

**Original Research Article**

**Feed Efficiency and Blood Profiles of West African Dwarf Goats fed *Pleurotus Tuber-regium* Biodegraded Rice Straw and Maize Offal - Brewer Yeast Slurry Mixture**

**ABSTRACT**

---

**Aim:** This study was conducted to evaluate the effect of feeding *Pleurotus Tuber-regium* biodegraded rice straw (PTTRS) and maize offal: brewer yeast slurry mixture (MOBYS) on feed efficiency, haematological and serum biochemical profiles of West African Dwarf (WAD) goats

**Study Design:** The Completely Randomized Design was used for the study

**Place and Duration of the Study:** The study was conducted at the Sheep and Goat Unit section of the University of Agriculture Makurdi Livestock Teaching and Research Farm, Makurdi, Nigeria. Makurdi is located at Latitude 7° 43' N and Longitude 8° 31' E. The Experiment lasted for 90 days.

**Methodology:** Twenty four West African Dwarf (WAD) goats weighing 8.05 kg on the average were allotted to six groups of four goats per treatment in a completely randomized design for the study. The six dietary treatment groups were fed varying levels of MOBYS, and *ad libitum*, untreated rice straw (UTRS) and *Pleurotus tuberregium* treated rice straw (PTTRS) thus: T1= 100 g MOBYS and UTRS (control) *ad libitum*, T2=100 g MOBYS and PTTRS *ad libitum*, T3=200 g MOBYS and UTRS *ad libitum*, T4=200 g MOBYS and PTTRS *ad libitum*, T5=300 g MOBYS and UTRS *ad libitum*, and T6=300 g MOBYS and PTTRS *ad libitum*. Parameters measured were feed efficiency, haematological and serum biochemical profiles. On the last day of the study, blood was collected from jugular veins of the goats into previously prepared tubes and sent for analysis. The blood was analyzed for hematological and serum biochemistry parameters using Midray 3500 Autohaematology Analyzer. Feed efficiency was calculated as the difference in weight between the final and initial weights divided by the amount of feed consumed between the dates the initial and final body weights were taken

**Results:** Feed efficiency values were 0.059, 0.061, 0.066, 0.068, 0.068 and 0.069 Kg for T1, T2, T3, T4, T5 and T6 respectively and the values showed no significant difference ( $P=0.30$ ). Values obtained for haematological parameters for T1, T2, T3, T4, T5 and T6 were as follows: Packed cell volume (PCV) 24.20, 24.80, 26.30, 27.00, 30.40 and 30.80%; haemoglobin (Hb) 8.50, 8.52, 9.02, 9.25, 11.20 and 11.40 g/dl; red blood cells (RBC) 13.10, 13.00, 14.12, 14.72, 15.80 and 16.20  $\times 10^6$  ul; white blood cells (WBC) 8.10, 8.70, 8.80, 8.60, 8.10 and 8.70  $\times 10^6$  ul; mean corpuscular volume (MCV) 22.85, 23.20, 23.70, 23.80, 24.20 and 24.80 fl; mean corpuscular haemoglobin (MCH) 6.93, 7.02, 7.07, 7.10, 7.24 and 7.36 pg and mean corpuscular haemoglobin concentration (MCHC) 33.10, 33.40, 32.80, 33.50, 33.40 and 33.00 g/dl respectively while corresponding values for the serum

biochemical parameters were: urea 17.21, 17.00, 17.30, 17.80, 17.50 and 17.60 mmol; total protein (TP) 68.60, 68.30, 69.10, 69.00, 70.70 and 70.80 g/dl; albumin (ALB) 32.10, 32.0, 32.0, 32.3, 32.8 and 32.90 g/dl; globulin (GBL) 46.48, 46.28, 46.85, 47.88 and 47.90 g/dl; Serum Glutamic Oxaloacetic Transaminase (SGOT) 198.10, 198.60, 198.60, 198.10, 198.80 and 198.90 iu/l; Serum Glutamic Pyruvic Transaminase (SGPT) 95.30, 96.10, 95.80, 96.00, 95.60 and 95.40 mg/dl and creatinine 101.20, 103.00, 102.10, 103.20, 102.80 and 103.00 umol/l respectively. Significant ( $P=0.02$ ) were observed in only the PCV, Hb, RBC, GBL and creatinine; in general all the haematological and serum biochemical profile values were within the reference ranges.

**Conclusion:** It was concluded that feeding the test inputs at increasing levels improved the feed efficiency, haematological and serum biochemical parameters of the West African Dwarf goats.

10

11 Key words: Feed- efficiency; blood- profiles; rice- straw; biodegraded; maize -offal; brewer –yeast-  
12 slurry

### 13 1. INTRODUCTION

14 Many evaluation tools are used to assess the efficacy of production by farm animals to enable quality  
15 decision making. One of such tools is feed efficiency which assesses how much of a product that is  
16 produced per unit of feed. This assessment is important because feed cost contributes substantially to  
17 farm cost; additionally feed is a very critical input that must be utilized at the best options. Factors  
18 affecting feed efficiency include genetics, environment and diet. Feed efficiency can be improved by  
19 increasing diet digestibility, increasing forage fibre (NDF) digestibility, stimulating rumen microbial  
20 digestion, optimizing feed intake, maintaining the animal in an adequate environment, in optimal  
21 health and management and optimal growth rates [1]. The transformation of food energy into products  
22 of animal origin, as in any other energy transformation system, is not devoid of losses since there is  
23 an efficiency by which the food energy is used for maintenance and production [2]. [3] reported feed  
24 efficiency values of 0.122 and 0.167 Kg for Spanish and Tennessee Stiff – legged breeds from  
25 weaning to six months and 0.088 and 0.104 Kg from nine to 13 months respectively implying that the  
26 Tennessee Stiff – legged breed was more efficient in converting feed to weight gain compared to the  
27 Spanish breed. The authors also asserted that feed intake is one of the most important factors in  
28 allowing meat animals to express their genetic potentials.

29 Blood performs an important role in the overall well being of the animal. It is often difficult to assess  
30 the correct health status of an animal without recourse to an examination of its blood, as it is a fast  
31 and readily available technique employed in assessing clinical, nutritional and health status of

32 animals, as well as giving some insight into their production performance potential [4]. Baseline data  
33 on haematological and biochemical values could be used for diagnosis of disease, for criteria of  
34 adaptability as well as to elucidate some physiological mechanisms in WAD goats [5]. Haematological  
35 parameters assessment is an important and reliable medium used to monitor and evaluate health and  
36 nutrition status of animals [6]. Nutrition is one of the factors that affect blood chemistry [7]. It is  
37 expected that where feeds are most efficiently utilized, there should be a corresponding blood picture  
38 to support such assertion. The aim of the study was to evaluate the feed efficiency and blood profiles  
39 of West African Dwarf goats fed *pleurotus tuber-regium* biodegraded rice straw and maize offal –  
40 brewer yeast slurry mixture.

41

## 42 **2. MATERIAL AND METHODS**

### 43 **2.1 Preparation of feed materials**

#### 44 **2.1.1 Gathering and processing rice straw**

45 Rice straw was gathered from rice farms around University of Agriculture, Makurdi environs after rice  
46 was harvested and threshed. It was baled and kept in store to prevent rain water from possibly  
47 wetting and spoiling it. Later, the rice straw was milled using a blur mill to reduce its particle size and  
48 create a greater surface area for microbial activity. The milled straw was then put in sacks and stored  
49 until required for use.

#### 50 **2.1.2 Mass composting of rice straw for experimental feeding of goats**

##### 51 **2.1.2.1 Preparation of inoculation rooms**

52 Floors, walls and doors of the inoculation room were swept, washed and disinfected using Dettol  
53 disinfectant in water at the rate of one litre Dettol to four litres of water. The floors were then mopped  
54 free of water and the doors left open for one week to enable drying of the room.

##### 55 **2.1.2.2 Composting of milled rice straw**

56 The milled rice straw was wetted with water at the rate of one kg straw to two litres of water and  
57 thoroughly mixed to enable complete wetting of the straw. Then the straw was heaped in one place  
58 and covered using polyethylene sheets to create an airtight environment suitable for composting [8].

59 The straw heap was turned inside out every other day for a total period of seven days after which the  
60 heap was spread out to enable cooling of the composted straw.

### 61 **2.1.2.3 Fungal inoculation of the straw.**

62 Tubers of *Pleurotus tuberregium* (PTR), obtained from dealers were weighed, washed and soaked in  
63 water for one hour after which they were removed and put in white transparent buckets and covered  
64 for two days to enable spore formation of the tubers. After two days, the PTR were removed and  
65 dissected to smaller bits carrying the spores. The composted straw was loaded on three tier wooden  
66 trays of dimension 1.5 m x 1.2 m x 0.75 m (height, breadth and width) constructed using 2x2" wood  
67 and wire mesh base. The base of the wooden tray was covered with white transparent polyethylene  
68 sheet disinfected using methylated spirit soaked cotton wool. Spores of PTR were then inoculated into  
69 the composted rice straw at the rate of one kg spores to five kg straw. The ends of the polyethylene  
70 sheets were then brought together and sealed using masking tape to create an airtight environment.  
71 Water was then poured on the room floor and some left in buckets after which doors of the inoculation  
72 room were closed. After 30 days, the mass of composted straw now colonized by mycelium of the  
73 fungi showing whitish growths was taken out of the inoculation trays from the inoculation room and  
74 sun dried to terminate growth of the fungi and dry the material. The material was then sun dried and  
75 then put in sacks and stored until required for use.

### 76 **2.1.3 Maize offal: brewer yeast slurry mixture (MOBYS) preparation.**

77 Maize offal was bought from mills, sun dried stored in sacks. Brewer yeast slurry was collected from  
78 Benue Brewery Limited, Makurdi, Nigeria, moved to the drying site and mixed with maize offal in the  
79 ratio of 1:1 by weight and sun dried with constant turning to prevent lumps from following. After sun  
80 drying, the MOBYS was then put in sacks and stored.

## 81 **2.2 Goat pen preparation**

82 The goat pen having cages for individual housing and feeding of the goats were used. The individual  
83 cages were constructed using 2x2" wood with lockable doors. Dimensions of the cages were 1.27 m x  
84 1.2 m x 0.7 m (height, breadth and width). The cages were thoroughly swept, washed, disinfected and  
85 left to dry. The entire pen was then fumigated using Sniper (2, 3 – dichlorovinyl dimethyl phosphate)  
86 and Marshal (Lambda – cyhalothrin 2.5 EC) at the rate of 3 ml to 200 ml water and 20 ml to 20 liters

87 water respectively. The feeding troughs were constructed using wooden planks and were of the  
88 dimension 0.25 m x 0.25 m x 0.30 m (height, breadth and width).

### 89 **2.3 Acquisition of goats/ acclimatization**

90 24 Young WAD bucks weighing 8.05 kg on the average were sourced from areas of the state where  
91 vaccination against PPR had been carried out and conveyed to the farm. They were then exposed to  
92 a 30 day acclimatization period during which they were given prophylactics against endo and  
93 ectoparasites and a general antibiotic cover thus: Terramycin (long acting) @ 1.0 ml per goat, Eagle  
94 vitaflash @ 0.5 ml per goat, Pour on @ 1.0 ml per goat administered at backline of the goats,  
95 ivermectin @ 1.0 ml per 10kg live weight and iron Dextrant @ 1.0 ml per goat.

96 They were then randomly allocated to the six dietary treatments and caged individually.

### 97 **2.4 Animal feeding**

98 After acclimatization period, the goats were then exposed to the following dietary treatments for 90  
99 days:

100 T1 = 100 g MOBYS and untreated straw (RS) *ad libitum*

101 T2 = 100 g MOBYS and *Pleurotus tuberregium* treated rice straw (PTRRS) *ad libitum*

102  
103 T3 = 200 g MOBYS and RS *ad libitum*

104  
105 T4 = 200 g MOBYS and PTRRS *ad libitum*

106 T5 = 300 g MOBYS and RS *ad libitum*

107 T6 = 300 g MOBYS and PTRRS *ad libitum*

108 Four goats were used per treatment with each goat forming a replicate. The goats were also served  
109 water and Yalama Blogu Royal Mineral Licking Block *ad libitum*. Their drinking water and MOBYS  
110 were put in poultry chick drinkers and inserted into the feeding troughs while the untreated rice straw  
111 and PTRRS were served directly in the feeding troughs.

### 112 **2.5 Parameters Assessment**

#### 113 **2.5.1 Feed efficiency estimation**

114 Feed efficiency was calculated as the difference in weight between the final and initial  
115 weights divided by the amount of feed consumed between the dates the initial and final body  
116 weights were taken [3].

### 117 **2.5.2 Blood Parameters assessment**

118 On the last day of the study, blood was collected from jugular veins of the goats into  
119 previously prepared tubes and sent for analysis. The blood was analyzed for haematological  
120 and serum biochemistry parameters using Midray 3500 Autohaematology Analyzer within  
121 one hour of collection at the laboratory of the University of Agriculture, Makurdi Veterinary Teaching  
122 Hospital.

### 123 **2.5.3 Experimental design and statistical analysis**

124 The experimental design used was the Completely Randomized Design. Data obtained were  
125 analyzed using [9], while significant differences in means were  
126 separated using Duncan Multiple Range Test as outlined by [10].

127

## 128 **3. RESULTS**

### 129 **3.1 Feed Efficiency**

130 The feed efficiency values of the experimental goats are shown in Table 1. The feed  
131 efficiency values were highest in T6, followed by T5, then T4, T3 and T2 while T1 had the  
132 least value. The feed efficiency values were not significantly different ( $P=.30$ ) from each  
133 other, though they increased with increased MOBYS intake.

### 134 **3.2 Haematological profile**

135 The haematological profile of the experimental goats is shown in Table 2. The results showed  
136 a similar pattern of PCV, Hb and RBC where highest values were obtained for T5 and T6,  
137 also significantly higher ( $P=.04$ ) than T3 and T4 values which were also significantly higher  
138 ( $P=.03$ ) than values of T1 and T2 which were similar to each other. These values increased  
139 with increasing MOBYS intake. Values of WBC, MCV, MCH and MCHC showed no  
140 significant difference ( $P=.10$ ).

### 141 **3.3 Serum biochemistry**

142 Serum biochemistry values of the WAD goats are presented in Table 3. From the results, serum urea,  
143 total protein, albumin, SGOT, SGPT and cholesterol values of the various treatments were statistically  
144 similar ( $P=.07$ ) and showed no specific pattern. Globulin values were highest for T6 and T5, followed

145 by T3 and T4 and lowest for T2 and T1 with the significant difference (P=.02) following same pattern  
 146 and corresponding with MOBYS intake pattern. Creatinine values were highest for the PTTRS fed  
 147 goats and also significantly higher (P=.02) than those of RS fed goats, a pattern that repeated itself as  
 148 MOBYS intake increased.

149 Table 1. Feed efficiency of WAD Goats Fed Fungal Treated Rice Straw Supplemented with Maize  
 150 Offal: Brewer Yeast Slurry Mixture

151

Parameter	T1	T2	T3	T4	T5	T6	SEM
Feed intake (Kg)	20.18	19.06	26.58	27.65	34.70	35.65	425.52
Weight gain (Kg)	1.19	1.17	1.75	1.87	2.37	2.45	0.007
Feed efficiency (Kg)	0.059	0.061	0.066	0.068	0.068	0.069	0.003

152 T1, T3 and T5 fed MOBYS and untreated rice straw  
 153 T2, T4 and T6 fed MOBYS and *Pleurotus tuberregium* treated rice straw

155 Table 2. Hematological Parameters of WAD Goats Fed Fungal Treated Rice Straw Supplemented  
 156 With Maize Offal: Brewer Yeast Slurry Mixture

157

Parameter	T1	T2	T3	T4	T5	T6	SEM
PCV (%)	24.20 <sup>c</sup>	24.80 <sup>c</sup>	26.30 <sup>bc</sup>	27.00 <sup>b</sup>	30.40 <sup>a</sup>	30.80 <sup>a</sup>	1.14
Hb (g/dl)	8.50 <sup>c</sup>	8.52 <sup>c</sup>	9.02 <sup>bc</sup>	9.25 <sup>b</sup>	11.20 <sup>a</sup>	11.40 <sup>a</sup>	0.32
RBC (x 106/ul)	13.10 <sup>c</sup>	13.00 <sup>c</sup>	14.12 <sup>bc</sup>	14.72 <sup>b</sup>	15.80 <sup>ab</sup>	16.20 <sup>a</sup>	0.64
WBC (x 106/ul)	8.10	8.70	8.80	8.60	8.10	8.70	0.46
MCV (fl)	22.85	23.20	23.70	23.80	24.20	24.80	0.84
MCH (pg)	6.93	7.02	7.07	7.10	7.24	7.36	0.21
MCHC (g/dl)	33.10	33.40	32.80	33.50	33.40	33.00	0.56

158 a,b,c,---- Means on same row with different superscripts vary significantly (P=.05)  
 159 T1, T3 and T5 fed MOBYS and untreated rice straw  
 160 T2, T4 and T6 fed MOBYS and *Pleurotus tuberregium* treated rice straw  
 161 PCV= Packed Cell Volume; Hb= Haemoglobin; RBC= Red blood cells;  
 162 WBC= white blood cells MCV= mean corpuscular volume MCH= mean corpuscular  
 163 haemoglobin; MCHC= mean corpuscular haemoglobin concentration

164  
 165  
 166  
 167  
 168  
 169  
 170  
 171

172 Table 3. Serum Biochemical Parameters of WAD Goats Fed Fungal Treated Rice Straw  
 173 Supplemented With Maize Offal: Brewer Yeast Slurry Mixture  
 174  
 175

Parameter	T1	T2	T3	T4	T5	T6	SEM
Urea (mmol/l)	17.21	17.00	17.30	17.80	17.50	17.60	0.39
Total protein (g/dl)	68.60	68.30	69.10	69.00	70.70	70.80	1.20
Albumin (g/dl)	32.1	32.0	32.0	32.3	32.80	32.90	0.50
Globulin (g/dl)	46.48 <sup>c</sup>	46.28 <sup>c</sup>	46.85 <sup>b</sup>	46.68 <sup>b</sup>	47.88 <sup>a</sup>	47.90 <sup>a</sup>	0.15
SGOT (iu/l)	198.10	198.60	198.60	98.10	198.80	198.9	0.46
SGPT (mg/dl)	47.00	47.20	48.00	47.90	48.00	48.05	0.43
Cholesterol (mg/dl)	95.30	96.10	95.80	96.00	95.60	95.4	0.36
Creatinine (umol/l)	101.20 <sup>c</sup>	103.00 <sup>a</sup>	102.10 <sup>b</sup>	103.20 <sup>a</sup>	102.80 <sup>b</sup>	103.00 <sup>a</sup>	0.40

176 a,b,c,---- Means on same row with different superscripts vary significantly (P<0.05)  
 177 T1, T3 and T5 fed MOBYS and untreated rice straw  
 178 T2, T4 and T6 fed MOBYS and *Pleurotus tuberregium* treated rice straw  
 179 SGOT= Serum Glutamic Oxaloacetic Transaminase; SGPT= Serum Glutamic Pyruvic Transaminase

180

## 181 4. DISCUSSION

### 182 4.1 Feed Efficiency

183 The feed efficiency values obtained for the goats in this work are lower than those reported  
 184 by [3] who reported values ranging from 0.088 to 0.146 for Spanish and  
 185 Tennessee Stiff – legged breeds respectively. The low values reported in this work are  
 186 however explained by the fact that feed efficiency is affected by many factors including  
 187 genetics, environment and diet.

### 188 4.2 Haematological profile

189 The PCV values reported in this work fall within the range reported by other authors in the  
 190 country [11]; [12]. The significant difference agrees with the  
 191 works of [13], but disagrees with reports of  
 192 [14] [15]. The PCV in this study is reasoned to have been a  
 193 response to the crude protein status of the dietary treatments that were significantly different  
 194 among them. [16] had attributed lack of significant difference in PCV

195 values to marginal differences in crude protein content of diets while [11]  
196 attributed significant differences in PCV values to variation in crude protein levels of the  
197 diets. In this study, the dietary crude protein level varied from 15.72 % (T1) to 21.62 % (T6)  
198 and is believed to be responsible for significant variation in PCV values. [5] had noted that PCV is  
199 beneficial in assessing the protein  
200 status and possibly forecasting the degree of protein supplementation in goats.  
201 The Hb result of this study agrees with works of [13] but disagrees with that of [17]. This Hb result is  
202 attributed to the protein content of the dietary treatments. According to [12], low Hb values usually  
203 connote nutritional anaemia. In this study the nutrient status of the dietary treatments were high, thus  
204 eliminating possibility of nutritional anaemia, and giving credence to the significantly different Hb  
205 values for the different dietary treatments.

206 The RBC result agrees with works of [11] and [15] but contradicts that of [18]and [17]. The significant  
207 difference observed here in is reasoned to be related to the crude protein levels of the dietary  
208 treatments. According to [19], RBCs are the hemoglobin (iron-protein compound) containing cells of  
209 blood. The pattern of significance relates closely to the crude protein levels of the dietary treatments.

210 The WBC non significance agrees with works of [11] and [17] but contradicts those of [16] and [13].  
211 The non significance of WBC is reasoned to be caused by ability of the dietary treatments to confer  
212 similar body immunity against diseases. According to [5], similarity in WBC may imply conferment with  
213 similar immunity since WBC is known to fight disease; WAD goats seem to possess protective  
214 system, providing a rapid and potent defense against infectious agents and this is probably the  
215 physiological adaptation of the spp in zones characterized by disease prevalence.

216 The MCV values agree both in range and non significance with earlier report by [11], but contradicts  
217 report of [17]. The normal and similar values go to buttress the assertion by [20] that normal values  
218 could imply that the animals may neither stand the risk of haemoconcentration nor anaemia. This is  
219 supported by adequacy of the nutrient contents of the dietary treatments as well as nutrient intake by  
220 the experimental animals.

### 221 **4.3 Serum Biochemistry**

222 The urea values reported agree with works of [15], [17] and [12]. The range of urea values and non  
223 significance is reasoned to be due to sufficiency of protein quality fed the experimental animals.

224 According to [5], higher values of urea (above reference range) could be attributed to an imbalance in  
225 amino acids, indicating the diet had lower biological value. Increased catabolism of amino acids when  
226 protein of lower biological value is fed is responsible for high urea values.

227 Total protein values herein agree with results of [11], [12] and [21] but disagree with results of [13].  
228 High values of TP have been noted to be suggestive of high protein quality of the diet and health  
229 status of the animals[22]; [12]. Since the diets provided suitable nutrient in quantity and quality, it is  
230 reasoned that the similarity in total protein values is normal. Moreso, [12] had reported that total  
231 protein values could be constant at a fairly large range of dietary protein.

232 Albumin values reported in this work agree with reports of [11], [12] and [21]. [11] and [15] had  
233 reported significant effect of location and high tannin content feeds on ALB of WAD goats. In this  
234 study, the experimental animals were kept in same location and also high tannin was not in the  
235 experimental diets.

236 The Globulin values showed a significant difference as was earlier reported by [13] and [16] and [15].  
237 The report however contradicts that of [11] and [17]. The significantly different globulin values are  
238 however of no consequence because they all fall within the reference range.

239 SGOT values in this work are in agreement with work of [17]. It is reasoned that the experimental  
240 diets contained no intrinsic factor that could have caused a serious challenge to the heart and/or liver  
241 to make elevated SGOT quantity to be detected in the blood. SGOT is an enzyme that is normally  
242 present in the liver and heart cells and is released into the blood when the liver or heart is damaged  
243 [23].

244 The SGPT values also agree with works of [24] and [17]. The SGPT values are reasoned to be so  
245 because of absence of any serious challenge to the heart or liver, or excess dietary protein. Blood  
246 SGPT levels are elevated with damage to liver or heart, or by some medications [23]; higher levels of  
247 SGPT may be due to the fact that higher values of the enzyme are required to contend with the high  
248 dietary protein content of the diet [25].

249 Cholesterol result herein is in agreement with works of [15], [17] and [21]. The cholesterol values all  
250 fall within the reference range and are thus expected to be beneficial to the animal. [26] had reported  
251 that blood cholesterol is not affected by feeding system; it shows an increasing trend after puberty. It

252 is also reasoned that with these cholesterol values, the animals would not face the risk of myocardial  
 253 infractions usually associated with high blood cholesterol content and emaciation due to low serum  
 254 cholesterol [27].

255 The Creatinine showed significantly different values for the dietary treatments, however, all the values  
 256 fell within the reference range. The significant effect reported herein disagrees with other workers  
 257 [11]; [17]; [21]. These creatinine values mean absence of any factor in the feed to portray its poor  
 258 quality and also negatively affect the stability and normal working of the kidney. According to [5]  
 259 serum Creatinine level is a useful indicator of glomerular filtration in the kidney, normal values indicate  
 260 animals are not in a catabolism situation and kidney function is improved, consequently, the animal is  
 261 in good nutritional condition.

## 262 5. CONCLUSION

263 It was concluded that feeding the test inputs at increasing levels improved the feed efficiency,  
 264 haematological and serum biochemical parameters of the West African Dwarf goats.

## 265 REFERENCES

- 266 1. Ishler V, White R. Feed efficiency in dairy heifers. Accessed on line at the Pennsylvania state  
 267 university (US) [https://extension.psu.edu/feed efficiency in dairy heifers](https://extension.psu.edu/feed%20efficiency%20in%20dairy%20heifers) on 20/12/2017 at  
 268 00:41  
 269
- 270 2. Henrique DS, Vieira RAM, Malafia PAM, Mancini MC, Goncalves AI. Estimation of the total  
 271 feed efficiency of Metabolizable energy utilization for maintenance and growth by cattle in  
 272 tropical conditions. *Revista Brasileira de Zootecnia* 34: 1006 – 1016. 2005
- 273 3. Dzakuma JM, Risch E, Smith O, Blackburn H.D. Level of feed intake on performance of two  
 274 goat genotypes. *South African Journal of Animal Science* 34(Supplement 1) 38 – 41. 2004
- 275 4. Aderemi FA, Tewe OO, Adesehinwa OK. Utilization of cassava root and leaves in diets for  
 276 layers. *Tropical Veterinarian* 18:213-219. 2000
- 277 5. Daramola JO, Adeloye AA, Fatoba TA, Soladoye AO. Hematological and biochemical  
 278 parameters of West African Dwarf goats. *Livestock Research for Rural Development*. 17 (8):  
 279 28-38. 2005
- 280 6. Gupta AR, Putra RC, Sanni M, Swarup D. Hematology and serum biochemistry of Chital (Axis  
 281 axis) and barking deer reared in semi captivity. *Veterinary Research Communication*. 31:801-  
 282 808. 2007
- 283 7. Akingbede AA, Nsahlai IV, Morris CD, Iji PA. Field activities and Blood profile of pregnant  
 284 South African indigenous goats after receiving dihydroxy pyridonepdegrading rumen bacteria  
 285 and grazing *Leucaena leucocephala* grass or natural pasture. *Journal of Agricultural Science*.  
 286 *Cambridge*. 138:103-113.2003
- 287 8. Oei P. Mushroom Cultivation. With Special Emphasis on Appropriate Techniques for  
 288 Developing Countries. CTA series. Tool publications, Leiden.56pp. 1996
- 289 9. Minitab Statistical Software . Minitab Statistical Software 1991, Rehearse 15.0. MiniTab Inc.,  
 290 State College, P.A. USA.
- 291 10. Steel RGD, Torrie JH. Principles and procedures of statistics. New York, McGraw-Hill Book  
 292 company. 633pp. 1980
- 293 11. Babayemi OJ, Bamikole MA., Oduguwa BO. Hematological and biochemical components of  
 294 West African Dwarf goats fed *Tephrosia bracteolata* based forage. *Tropical Animal*  
 295 *Investigation*. 6: 31-38. 2003

- 296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345
12. Oduguwa BO, Amole AO, Okwelum N, Shittu OO, Ogunlolu BT, Olajuyin SA. Performance and blood chemistry of West African Dwarf goats fed varying levels of pineapple and cassava peels waste basal diet. *Proceedings, 17<sup>th</sup> Annual Conference, Animal Science Association of Nigeria*, 9<sup>th</sup> -13<sup>th</sup> Sept. 2012, Abuja. Pp. 607-610.
  13. Imasuen JA, Isidahomen EC. Effect of different management environments on hematological characteristics of West African Dwarf goats. *Proceedings, 15<sup>th</sup> Annual Conference, Animal Science Association of Nigeria* 13<sup>th</sup> -15<sup>th</sup> Sept. 2010 held at University of Uyo Pp. 204-206.
  14. Ifut OJ, Inyang UA, Ikpatt EA, Eyoh GD. Effect of management systems on hematology, parasite status and body mass index of West African Dwarf goats in University of Uyo farm. *Proceedings, 15<sup>th</sup> Annual Conference, Animal Science Association of Nigeria* 13<sup>th</sup> -15<sup>th</sup> Sept. 2010 held at University of Uyo Pp 656-658.
  15. Olafadehan OA, Obun CO, Yusuf AM, Okinade SA, Suleiman MK. Hematological and Biochemical indices of Red Sokoto goats fed tannin rich *Pterocarpus erinaceus* forage diets. *Proceedings, 16<sup>th</sup> Annual Conference, Animal Science Association of Nigeria* 12<sup>th</sup> -15<sup>th</sup> Sept. 2011 held at Kogi State University, Anyigba. Pp. 474-478.
  16. Arigbede AA, Aderinola AO, Akinlade JA, Sodeinde FG, Ameen SA, Mustapha WA. Growth performance and blood profile of West African Dwarf goats maintained on *Brachiaria brizantha-Gliricidia sepium* and *melinus minutiflora-Gliricidia sepium* mixture. *Proceedings, 32<sup>nd</sup> Annual Conference, Nigerian Society for Animal Production* 18<sup>th</sup> -21<sup>st</sup> March 2007 held at Calabar. Pp. 567-569.
  17. Ngi J. The nutritive potentials of sweet orange (*Citrus sinensis*) fruit peel meal for goat feeding. Ph.D. thesis, Department of Animal Production, University of Agriculture, Makudi, Nigeria. 125pp 2012
  18. Fasae OA, Akinlade AA, Yusuf A.O. Hematology of traditionally managed growing West African Dwarf goats as influenced by location and sex in Odeda area of Ogun State, Nigeria. *Proceedings, 16<sup>th</sup> Annual Conference, Animal Science Association of Nigeria* 12<sup>th</sup> -15<sup>th</sup> Sept 2011 held at Anyigba Pp. 163-166.
  19. Smith BR. Blood. Microsoft Encartha 2009 [DVD]. Redmonds, W.A: Microsoft Corporation 2008
  20. Fradson RD. Anatomy and Physiology of Farm Animals. 3<sup>rd</sup> Edition. Bialliere Tindall Publishers, London. Pp. 62-94. 1981
  21. Adediji OY, Falola OO, Popoola MA, Odetola OM, Areegbe AO, Saka AA. Growth performance and serum biochemistry of West African Dwarf goats fed diets containing processed wild cocoyam (*Colocasia esculenta*) urea meal. *Proceedings, 15<sup>th</sup> Annual Conference, Animal Science Association of Nigeria*, 8<sup>th</sup> -12<sup>th</sup> Sept. 2013, Abuja Pp. 355-358.
  22. Lawal E, Aderemi FA, Mosobalaje MA, Tewe OO. Supplementation of Palm kernel cake based diets with brewers dried yeast in growth response, hematology and serum biochemistry of fed broilers. *Tropical Journal of Animal Science*. 8 (1): 55-62. 2005
  23. MedicineNet. Webster's New world Medical Dictionary 2012. Retrieved at MedicineNet.Com <http://www.medterms.com> on 17<sup>th</sup> August, 2013.
  24. Sabry ASA. Biological treatments of some by-products in ruminants feeding. M.Sc. Thesis Al-Azhar University, Egypt. Pp161. 2007
  25. Ugwuneme, M.C. (2011). Effect of dietary palm kernel meal for maize on the hematological and Serum chemistry of broiler turkey. *Nigerian Journal of Animal Science*. 13: 103 – 112. 2011
  26. Zubcic D. Some Biochemical Parameters in the Blood of Grazing German Improved Fawn goats from Istria, Croatia. *Veterinarski Arhiv*. 71 (5): 237-244. 2001
  27. McDonald P, Edwards RA, Greenhalgh JFD, Morgan, CA. Animal Nutrition. 5<sup>th</sup> Edition. London Scientific and Technical Publishers, England. Pp 221-237. 1995