



Haematological and Serum Biochemistry Profiles of Yankasa Sheep Fed Complete Diets Containing Rice Straw

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Abstract: Sheep play a significant role in socio-cultural activities as they are of great use during cultural, religious and festive in Nigeria. Sheep production is the best way of enhancing meat supply and also generates income to small holder farmers. The aim of this study was to investigate the haematological and serum biochemistry profiles of Yankasa sheep fed complete diets containing rice straw. Twelve (12) Yankasa sheep (rams) were used in this experiment. The animals were randomly distributed to 4 groups of 3 animals each. Each ram served as a replicate and an adjustment period of a week was allowed for the animals before data collection commenced. The feeding trial lasted for a period of 70 days. In this study completely randomized design (CRD) was used. Data collected was analyzed using Analysis of Variance (ANOVA). The treatment means were separated and compared using standard error of the mean (SEM), and Duncan's Multiple Range Test (DNMRT) as contained in SPSS (2013) for window 32, version 24. Results of this experiment revealed that for haematological parameters, white Blood cells (WBC), Haemoglobin (HGB) and Mean corpuscular haemoglobin (MCH) were not significant ($P>0.05$), while Red Blood Cell (RBC) and other parameters were significantly affected ($P<0.05$) by the level of inclusion of rice straw in the diets. Moreover, for biochemical parameters urea, sodium, bicarbonate (HCO_3), creatinine and Glutamic Oxaloacetic Transaminase (SGOT) were not significant ($P>0.05$), while potassium, Glutamic Pyruvi Transaminase (SGPT) and alkaline phosphate were significantly affected ($P<0.05$) by the level of inclusion of rice straw in the diets. From the present study, it can be concluded that the haematological and biochemical parameters for sheep studied in this experiment fall within recommendations. Therefore, this study recommends that rice straw could be incorporated into the sheep diet up to 50% as replacement level for wheat offal without any health challenge. Moreover, the feeds are fit for animal consumption.

Keywords: sheep; haematological; biochemistry; diets, rice straw.

INTRODUCTION

Sheep production is an emerging sector for employment and income generation for the rural poor, especially landless, destitute and divorced women. It is also an effective tool for poverty alleviation for the rural poor (Ahmed, *et al* 2010). Sheep play a significant role in socio-cultural activities/practices as they are of great use during cultural and religious festivals such as naming ceremony in Nigeria. Sheep production is the best way of enhancing meat supply and also generates income to small holder farmers. Sheep are found throughout Nigeria, but the highest population is found in the Northern part where the three of the four breeds of sheep are found, the breeds are *Uda*, *balami* and *Yankasa*. Premium Times News Paper (2017) reported that Nigeria estimated the population of 41.3 million sheep in the country. Efficient, intensive production of meat, milk and other foods requires blended and balanced feeds (FAO 2010). Unfortunately, there is shortage of forage supply in the north-western region of Nigeria where the population of sheep is very high. This is associated with rainfall distribution pattern of the area (Mohammed and Saleh, 2018).

Ranjhan (2001) reported that Feeding only rice straws do not provide enough nutrients to the ruminants to maintain high production levels due to its low nutritive value but physical treatment of crop residues like straws could be achieved by means of milling, grinding, chopping and steaming methods have been shown to

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be effective in increasing digestibility and feed intake in cattle when major portion of forage was replaced by straws but high levels of productive performance obtained on these rations is dependent on their predominant content of energy feed such as cereal grains. Rice straw is available in the north western Nigeria especially during the long dry season for ruminants but it has a low feeding value and should be regarded as an emergency feed for fattening rams.

Blood is an important index of physiological and pathological changes in an organism. The primary function of the blood is to transport oxygen from respiratory organs to body cells distributing nutrients and enzymes to cells and carrying away waste products thereby maintaining homeostasis of the internal environment. The various functions of the blood are carried out by the individual and collective actions of its constituents – the haematological and biochemical components. Haematological tests have been widely used for the diagnosis of various diseases and nutritional status of animal. The information gained from the blood parameters would substantiate the physical examination and together with medical history provide excellent basis for medical judgment. In addition, it would help determine the extent of tissue and organ damage, the response of defense mechanism of the patient and aid in the diagnosing the type of possible anemia (Njidda *et al.*, 2014).

The aim of this study was to investigate the haematological and serum biochemistry profiles of Yankasa sheep fed complete diets containing rice straw.

MATERIAL AND METHODS

Experimental Location

This study was conducted at the Federal College of Education (Technical) Bichi, Department of Agricultural Education Teaching and Research Farm, Kano State, Nigeria. Kano is situated in the Sahelian geographic region, South of the Sahara in the north-western Nigeria, 481 metres (1,578 feet) above sea level within longitude: 8°31'00" E and latitude: 12°00'00" N (Wikipedia, 2018; Dateandtime.info, 2018).

Data Collection

Blood samples were collected from 3 replicates per treatment at the end of the study for haematological and serum biochemical analysis. The sheep were bled through jugular vein and 10ml of blood collected. 3ml of the blood samples were collected into plastic tube containing Ethylene Tetra A Acid (EDTA) for haematological studies to prevent blood clotting. The remaining 7ml of blood samples were deposited in anti-coagulant free plastic tube and allowed to clot at room temperature within 3hrs of collection so as to harvest the serum separately. The serum samples were stored at -20°C for biochemical studies.

Chemical Analysis

Haematological parameters were determined according to the method described by Baker and Silverton (1985) using Sysmex System Haematology Analyser machine. Serum Aspartate Aminotransferase, Serum Alanine Aminotransferase and Alkaline phosphatase were analysed

spectrophotometric linked reaction method (Cheesbrough, 2004). The blood samples collected were analyzed for blood urea nitrogen by the method of Tannins and Maylor (1968), Creatinine was determined according to the method described by Lamb (1991).

Experimental Rams and their Management

Twelve (12) Yankasa sheep (rams) aged 12 to 18 months old were used in this experiment and were purchased from Badume market, Dawakin Tofa local government area of Kano State. The animals were randomly distributed to 4 groups of 3 animals each. Each ram served as a replicate and an adjustment period of a week was allowed for the animals before data collection commenced. The feeding trial lasted for a period of 70 days. Water and salt lick were also offered *ad libitum*. The animals were quarantine in the College Farm, for two weeks, and given

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prophylactic treatment with Avomec® against *endo* and *exto* parasites and also treated with oxytetracycline HCl (a broad spectrum antibiotic). Prior to the experiment, the animals were managed intensively and group-fed with groundnut haulm and wheat offal.

Experimental Feeds Preparation

The principal ingredient for the experimental feed was rice straw which was collected from the rice farms in Bagwai Local Government Area of Kano State. The straws were sun dried on a floor for a period of 3 – 4 days depending on sunlight intensity and finally milled with a hammer mill to produce rice straw meals. Other feed ingredients for the preparation of the feed include the following: wheat offal, rice bran, cotton seed cake, groundnut haulm, maize, sorghum stover, salt and bone meal which were purchased from Kano metropolitan market.

Four complete experimental feeds were formulated using varying levels of rice straws to replace wheat offal at 0(control), 25, 50 and 75% inclusion levels (Table 1). The four experimental diets were used to feed the twelve (12) rams. The diets were designated as diets A, B, C and D representing experimental treatments.

Table 1. Composition of the Rice straw Meal Based Diets fed to Sheep

Ingredients (%)	Experimental Treatments			
	A	B	C	D
Rice straw	0	8.75	17.5	26.25
Wheat Offal	35	26.25	17.5	8.75
Rice Offal	10	15	20	20
Cotton Seed Cake	10	15	15	15
Groundnut Haulm	28	18	18	18
Maize	05	05	05	05
Sorghum Stover	10	10	05	05
Salt	1	1	1	1
Bone Meal	1	1	1	1
Total	100	100	100	100
Calculated Values (%)				
CP	14.66	13.73	12.73	11.52
CF	18.18	19.02	16.05	17.63

CP = crude protein, CF = crude fiber

Statistical Analysis

In this study completely randomized design (CRD) was used. Data collected was analyzed using Analysis of Variance (ANOVA). The treatment means were separated and compared using standard error of the mean (SEM), and Duncan's Multiple Range Test (DNMRT) as contained in SPSS (2013) for window 32, version 24.

RESULTS AND DISCUSSION

Effect of Feeding Rice Straw Based Diets on Haematological Profile of Yankasa Sheep

The results of the effect of feeding rice straw based diets on haematological profile of Yankasa sheep are presented in Table 2. White Blood cells (WBC), Haemoglobin (HGB) and Mean corpuscular haemoglobin (MCH) were not significant ($P>0.05$), while Red Blood Cell (RBC) and other parameters were significantly affected ($P<0.05$) by the level of inclusion of rice straw in the diets. The values for WBC ranges from 7.83 to 8.80 $10^3/$

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μL are within the values of 3.77 - 16.10 $\times 10^9/\text{l}$ reported by Mohammed and Saleh (2018) for fattening Yankasa sheep fed sugarcane peels containing diets. The WBC of this study is also comparably with the test diets of the study of Aruwayo *et al.* (2011) for haematological parameters of *Uda* lambs fed graded levels of alkali -treated neem kernel cake with the values of 11.67 - 8.90 $10^9/\text{l}$. Yankasa sheep seem to possess protective system, providing a rapid and potent defense against any infectious agent and this is probably the experimental animals and did not have diseases that could have altered the white blood cells and the differentials from the normal range for a sheep. The RBC reported in this study of 4.65 to 6.57 $10^6/\mu\text{L}$ are lower to the normal values of 9 to 15 $10^6/\mu\text{L}$ reported by Banerjee (2007) for sheep and also lower than the values of 8.93 - 10.81 $10^6/\mu\text{L}$ for the study of Musa *et al.* (2016) for haematological profile of *Uda* ram fed graded levels of *Xylopiya aethiopicum*. The low RBC counts recorded for the sheep in the present study is likely for the animals to be high susceptibility to anemia-related disease conditions. The values of HGB (8.2 - 11.70 g/dl) for all the treatments in this study were within range of HGB (8-16 g/dl) of growing sheep reported by Coles (1986) and 9.37 - 10.50 dl values reported by Aruwayo *et al.* (2011). With the relatively higher HGB concentration observed in this study it is an advantage in terms of the oxygen carrying capacity of the blood. The values for Packed Cell Volume (PCV) for this result are comparable to the values of 38-45% reported by Swenson (1990). The values obtained for HGB and PCV show that the experimental diets were adequate for the nutritional requirements, and the test diets did not constitute any health hazards to the rams. The values of Mean corpuscular volume (MCV) 79.43 - 105.60 fl in this study are lower than the values of 102.02 to 112.40 fl obtained by Eyoh *et al.* (2016) for West African Dwarf Goats (WAD). However, values are higher than the normal values of 28 - 40 fl reported by Banerjee (2007) for sheep, which could have resulted from the release of immature red blood cells into the blood system (Merck, 1998). The MCH recorded in this study that ranges between 13.47 to 20.23pg is lower than the values of 31.0 - 32.65 pg reported by Aruwayo *et al.* (2011) for growing sheep. The results of MCH and Mean corpuscular haemoglobin Concentration (MCHC) of this study are closely related to results of MCH 30.4 - 32.65 pg and MCHC 35.07 - 37.23 g/dl respectively reported by Musa *et al.* (2016). MCV, MCH and MCHC blood indices are important for diagnosis of anemia in most animals and also serve a useful index of the capacity of the bone marrow to produce red blood cells (Awodi *et al.*, 2005; Saleh, 2017).

Table 2. Haematological Parameters of Yankasa sheep fed Rice Straw Containing Diets

Parameters	Treatments				SEM
	A	B	C	D	
WBC ($10^3/\mu\text{L}$)	8.23	7.83	8.80	8.03	1.32
RBC ($10^6/\mu\text{L}$)	4.65 ^b	5.87 ^a	6.57 ^a	6.12 ^a	0.36
HGB (g/dL)	9.27 ^b	11.40 ^a	11.70 ^a	8.20 ^b	10.82
PVC (%)	45.03	57.40	62.93	47.90	9.03
MCV (fL)	105.60	91.40	96.07	79.43	15.42
MCH (pg)	20.23 ^a	18.23 ^a	18.47 ^a	13.47 ^b	1.96
MCHC (g/dL)	20.37	20.30	19.67	20.33	5.01

SEM: standard error of mean ^{a,b,c} Means on the row with different superscripts are significantly ($p < 0.05$) different. WBC (white blood cell), RBC (red blood cell), HGB (Haemoglobin), PCV (packed cell volume), MCV (mean corpuscular), MCH (mean corpuscular haemoglobin) and MCHC (mean corpuscular haemoglobin concentration),

Effect of Feeding Rice Straw Based Diets on Serum Biochemistry Parameters of Rams fed Rice Straw Containing Diets of Yankasa sheep

The results of the effect of feeding rice straw based diets on serum biochemistry profile of Yankasa sheep are presented in Table 3. Urea, sodium, bicarbonate (HCO_3), creatinine and Glutamic Oxaloacetic Transaminase (SGOT) were not significant ($P > 0.05$), while potassium, Glutamic Pyruvi Transaminase (SGPT) and alkaline

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phosphate were significantly affected ($P < 0.05$) by the level of inclusion of rice straw in the diets. The values for urea in this study that range between 4.67 to 6.23 mmol/L are similar to the result of 4.60 – 5.67 mmol/L obtained by Aruwayo *et al.* (2011) for sheep and higher than the values of 2.28 – 3.06 mmol/L reported by Musa *et al.* (2011) for sheep. The urea nitrogen level in the control and test diets were all within the normal range reported for sheep by Boyd (1984) and Coles (1986). The normal values of urea obtained in this study portends that the test diets provided adequate protein for the animals. This agrees with Coles (1986) that low dietary protein may result in decrease urea nitrogen. The urea levels in conjunction with creatinine (slightly below the normal range in this study) levels indicate normal liver Aruwayo *et al.* (2011). The sodium values recorded of 175.67 – 181.00 mEq/L are closely related to the study of Aruwayo *et al.* (2011). The high level of sodium in the blood of the animals in this study has been attributed to the variable dietary intake of salt which also resulted in the high values of chlorine of 91.00 -96.67 mEq/L. The values of potassium reported in this study that range between 4.40 – 5.70 mEq/L which are similar to the result of Aruwayo *et al.* (2011). The electrolytes being within normal range is an indication that the test ingredient may not interfere with the normal renal function of the animals Musa *et al.* (2016). Glutamic Pyruvi Transaminase (SGPT) values (9.47 – 13.57 IU/L) in this study were within the normal range reported by The Merck (1998). High SGPT could indicate liver flukes and pyrrolizidine alkaloid toxicity. However, high levels of SGPT can be normal in growing animals due growth of bones Musa *et al.* (2016). The values of Glutamic Oxaloacetic Transaminase (SGOT) of 115.00 – 152.00 IU/L in this study are closely related to the values of 47.3 - 129.0 IU/L reported by Musa *et al.* (2016). These values were lower than the values of 15- 44u/l for SGPT reported by Boyd (1984). The SGOT in this study is above the normal values. The variation of serum biochemistry parameters may also due to the differences in feed, methods, of collection and handling of blood samples, differences in environment, sex, age and so on. Musa *et al.* (2016) indicate that the animals with higher SGOT may have liver disorder when they ingest test ingredients in high quantity which will interfere with liver dysfunction. But the experimental animals in the present study were physically healthy before and after taking blood samples. Aruwayo *et al.* (2011) reported that the level of SGOT is helpful for the diagnosis and following of cases of myocardial infarction, hepatocellular disease and skeletal muscle disorders and also in trauma or in diseases affecting skeletal muscle, after a renal infarct and in various haemolytic conditions. However, inclusion of rice straw in the experimental diets indicates that the straw is not toxic to the liver. Moreover, SGPT and SGOT are excellent markers of liver damage caused by exposure to toxic substances.

Table 3. Serum Biochemistry Parameters of Yankasa sheep fed Rice Straw Containing Diets

Parameters	Treatments				SEM
	A	B	C	D	
Urea (mmol/L)	6.23	6.00	4.67	4.97	0.76
Sodium (mEq/L)	180.33	181.00	175.67	177.33	4.45
Potassium(mEq/L)	4.40 ^c	4.90 ^{bc}	6.27 ^a	5.70 ^{ab}	0.43
Chlorine (mEq/L)	91.00 ^b	96.67 ^a	93.33 ^{ab}	96.33 ^a	2.16
HCO ₃ (mg/dL)	73.33	67.67	104.00	69.33	27.21
Creatinine (mg/dL)	0.77	0.70	0.93	0.90	0.11
SGOT(IU/L)	152.00	117.00	121.67	115.00	16.59
SGPT(IU/L)	13.57 ^a	12.63 ^a	9.47 ^b	11.93 ^{ab}	1.15
ALP (IU/L)	244.33 ^a	152.00 ^{ab}	125.33 ^{ab}	72.67 ^b	50.17

SEM: standard error of mean ^{a,b,c} Means on the row with different superscripts are significantly ($p < 0.05$) different. HCO₃ = Bicarbonate; SGOT = Glutamic Oxaloacetic Transaminase or Aspartate Aminotransferase (AST); SGPT = Glutamic Pyruvi Transaminase or Alanine Aminotransferase (ALT). ALP = Alkaline Phosphate.

CONCLUSIONS

The haematological and serum biochemistry of sheep fed rice straw containing diets presented in this study indicated that incorporation of rice straw up to 50% replacement level seems more safely for the animals more especially if the diet will be used for longer period of feeding. From the present study, it can be concluded that the haematological and biochemical parameters for sheep studied in this experiment fall within recommendations. Therefore, this study recommends that rice straw could be incorporated into the sheep diet up to 50% as replacement level for wheat offal without any health challenge. Moreover, the feeds are fit for animal consumption.

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