INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-3, Issue-1, Jan-Mar-2013 ISSN 2231-4490
Coden : IJPAES www.ijpaes.com

Received: 25th Dec-2012 *Revised: 02nd Jan-2013* *Accepted: 02nd Jan -2013*

Research article

HEMATOLOGICAL CHARACTERISTICS OF WEANED RABBITS FED LEAVES of TWO SELECTED BROWSE PLANTS and THREE TROPICAL GRASSES

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ABSTRACT: This study looks at the hematological characteristics of weaned rabbits fed three tropical grasses and the leaves of two selected tropical browse plants. The three grasses include *Tridax procumbens*, *Pannicum maximum* and *Pennisetum purpureum* and the two browse plants are *Myrianthus arboreus* and *Gmelina arborea*. Hematological characteristics studied include packed cell volume (PCV), hemoglobin (Hb), red blood cells (RBC), white blood cells (WBC), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and mean corpuscular volume (MCV). The study was carried out in the Research and Teaching Farm of the Delta State University Asaba Campus, Delta State Nigeria. Twenty (20) rabbits were used; significantly different means were separated using Duncan's Multiple Range procedure. Significance was reported at 5% level of probability. Significant ($P<0.05$) differences between the test diets were observed for the all the parameters measured, weekly variations existed, values obtained were within reported ranges.

Keywords: Hematological characteristics, weaned rabbits tropical leaves, browse plants

INTRODUCTION

The interest of animal nutritionists in recent years has been the search for cheaper locally available and nutritionally viable alternative feedstuff [1] [2]. Recent studies on the potentials of leaf meals in the diet of livestock [3] [4] have shown significant growth responses by animals fed such meals. Such leaf meals have been shown to yield relatively higher levels of crude protein and minerals and lower crude fiber levels than tropical grasses and are gaining acceptance as feedstuff in livestock diets and are considered to be non-conventional feeding materials [5] [6] [7] [8]. This has brought a growing realization in the use of plant leaf meals and grasses in the diet of livestock. The nutrient profile of some of these non-conventional feeding materials compare favorably well with some conventional feeding materials [9] [8] [10]. The African continent is faced with the shortage of animal protein, due to poor production performance of animals which has led to high cost of livestock and livestock products. This situation may not be due to insufficient number of livestock needed to meet the recommended animal protein intake, but may be due to low quality and quantity of feed especially during the dry season [11]. This could also be due to little knowledge of the potentials of non-conventional feed resources, the presence in some cases of anti-nutritional elements and the lack of proper storage capabilities especially over long periods [12]. Animal feed in terms of quantity and quality poses a major challenge to livestock production, feed costs may rise up to 60 per cent of the total cost of production necessitating a cheap and readily available feed source required for fast growth and reproduction [13]. Energy and nitrogen utilization in the dry season must be highly considered if high productivity in animals must be achieved. Given the scarcity and low nutritive value of forage during the dry season, there is need to feed animals with leaves from plant species that tend to retain their leaves during this period. Rabbits are highly prolific animals capable of increasing the animal protein intake of Africans. Their reputation for fast growth, short gestation period, early maturity, ease of management and their small sizes make them affordable [14]. Growth and reproductive performance of rabbits depend largely on their ability to obtain and digest feed effectively [15].

The beneficial effects of feeding rabbits with noted concentrate and forage rations have been observed [16] [15]. Their ability to digest feed however depends on the nutrient composition of the diet [17]. A range of between 12 and 22% protein has been suggested by several authors [18] [19]. A significant positive correlation exists between the protein content of the feed and the crude protein digestibility [20] which shows that the higher the protein content of the diet, the higher the digestibility of the proteins. It has also been shown [21] that feeding rabbits with green forage is sufficient just for maintenance. Studies have shown that a 50:50 mixture of *centrocema pubescens* and a maize concentrate diet is optimal for maximum performance [15]. Optimal performance of weaner rabbits fed a mixture of legumes and a maize concentrate diet has been attributed to the high content of digestible protein and energy contents of the diet [22]. Studies [23] [24] have shown that the use of some of these non-conventional feeding materials could produce some undesirable physiological and biological alterations when fed directly to the animals, which may manifest in the hematological characteristics of the animals. These qualities reflect physiological responses of animals to their health, environment and nutrition [25]. Hematological values are widely used to determine systemic relationships and physiological/pathological adaptations including the evaluation of good health conditions and diagnosis of various types of animal disease. [26]

This study therefore was carried out to ascertain the effect of feeding rabbits with three tropical grasses; *Tridax procumbens*, *Pannicum maximum* and *Pennisetum purpureum*, and the leaves of two tropical browse plants; *Myrianthus arboreus* and *Gmelina arborea*, on the hematological characteristics of the rabbits. Choice of browse plants is as a result of recent studies on the nutrient profile of the leaves [8] [10].

MATERIALS and METHODS:

This study was conducted in the rabbit unit of the Delta State University Research and Teaching Farm, Asaba Campus, Delta State Nigeria ($6^0$14'N and 6^0 49'E).

TEST MATERIALS and DIETS:

Fresh young leaves of *Tridax procumbens*, *Pannicum maximum*, *Pennisetum purpureum*, *Myrianthus arboreus* and *Gmelina arborea*, were collected from the farm lands within the university community and fed with normal concentrate diets.

The composition of the concentrate diet is given in Table 1 below. The diet was formulated to contain approximately 21per cent crude protein and 2340 kcal/kg metabolizable energy.

Table 1. Composition of concentrate diet (g/kg DM)

Maize	54
Soya beans	17
Fish meal	4
Wheat offal	20
Bone meal	2.2
Salt	1
Premix	1
Methionine	0.4
Lysine	0.4
Calculated crude protein	21%

The experimental diets were prepared as given below

Treatment 1 (T1 control): Concentrate diet + *Tridax procumbens* , Treatment 2 (T2): Concentrate diet + *Panicum maximum*,Treatment 3 (T3): Concentrate diet + *Pennisetum purpureum*,Treatment 4 (T4): Concentrate diet + *Myrianthus arboreus* Treatment 5(T5): Concentrate + *Gmelina arborea*

Tridax procumbens was chosen as the control diet because recent studies [27] [28] [29] have shown positive growth and production performances by rabbits fed diets with *Tridax procumbens*.

ANIMALS and THEIR MANAGEMENT:

Twenty weaned chinchilla rabbits of mixed sexes aged between 8 to 9 weeks were weighed individually and randomly assigned to the five experimental diets with four rabbits per treatment. Each rabbit was used as a replicate. The rabbits were housed singly in hutches. On arrival, the rabbits were given anti- stress drugs and multivitamins. The hutches, drinking and feeding equipment were cleaned daily. Weighed amounts of the experimental diets were given to the animals for a period of five weeks. Concentrate and forage were fed separately in a ratio of 1:2.

EXPERIMENTAL PROCEDURE:

Proximate analysis was carried out to determine the proximate composition of the forage using methods prescribed by AOAC [30]. Blood samples were taken weekly from the animals through venipuncture of the left ear. Parameters determined include; packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), hemoglobin (HB), mean corpuscular hemoglobin (MCH) mean corpuscular volume (MCV) and mean corpuscular hemoglobin count (MCHC).

STATISTICAL ANALYSIS:

Data collected were subjected to a one-way analysis of variance (ANOVA) procedure in a completely randomized design, using the IRRISTAT for windows (version 5.0) computer software. Duncan's Multiple Range Test [31] was used to separate the means at 5% level of probability.

RESULTS and DISCUSSION:

The results of the proximate analysis of the test forage given to the experimental animals are given in Table 2. Significant differences ($P<0.05$) exist between the means of the test forages. Moisture content of *Tridax procumbens* is significantly higher than the other test materials. *Myrianthus arboreus* has significantly ($P<0.05$) higher ash content than the other test materials. *Gmelina arborea* has significantly ($P<0.05$) higher ether extract values indicating a higher fat content. *Pannicum maximum* has significantly higher crude fiber values than the other test materials except *Pennisetum purpureum*. Crude fiber is useful for maintaining bulk motility and increased intestinal peristalsis by surface extension of the food in the intestinal tract [32]. It is also necessary for food digestion. The results show that the crude fiber content of all the test materials are within the ranges of reported values and are therefore suitable as feed materials for animals. Crude protein values are lower for the grasses compared with the leaves of the browse plants. Values for crude protein of the leaves of the tropical browse plants fall within the range of reported values [10].

The results for the weekly variation of the hematological characteristics of rabbits fed the experimental diets are given in Tables 3 to 7.There were no significant ($P>0.05$) differences in PCV between the test diets in week one. In week two however, significant ($P<0.05$) differences were observed, with rabbits fed diet T3 having the lowest values. However significant ($P<0.05$) differences were observed in weeks three to five. In week four results show that rabbits fed diet T5 had the highest values. In week five results obtained show that rabbits fed diet T2 had the highest values. Values obtained compare favorably with reported values [8] [33] [34].

Table 2 Proximate Composition of the forages (%)

Proximate composition	*T.procumbens* T1	*P.maximum* T2	*P.purpureum* T3	*M.arboreus* T4	*G.arborea* T5
Moisture	**2.05^{a}**	**1.23^{b}**	**1.10^{c}**	**1.25^{b}**	**2.00^{a}**
Ash	**9.65^{b}**	**2.12^{e}**	**6.11^{c}**	**13.05^{a}**	**4.24^{d}**
Ether extract	**4.25^{b}**	**1.45^{e}**	**2.61^{c}**	**1.82^{d}**	**5.25^{a}**
Crude fiber	**30.40^{b}**	**39.65^{a}**	**38.81^{a}**	**27.35^{bc}**	**24.25^{c}**
Crude protein	**1.31^{c}**	**0.88^{d}**	**0.95^{d}**	**18.0^{a}**	**14.6^{b}**

^{a,b,c} = Means with different superscript in the same row are significantly (P<0.05) different.

Results for hemoglobin show that the test diets did not affect significantly (P>0.05) the hemoglobin content of the animals in week one, in week two however, T1 had significantly (P<0.05) higher values. In weeks three and five, T5 had significantly (P<0.05) higher values than the other test diets. The RBC values of all the test diets did not reveal significant (P>0.05) differences between the means in weeks one and two. Significant (P<0.05) weekly increases were observed in the RBC values with significant (P<0.05) differences being observed in weeks three to five. *Myrianthus arboreus* had lower values than the other experimental diets. Studies [23] [24] have shown that high protein diets in rabbits could produce some undesirable physiological and biological alterations which may manifest in the hematological characteristics of the animal when fed such diets. Proximate analysis of the test diets show higher protein contents of *Myrianthus arboreus*. The results for WBC showed significant (P<0.05) differences between the means. Weekly variations were observed for all the experimental diets, with *Gmelina arborea* having significantly (P<0.05) higher values than the other test diets. Results for the MCH values reveal significant (P<0.05) differences between the means. These values differed slightly over the weeks. Rabbits fed diet T4 had significantly (P<0.05) higher values than the other test diets throughout the experimental period. Highest values were noted with rabbits fed diet T4. Significant (P<0.05) differences were observed for the MCHC values with variations throughout the experimental period. Slight variations were observed throughout the experimental period; however this would not necessarily be as a result of the experimental diets. Results obtained for the MCV values showed significant differences between the means. Rabbits fed diet T4 had significantly (P<0.05) higher MCV values than the other rabbits. Weekly variations were observed, with slight reductions being observed throughout the experimental period. This would be as a result of daily management and/or sample collection techniques and not as a result of the experimental diets.

Table 3 Week 1

Parameters	Control (T1)	*P.maximum* (T2)	*P.purpureum* (T3)	*M.arboreus* (T4)	*G.arborea* (T5)
PCV (%)	27.50^{a}	27.75^{a}	26.50^{a}	28.05^{a}	28.00^{a}
HB (g/dl)	5.50^{a}	5.87^{a}	5.60^{a}	6.10^{a}	6.05^{a}
RBC(10^{6}/ml)	3.64^{a}	3.72^{a}	3.90^{a}	3.76^{a}	3.90^{a}
WBC(10^{3}/ml)	2.05^{c}	3.95^{b}	3.50^{b}	5.50^{ab}	6.60^{a}
MCH (10^{-7}pg)	15.10^{c}	16.45^{b}	14.33^{c}	27.88^{a}	16.82^{b}
MCHC (%)	20.11^{b}	20.98^{b}	21.31^{ab}	19.02^{c}	22.45^{a}
MCV (10^{-7}fl)	75.70^{a}	76.77^{a}	67.95^{b}	78.20^{a}	73.95^{a}

^{a,b,c} = means with different superscript within the same row are significantly (P<0.05) different

Table 4 Week 2

Parameters	Control (T1)	*P.maximum* (T2)	*P.purpureum* (T3)	*M.arbnoreus* (T4)	*G.arborea* (T5)
PCV (%)	39.75[a]	34.75[a]	26.75[b]	40.00[a]	38.00[a]
HB (g/dl)	5.75[a]	3.23[b]	3.40[b]	2.10[c]	3.75[b]
RBC (10^6/ml)	6.50[b]	6.90[b]	7.60[a]	6.90[b]	6.55[b]
WBC (10^3/ml)	5.20[c]	4.90[c]	6.30[b]	4.75[c]	7.20[a]
MCH (10^{-7}pg)	6.15[a]	5.55[b]	4.90[c]	5.51[b]	6.25[a]
MCHC (%)	14.45[a]	10.56[c]	12.79[b]	5.31[d]	10.24[c]
MCV (10^{-7} fl)	46.23[c]	53.78[b]	41.65[c]	42.35[c]	58.25[a]

[a,b,c] = means with different superscript within the same row are significantly (P<0.05) different.

Table 5 Week 3

Parameters	Control (T1)	*P.maximum* (T2)	*P.penisetum* (T3)	*M.arboreus* (T4)	*G.melina* (T5)
PCV (%)	31.00[a]	28.00[a]	28.50[a]	27.50[a]	31.25[a]
HB (g/dl)	6.33[a]	5.85[c]	6.73[a]	6.13[b]	6.03[b]
RBC (10^6/ml)	20.80[a]	11.45[b]	12.15[b]	7.80[c]	14.70[bc]
WBC (10^3/l)	6.20[b]	5.95[b]	6.90[b]	5.35[c]	7.95[a]
MCH (10^{-7} pg)	4.45[d]	5.30[c]	5.70[c]	6.38[a]	7.12[a]
MCHC (%)	23.98[a]	20.99[a]	23.45[a]	22.93[a]	22.35[a]
MCV (10^{-7} fl)	15.23[d]	25.38[b]	18.23[c]	36.50[a]	31.73[a]

[a,b,c] = means with different superscript within the same row are significantly (P<0.05) different

Table 6 Week 4

Parameters	Control (T1)	*P.maximum* (T2)	*P.penisetum* (T3)	*M.arboreus* (T4)	*G.melina* (T5)
PCV (%)	20.00[b]	24.00[ab]	21.00[b]	23.25[ab]	27.50[a]
HB (g/dl)	5.88[a]	5.88[a]	5.28[a]	5.90[a]	5.50[a]
RBC (10^6/ml)	21.25[a]	15.75[b]	16.90[b]	10.35[c]	12.25[c]
WBC (10^3/ml)	6.20[b]	5.05[c]	4.85[c]	6.4[b]	7.50[a]
MCH (10^{-7}pg)	2.76[c]	3.76[c]	3.16[c]	6.71[b]	7.85[a]
MCHC (%)	29.99[a]	23.32[b]	25.45[b]	21.52[b]	19.85[c]
MCV (10^{-7}fl)	16.79[b]	16.07[b]	12.62[c]	23.10[a]	16.88[b]

[a,b,c] = means with different superscript within the same row are significantly (P<0.05) different

Table 7 Week 5

Parameters	Control (T1)	*P.maximum* (T2)	*P.penisetum* (T3)	*M.arboreus* (T4)	*G.melina* (T5)
PCV (%)	25.25[d]	38.50[a]	37.00[b]	37.25[b]	34.75[c]
HB (g/dl)	5.98[a]	5.95[a]	6.50[a]	5.25[b]	6.60[a]
RBC (10^6/ml)	24.95[a]	22.75[a]	23.75[a]	14.20[b]	23.50[a]
WBC (10^3/ml)	6.78[b]	7.25[ab]	8.80[a]	5.90[c]	7.95[a]
MCH (10^{-7}pg)	2.45[c]	2.60[b]	2.80[b]	6.80[a]	2.80[b]
MCHC (%)	17.05[a]	15.47[b]	17.57[a]	12.60[b]	19.02[a]
MCV (10^{-7}fl)	14.85[d]	17.10[b]	15.88[b]	27.40[a]	16.14[c]

[a,b,c] = means with different superscript within the same row are significantly (P<0.05) different

CONCLUSION

Results obtained do not reveal significant effects of the experimental diets on the hematological characteristics of the rabbits, except in rabbits fed diet T4 which had lower RBC values than the rabbits fed the other experimental diets. Values obtained generally are within the ranges of reported values [8] [33] [34]. The effect of these diets on growth performance would be a good indicator as to the suitability or otherwise of these forages in the diets of rabbits.

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