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Lipid Profile and Serum Biochemistry of Rabbit Bucks Administered Methanolic Extracts of Andrographis Paniculata

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Abstract

Thirty-six (36) mixed-breed rabbit bucks, aged, 5-6 months were subjected to a study to determine the effects of Andrographis paniculata extract on the lipid profile and serum biochemistry. The rabbits were randomly assigned into four groups, designated as T1, T2, T3 and T4 in a completely randomized design (CRD), with nine animals per treatment group. 1g of dried methanolic extract of A. paniculata was reconstituted in 100ml of distilled water to form a liquid suspension, which was administered orally to the rabbit early hours of the morning using a sterile syringe at the rates of 0.0mg/kg, 125mg/kg, 250mg/kg and 500mg/kg respectively. Blood samples at weeks 4 and 8 and analyzed to determine the lipid profile and serum biochemical properties. Data obtained were subjected to Analysis of variance using SPSS Version 20. Significant means were separated using Duncan's Multiple Range Test. Results obtained showed significant increase (P>0.05) in HDL (good cholesterol) level while bad cholesterol, LDL and VLDL tended to decline with increase in administration rate of the extract. Similarly Higher values (P>0.05) was recorded for serum proteins in the treated group compared to the control. Glucose levels to decreased significantly with increase in dose of the extract. AST and ALT values fell within normal ranges for rabbits, suggesting that the extract had minimal or no toxic effect. It is concluded from this study that the A. paniculata extract used in this study had a positive influence on lipid profile of the rabbit, thus further enhancing meat quality and consumer safety.

Keywords: Blood, Buck, Lipid, Rabbit, Samples Serum.

Introduction

Food safety and consumer health are cardinal components of food security. World Bank (World Bank, 2021), defined food security as when people have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Animal-based proteins have been identified to be a reliable source of high quality dietary proteins for humans and farm animals. The health implications of high cholesterol levels associated with consumption of dietary fats has become an issue of concern globally.

Rabbits offer great potentials as a food enterprise especially in developing countries; they are prominent for their enormous abilities and good attributes which include: high prolificacy, short gestation period, fast growth rate, high efficiency in converting forage to meat, high nutritional quality and relatively low cost of production (Arijeniwa et al., 2000; Ajayi et al., 2021).

Andrographis paniculata, commonly known as the "king of bitters", is an herbaceous plant that has been reported to have several properties that are of tremendous benefit to human and animal health. The leaves contain a major bioactive component- andrographolide, which is very bitter in taste and has been reported to have anti-inflammatory, antibacterial, hypoglycemic, hypocholesterolemic, hepatoprotective and adaptogenic effects (Shahid, 2011; Saumendu et al., 2012). The Andrographolides in the plant are believed to enhance immune functions such as in the production of white blood cells, to support the release of interferon, and to promote the

healthy activity of the lymphatic system (Blumenthal et al., 1998; Coon & Ernst, 2004). The plant is commonly cultivated in India, southern and South-Eastern Asia to treat infections and some diseases.

Food safety is a primary concern to consumers all over the globe. The consumption rates of animal products such as Meat, egg and diary has been reported to be one of the major causes of hyperlidemia or hypercholesterolemia (increased cholesterol levels in the blood). Animal-based proteins such as: meat, fish, egg and milk are the commonest sources of rich dietary protein to humans. In the face of numerous health challenges associated with dietary intake of fatty and high cholesterol foods, the quality of animals produced and offered for human consumption need to be critically considered. Health challenges such as high blood pressure, cardiac arrest, Arteriosclerosis, stroke and peripheral arterial disease (PAD), amongst others have been linked to high cholesterol and sugar levels in the blood. The preponderance of Low density lipoproteins in the blood poses serious threat to health. There is a dire need for scientific studies on possible ways of further improving the quality of animal products available, aimed at producing safer and heathier products, geared towards promoting and protecting consumer health. This study sought to evaluate the effect of consumption of extracts of King of Bitters (*Andrographis paniculata*) on the lipid profile and serum biochemical characteristics of domestic rabbit bucks.

Materials and Methods

Experimental site

The experiment was conducted at the Rabbitry Unit of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State. The study area lies at an altitude of 122m and within the rainforest zone of south-eastern. Nigeria it has binomal rainfall pattern and total annual rainfall range of 1700 – 2100mm. The maximum ambient temperature of the area ranges from 27^0C to 36^0C during the hot dry season of the year (November – April) and minimum ambient temperature ranges from 200C to 260C during the cold rainy season (May – September). The relative humidity ranges 57 – 91 and is location in hot humid tropics (National Root Crops Research Institute [NRCRI], 2017).

Experimental animals and management

Thirty-six (36) mature mixed-breed rabbit bucks, aged 6-7 months were used for this study. The animals were purchased from reputable rabbit breeders and quarantined for a period of three (3) weeks before commencement of the experiment. The animals were housed in individual cells in wooden hutches and fed concentrate ration of 16% crude protein and 2630 ME/kg energy; alongside grass-legume forages. Fresh clean water was provided adlibitum.

Experimental design and procedure

The thirty-six (36) rabbit bucks were randomly selected and assigned into four (4) treatment groups designated as T1, T2, T3 and T4 in a completely randomized design. Each treatment comprised nine (9) animals. The treatments were replicated 3 times with 3 animals per replicate. Dried methanolic extract of *A. paniculata* was obtained from Natural Remedies Laboratories, India; a reputable human and animal herbal Pharmaceutical Laboratory. One gram (1g) of the dry powder of the *A. paniculata* extract was reconstituted in 100ml of distilled water to form a liquid suspension, which was administered orally to the rabbits early hours the of morning at varied rates using a sterile syringe for a period of 8weeks. The administration rates for the various experimental groups are as presented below:

T_1: (control): 0.0mg of extract per kg body weight per day.
T_2: 125mg of extract per kg body weight per day.
T_3: 250mg of extract per kg body weight per day.
T_4: 500mg of extract per kg body weight per day.

The dose of the liquid suspension administered to the experimental rabbits, per kilogram body weight was determined using the formular:

$$\text{Dosage (ml)} = \frac{\text{Administration rate X concentration of solution}}{\text{Body weight of Animal}}$$

Data collection and analysis

Blood samples were collected from the experimental bucks at weeks 4, 6, and 8, of administration of the extract for serum biochemical analysis. 5ml of blood was extracted via the ear vein using a sterile hypodermic syringe. The blood was allowed to coagulate to produce serum for blood chemistry evaluation. The serum chemistry parameters: urea, creatinine, Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), total protein, albumin, globulin, total bilirubin, cholesterol, glucose and serum electrolyte were prepared according to standard clinical chemistry procedure (Reitman& Frankel, 1953; Roschlan et al.,1974). These serum components were determined using an automated biochemical analyzer (Eastman Kodak Co., Rochester, NY). The serum globulin values were determined by deducing the difference between serum total protein and serum albumin.

The results obtained from laboratory analysis were subjected to analysis of variance (ANOVA) as described by Steel and Torrie (Steel & Torrie, 1980) using SPSS Version 20. Significant means were separated using Duncan Multiple Range test (Duncan, 1995).

The statistical models for the experiment is as shown below:

$$Y_{ij} = \mu + T_i + \varepsilon_{ij}$$

Where:
Y_{ij} : Single observation
μ : Overall mean
T_i : Treatment
ε_{ij} : Random error.

ε_{ij} is independent, identical and normally distributed with zero mean and constant variance ($\varepsilon_{ij} \sim$ iind o, σ).

Result and Discussion

Tables 1 and 2, show the results of lipid profile and serum biochemical analysis of rabbit bucks, following oral administration of varied doses of methanolic extracts of Andrographis paniculata.

Table 1: Lipid profile of rabbit bucks administered methanolic extracts of Andrographis paniculata

PARAMETERS	T_1 (0.0mg/kg)	T_2 (125mg/kg)	T_3 (250mg/kg)	T_4 (500ml/kg)	SEM
Total cholesterol (mg/dl)	76.37a	73.17b	72.36b	71.82b	0.65
Triglycerides (mg/dl)	92.85a	92.51a	90.44a	85.20b	1.23
HDL (mg/dl)	46.82a	49.40b	49.77b	51.40b	0.56
LDL (mg/dl)	6.36	6.35	5.13	5.12	0.57
VLDL (mg/dl)	18.70a	18.33a	18.10a	17.03b	0.23

[a,b,c,d] Means across rows with different superscripts differ significantly at P<0.05; S.E.M: Standard Error of the Mean. HDL= high-density lipoprotein; LDL= low-density lipoprotein; VLDL=Very Low density lipoprotein.

Total cholesterol and triglycerides levels were observed to decrease progressively with increase in the administration rate of the *A. paniculata* extract. Significantly lower values for total cholesterol were recorded in the treated groups T_2 (125mg/kg), T_3 (250mg/kg) and T_4 (500mg/kg) compared to the control experiment. Values obtained for Total cholesterol in the treated groups were statistically similar. A significantly lower value of Triglycerides was recorded in T_4 (500mg/kg), compared to other treatment. HDL was found to be statistically similar among the treated groups. Values obtained were however, significantly higher than that of the control experiment. There were no significant differences in the values recorded for LDL. VLDL varied within a narrow range; values obtained in T_2 (125mg/kg) and T_3 (250mg/kg) were similar to that of the control. The lowest value for VLDL was recorded in T_4 (500mg/kg). Results obtained from this study suggest that the methanolic extracts of A. paniculata administered to the rabbit bucks had significant influence on some physiological functions in the animals. The herbal extract is believed to have influenced lipid and glucose metabolism possibly due to a more enhanced liver function brought about by the A. paniculata administered to the rabbit during the study. This is in tandem with the assertion that the plant exhibits a liver stimulating and protective effects in animals.

Table 2: Serum biochemical properties of rabbit bucks administered methanolic extracts of *Andrographis paniculata*

PARAMETERS	T_1 (0.0mg/kg)	T_2 (125mg/kg)	T_3 (250mg/kg)	T_4 (500ml/kg)	SEM
Glucose (mg/dl)	98.67^{a}	88.00^{b}	87.00^{b}	79.33^{c}	3.35
Total Protein (mg/dl)	5.38^{c}	5.99^{b}	6.37^{b}	6.56^{a}	0.14
Globulin (g/dl)	2.70^{b}	3.02^{ab}	3.10^{a}	2.89^{ab}	0.06
Albumin (g/dl)	2.67^{c}	2.97^{bc}	3.26^{b}	3.66^{a}	1.12
AST (IU/L)	71.49^{bc}	68.08^{c}	72.68^{ab}	76.83^{a}	1.10
ALT (IU/L)	47.00^{ab}	43.67^{b}	47.03^{ab}	50.73^{a}	0.96
Urea (mg/dl)	21.00	24.13	19.10	22.37	0.76
Bilirubin (mg/dl)	0.43^{b}	0.50^{ab}	0.58^{a}	$0.48a^{b}$	0.02
Creatinine (mg/dl)	0.90^{ab}	0.91^{ab}	0.98^{a}	0.77^{b}	0.03
Sodium [Na+] (mEq/l)	137.70^{b}	140.17^{b}	141.40^{b}	147.43^{a}	1.27
Potassium [K+] (mEq/l)	3.62^{b}	4.43^{ab}	4.45^{ab}	4.73^{a}	0.18

[a,b,c,d] Means across rows with different superscripts differ significantly at P<0.05; S.E.M: standard Error of the Mean. AST= Aspartate transaminase; ALT= Alanine transaminase.

Results obtained from the serum biochemical studies conducted shows significant differences (P>0.05) between the treatment groups for most of the parameters measured. Serum glucose progressively declined as the dosage of extract increased. A significantly higher (P>0.05) value was obtained in the control group, T1 (0.0mg/kg), compared to the treated groups. The lowest value for glucose was recorded in T4 (500mg/kg). Serum protein level was significantly higher (P<0.05) in T4 (500mg/kg) than in T2 (125mg/kg) and T3 (250mg/kg). There was no significant difference (P>0.05) found between the T2 and T3 group for this blood parameter. They were however, significantly higher (P<0.05) than the control experiment. Significantly higher values were obtained for serum globulin and Albumin in T3 (250mg/kg) and T4 (500mg/kg) respectively. AST and ALT values were found to be significantly lower (P<0.05) in T2 (125mg/kg). Treatment T3 (250mg/kg) and T4 (500mg/kg) did not differ from the control group, for these two parameters. Results obtained for AST and ALT in this study suggest that the A. paniculata extract administered to the rabbit bucks in this study had minimal or no toxic effects on the rabbit bucks. Values obtained for blood urea level across the treatments were statistically similar (P>0.05). Bilirubin and creatinine levels were observed to be significantly higher in T3 (250mg/kg) than in the other treatment groups. The lowest value

for creatinine was recorded in T4 (500mg/kg). Serum sodium and potassium concentration tended to increase with increase in consumption rate of the herbal extract. Significantly higher ($P<0.05$) values were obtained in T4 (500mg/kg) for these two elements. Values obtained for blood sodium concentration was within the range of 135-148mmol/l reported by Ogbuewu (Ogbuewu, 2008).

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Conflict of Interest

The entire research team and authors of this manuscript affirm that there are no competing interest in the publication of this article.

Conclusion

The administration of methanolic extracts of king of bitters-Andrographis paniculata has been shown to have significant influence of the physiology of rabbit bucks. The lipid profile and other serum biochemical indices which are key indicators of the physiological state of the animals and its products were observed to have been positively influenced by the herbal extract administered to the rabbit bucks in this study. The significant reduction in the total cholesterol and levels the Low Density Lipoprotein and Very Low Density Lipoprotein (usually regarded as the bad cholesterol), and a simultaneous increase in the High Density Lipoproteins (good cholesterol) and the protein levels in the rabbit bucks, resulting from the consumption of A. paniculata extract used in this experiment, suggest an enhancement in meat quality and safety. It concluded from this study that the administration of methanolic extracts of Andrographis paniculata at the rates between 125 – 500 mg/kg to rabbits could promote meat quality and further ensure consumer safety and health. The consumption of A. paniculata is not recommended for breeding stock, earlier researches and as affiliated studies suggest that.

Abbreviations

HDL : High density lipoprotein;
LDL : Low density lipoprotein;
VLDL : Very low density lipoprotein;
AST : Aspartate transaminase;
ALT : Alanine transaminase.

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