0.65	**r=0.99** **p=0.007**	r=1.00 p=0.00

Keys: U/C Ratio=Urea//Creatinine Ratio. A. Weight= Absolute weight of Organ, R. weight =Relative weight of organ, r=correlation coefficient, p=confidence interval at 95%.

Table 6 Pearson's Correlation Analysis of Control Group on Renal Indices and Organ Weights

Pearson's Correlation Matrix	**Urea (mmol/L)**	**Creatinine (µmol/L)**	**U/C Ratio**	**A. weight (grams)**	**R. Weight (grams)**
Urea (mmol/L)	r=1.00 p=0.00				
Creatinine (µmol/L)	r=-0.80 p=0.40	r=1.00 p=0.00			
U/C Ratio	r=-0.20 p=0.87	r=0.74 p=0.46	r=1.00 p=0.00		
A. weight (grams)	r=0.85 p=0.34	r=-0.38 p=0.75	r=0.29 p=0.70	r=1.00 p=0.00	
R. Weight (grams)	r=0.83 p=0.38	r=-0.32 p=0.78	r=0.29 p=0.70	**r=0.99** **p=0.003**	r=1.00 p=0.00

Keys: U/C Ratio=Urea//Creatinine Ratio. A. Weight= Absolute weight of Organ, R. weight =Relative weight of organ, r=correlation coefficient, p=confidence interval at 95%.

In our study, Serum creatinine (SC) concentration based on their groups: group 1, 2, 3, control and toxicity group, there was no statistically significant difference in creatinine concentration between the albino rats. There was significant increase in the toxicity group, compared to control, with the 200mg/kg and 300mg/kg group having a significant decrease, compared with control and toxicity group. Our study, Urea concentration based on their groups: group 1, 2, 3, control and toxicity group, there was no statistically significant difference in urea concentration between the albino rats. There was significant increase in the toxicity group, compared to control, with the 200mg/kg and 300mg/kg group having a significant decrease, compared with control and toxicity group.

4. Conclusion

The results of the study clearly demonstrate that the administration of a high lipid diet and subsequent reversal with *Kola-Nitida* induces significant changes in the biological parameters under investigation. The strong statistical evidence

supports the conclusion that *Kola-Nitida* may play a role in mitigating the effects of a high lipid diet in Wistar rats. The consistently low residual variance across the datasets further emphasizes the reliability of these findings, indicating that the intervention was robust in its effects across all parameters.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest was disclosed.

Statement of ethical approval

Ethical considerations were received from the College of Health Science Research and Ethical Committee, Joseph Ayo Babalola University Osun state, Ikeji-Arakeji, Nigeria.

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