

Performance of West African Dwarf Goats fed *Pleurotus tuber-regium* Biodegraded Rice Straw and Maize offal: Brewer Yeast Slurry Mixture

ABSTRACT

Aims: To assess the growth performance of West African Dwarf Goats (WAD) fed rice straw biodegraded using *Pleurotus tuber-regium* (PTTRS) and maize offal mixed with fluid brewers' yeast slurry in a 1:1 ratio (MOBYS)

Study Design: Completely Randomized Design

Place and Duration of 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 tuber-regium* 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 Average daily feed intake (ADF), Average Daily body Weight Gain (ADBWG), Feed Conversion Ratio (FCR) and Average daily water intake (ADWI).

Results: Fungal treatment of rice straw together with MOBYS significantly ($P=0.05$) improved the daily feed intake, daily body weight gain and daily water intake from 224.20 g to 396.10 g, 13.20 g to 27.20 g and 620 ml to 1050 ml in T1 and T6 respectively.

Conclusion: combined feeding of the PTTRS and MOBYS to goats in confinement significantly improved feed intake, body weight gain, water intake and feed conversion ratio thereby portraying the feeding regime as a reliable dry season feed

Keywords: Performance, Goats, *Pleurotus tuber-regium*, Biodegraded, Rice Straw

1. INTRODUCTION

The growing human population has put a challenging responsibility on all stakeholders in the food production sector. This has necessitated research into tools for producing food to feed the ever increasing world population. Globally, there is an urgent need to increase livestock to meet the animal protein needs of the world's increasing population [1]. Shortages in availability and consumption of animal protein by Nigerians are worrisome due to its attendant effects on the citizenry [2]. For Nigerians to improve their animal protein intake, sustained production of livestock has been suggested [3]. Of these livestock, goat production is recommended due to its beneficial effects, some of which include provision of meat, milk, skin and hair, as a form of investment, assurance against

18 crop failure, prestige, sources of income and employment [4]. The population of goats in Nigeria has
19 been put at 53.8 million and were reported to have contributed 16% of the total domestically produced
20 meat in the country [5]. If these goats are well managed; they would substantially contribute their
21 products and increase Nigerians animal protein consumption profile [4].

22 The nutritional constraint to goat production is two way; availability of feed as well as quality of the
23 feed. To overcome availability of ruminant feeds on a year round basis, the combined use of crop
24 residues and agro industrial by-products is being researched on [6]. Nigeria, being an agrarian nation,
25 produces large quantities of crop residues each year after harvest, and as the crops are processed by
26 agro based industries, agro industrial by products are generated which need to be eliminated. One
27 crop residue produced in abundance in the country is rice straw [7]. Rice straw, the vegetative part of
28 rice plant which is left after grains have been harvested [8] is highly fibrous, low in digestibility, protein
29 content and palatability and high in oxalate content.

30 White rot fungi have been used extensively in recent times to investigate their effectiveness in
31 converting lignocellulose materials to more digestible feeds for ruminants. Fungal degradation of crop
32 residues is thought to have dual advantages of increased global food production and waste cycling
33 [9]. Improvement in nutritive quality of biologically treated crop residues and agro industrial by
34 products has also been reported by [10], [11], [12] amongst others.

35 Two by-products of agro processing industries that abound in the country are maize offal and brewer
36 yeast slurry. Maize offal is a product of maize processing. Its feed value is low and therefore cannot
37 be fed solely to animals for production unless when supplemented with a protein source [13]. Brewer
38 yeast slurry is a fluid by product of the beer brewing industry made up of spent yeast cells
39 (*Saccharomyces cerevisiae*). Once it is dried using an appropriate technique, it has high nutrient
40 content and has been effectively used as a feed input [14].

41 The study was carried out to evaluate the performance of West African Dwarf goats (WAD) fed
42 biologically treated rice straw and maize offal: brewer yeast slurry mixture.

43 **2. MATERIALS AND METHODS**

44 **2.1 Experimental Site**

45 The study was conducted at the Sheep and Goat Unit of the Livestock Teaching and Research Farm

of the University of Agriculture, Makurdi, Nigeria. Makurdi is located at Latitude 7° 43' N and Longitude 8° 31' E. The Experiment lasted for 90 days.

2.2 Processing of Experimental Feed Materials

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

2.2.1 Mass composting of rice straw for experimental feeding of goats

Floors, walls and doors of the inoculation room were swept, washed and disinfected using Dettol disinfectant (Formula: Chloroxylenol B.P.C 4.8% w/v, Oleum Pini Aromaticum 8.38% w/w, Isopropyl Alcohol 9.43% w/w, Sapo Vegetalis 5.60% w/w, Saccharum Ustum q.s, Aqua ad 100 vols., manufactured by Reckitt Benckiser, Nigeria Limited) in water at the rate of one liter Dettol to four liters of water. The floors were then mopped free of water and the doors left open for one week to enable drying of the room.

2.2.2 Composting of milled rice straw

The milled rice straw was wetted with water at the rate of 1.0 kg straw to 2.0 liters of water and thoroughly mixed to enable complete wetting of the straw. Then the straw was heaped in one place and covered using polyethene sheets to create an airtight environment suitable for composting [15]. The straw heap was turned inside out every other day for a total period of seven days after which the heap was spread out to enable cooling of the composted straw.

2.2.3 Fungal inoculation of the straw.

Tubers of *Pleurotus tuberregium* (PTR), obtained from dealers were weighed, washed and soaked in water for one hour after which they were removed and put in white transparent buckets and covered for two days to enable spore formation of the tubers. After two days, the PTR were removed and dissected to smaller bits carrying the spores. The composted straw was loaded on three tier wooden trays of dimension 1.5 m x 1.2 m x 0.75 m (height, breadth and width) constructed using 2x2" wood and wire mesh base. The base of the wooden tray was covered with white transparent polyethene

74 sheet disinfected using methylated spirit soaked cotton wool. Spores of PTR were then inoculated into
75 the composted rice straw at the rate of 1.0 kg spores to 5.0 kg straw. The ends of the polyethene
76 sheets were then brought together and sealed using masking tape to create an airtight environment.
77 Water was then poured on the room floor and some left in buckets after which doors of the inoculation
78 room were closed. After 30 days, the mass of composted straw now colonized by mycelium of the
79 fungi showing whitish growths was taken out of the inoculation trays from the inoculation room and
80 sun dried by spreading it thinly on a drying surface to terminate growth of the fungi and dry the
81 material. The material was then put in sacks and stored until required for use.

82 **2.2.4 Maize offal: brewer yeast slurry mixture (MOBYS) preparation.**

83 Maize offal was bought from mills, sun dried and stored in sacks. Brewer yeast slurry was collected
84 from Benue Brewery Limited, moved to the drying site and mixed with maize offal in the ratio of 1:1 by
85 weight and sun dried with constant turning to prevent lumps from following. After sun drying, the
86 mixture (MOBYS) was then put in sacks and stored.

87 **2.3 Proximate Composition and Fibre Fractions Analysis of Feed Materials**

88 Dry matter (DM) was determined by oven drying the milled samples to a constant weight at 105°C for
89 8 hours. Crude protein was determined as Kjeldahl nitrogen x 6.25. Ether extract, crude fibre and ash
90 were determined according to [16] method; gross energy was determined by use of bomb calorimeter
91 while the fibre fractions were determined by use of [17] method.

92 **2.4 Goat pen preparation**

93 The goat pen having cages for individual housing and feeding of the goats were used. The individual
94 cages were constructed using 2x2" wood with lockable doors. Dimensions of the cages were 1.27 m x
95 1.2 m x 0.7 m (height, breadth and width). The cages were thoroughly swept, washed, disinfected and
96 left to dry. The entire pen was then fumigated using Sniper (2, 3 – dichlorovinyl dimethyl phosphate)
97 and Marshal (Lambda – cyhalothrin 2.5 EC) at the rate of 3 ml to 200 ml water and 20 ml to 20 liters
98 water respectively. The feeding troughs were constructed using wooden planks and were of the
99 dimension 0.25 m x 0.25 m x 0.30 m (height, breadth and width).

100 **2.5 Acquisition of goats/ acclimatization**

24 Young WAD bucks weighing 8.05 kg on the average were sourced from areas of the state where vaccination against Pestes des Petit ruminants (PPR) had been carried out and conveyed to the farm. They were then exposed to a 30 day acclimatization period during which they were given prophylactics against endo and ectoparasites and a general antibiotic cover thus: Tridox L.A. (each ml solution contained 216 mg oxytetracycline dehydrate equivalent to 200 mg oxytetracycline; manufactured by FARVET laboratories Handelsweg 25, 5531 AE Bladel, Holland) @ 1.0 ml per goat administered intramuscularly; kepro vitaflash injectable multivitamins (composition per ml: vitamin A 4,500 iu; vitamin D3 1,000 iu; vitamin E acetate 10 mg; vitamin B1 HCL 12 mg; vitamin B2 Phosphate sodium 2.0 mg; vitamin B6 HCL 10 mg; vitamin B12 5.0 µg; Folic Acid 0.1 mg; vitamin K3 1.0 mg; Nicotinamide 20 mg; vitamin C 1.0 mg D-Panthenol 1.0 mg; manufactured by KEPRO B.V. Maagdenburgstraat 17 7421 ZA Deventer Holland) @ 0.5 ml per goat administered sub cutaneously, Pour on (100 ml contained: Cipermetine 5.0 g; Chlorpyrifos 7.0 g; Piperonile Butoxide 5.0 g; Citronellol 0.5 g; Qsp 100 ml) @ 1.0 ml per goat administered at backline of the goats, Ivomec (ivermectin 1.0%) @ 1.0 ml per 10kg live weight administered sub cutaneously and iron Dextran injection (each ml solution contained iron dextran equivalent to 100 mg iron; manufactured by Hebei Huarun Pharmacy Co., Ltd. No. 83, East Gucheng Road, Shijiazhuang, Hebei, China) @ 1.0 ml per goat administered intramuscularly.

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

2.6 Feeding of Experimental Goats

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

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

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

T3 = 200 g MOBYS and RS *ad libitum*

T4 = 200 g MOBYS and PTRRS *ad libitum*

T5 = 300 g MOBYS and RS *ad libitum*

T6 = 300 g MOBYS and PTRRS *ad libitum*

Four goats were used per treatment with each goat forming a replicate. The goats were also served water and Yalama Blogu Royal Mineral Licking Block *ad libitum*. Their drinking water and MOBYS

were put in poultry chick drinkers and inserted into the feeding troughs while the untreated rice straw and PTTRS were served directly in the feeding troughs.

2.7 Performance indices assessment

Weighed quantities of the feed and water were offered to the goats daily and intake was determined from the refusals collected the following day and weighed. Body weight observations were taken weekly on the first day of the week before feeding was done. Feed conversion ratio was calculated using the formula $FCR = \text{Total feed intake (g)} / \text{Total weight gain (g)}$

2.8. Data Analysis

Data generated was subjected to Analysis of Variance (ANOVA) using MiniTab Statistical Software and significant differences (at 95% probability) in means were separated using Duncan New Multiple Range Test as outlined by [18]

3. RESULTS

3.1 Nutrient Profile of Feed Materials

The nutrient profile of experimental feed materials is shown in table 1 while the fibre fractions are shown in Table 2. The proximate composition shows that there was an increase in dry matter (DM), crude protein (CP), ash, and gross energy (GE) when *Pleurotus tuberregium* was used to treat rice straw (RS), while the crude fibre (CF), ether extract (EE) and nitrogen free extracts (NFE) decreased as a consequence of the fungal treatment.

Table 1. Nutrient Composition of Feed Materials (on as fed basis)

Feed Material	DM (%)	CP (%)	CF (%)	EE (%)	ASH (%)	NFE (%)	Gross Energy (Mcal/Kg)
Untreated rice straw	90.13	8.32	34.14	2.91	5.88	48.75	3.32
Treated rice straw*	91.31	11.33	28.78	2.87	10.90	46.12	3.47
Maize offal	90.70	12.19	10.87	2.10	3.89	70.95	3.571
Brewer yeast slurry	15.21	44.08	4.21	1.70	9.36	40.65	3.612
MOBYS **	90.48	25.6	15.6	10.2	9.10	39.5	4.265

*Treated rice straw = *Pleurotus tuberregium* treated rice straw

**MOBYS = Maize offal: Brewer yeast slurry mixture at ratio of 1:1

DM= Dry Matter CP= Crude Protein CF= Crude Fiber EE= Ether Extracts

NFE= Nitrogen Free Extracts

Table 1. Fibre Fractions of the Feed Materials

FIBRE FRACTION	UTRS	PTTRS	MOBYS
NDF (%)	72.06	77.43	22.5
ADF (%)	51.31	6.14	13.15
ADL (%)	11.39	1.43	1.07
HEM (%)	20.75	71.29	9.35
CL (%)	39.92	4.71	12.08

NDF= Neutral Detergent Fibre ADF= Acid Detergent Fibre ADL= Acid Detergent
Lignin HEM= Hemicellulose CL= Cellulose UTRS=Untreated Rice
Straw PTTRS=*Pleurotus tuber-regium* treated Rice Straw MOBYS=Maize offal:
Brewer Yeast Slurry Mixture

3.2. GROWTH PERFORMANCE

Results of growth performance of WAD goats fed PTTRS supplemented with MOBYS is presented in Table 3. There was no significant difference ($P=.435$) in the initial body weights of the goats but final body weights of goats in T5 and T6 were higher and significantly different ($P=.00$) from those of T3 and T4 which were also higher and significantly different ($P=.00$) from those of T1 and T2. Daily rice straw and PTTRS intakes did not differ significantly ($P=.32$) among the dietary treatments. Mean daily total feed intake of T6 was highest and significantly different ($P=.00$) from the other treatments. This was followed by the other treatments in the order of T5, T4, T3, T1 and T2 which were significantly different ($P=.00$) from each other. Percent dry matter feed intake increased with increasing total daily feed intake and followed the order of T6, T5, T4, T3, T1 and T2; it showed significant difference ($P=.00$) where T6 and T5 were the highest and similar to each other, but significantly different ($P=.00$) from the other treatments. This was followed by T4 and T3 which were similar to each other but significantly ($P=.00$) different from T2 and T1 which were similar to each other. Mean daily metabolic rice straw intake and mean daily metabolic PTTRS intakes did not differ ($P=.28$) significantly among the dietary treatments. Mean daily metabolic MOBYS intake and Mean daily metabolic total feed intakes followed the patterns of mean total daily MOBYS intake and mean total daily feed intake. Values of mean daily body weight gain recorded for T5 and T6 were the highest and significantly different ($P=.00$) from the rest followed by T3 and T4 which were also higher and significantly different

Table 3. Performance of WAD Goats Fed Fungal Treated Rice Straw and Maize Offal: Brewer's Yeast Mixture

Parameter	T1	T2	T3	T4	T5	T6	SEM
Initial B.W. (Kg)	8.10	8.25	8.20	8.15	8.25	8.10	0.07
Final B.W (Kg)	9.29 ^c	9.42 ^c	9.95 ^b	10.02 ^b	10.62 ^a	10.55 ^a	0.09
D. RS intake (g)	128.50	-	120.60	-	115.30	-	4.22
D. PTTRS intake (g)	-	115.60	-	119.50	-	10.50	2.62
D. MOBYS intake (g)	95.70 ^e	96.20 ^e	174.70 ^d	187.74 ^c	270.20 ^b	285.60 ^a	4.79
D. TF.intake (g)	224.20 ^e	211.80 ^f	295.30 ^d	307.24 ^c	385.50 ^b	396.10 ^a	3.56
DM feed intake (%)	2.18 ^c	2.04 ^c	2.68 ^b	2.78 ^b	3.28 ^a	3.41 ^a	0.09
Total FI (Kg)	20,178	19,062	26,577	27,652	34,695	35,649	
D. RS intake m.	38.16	-	36.38	-	35.14	-	0.94
D. PTTRS intake m	-	35.25	-	36.14	-	34.07	0.61
D. MOBYS intake m	30.59 ^e	30.72 ^e	48.03 ^d	50.72 ^c	66.63 ^b	69.47 ^a	0.92
D. TF intake m.	57.93 ^e	55.52 ^f	71.23 ^d	73.38 ^c	87.00 ^b	88.79 ^a	0.64
D.BWG(g)	13.20 ^c	13.00 ^c	20.00 ^b	20.80 ^b	26.30 ^a	27.20 ^a	1.03
D.BWG m.	6.92 ^c	6.85 ^c	9.45 ^b	9.74 ^b	11.61 ^a	11.90 ^a	0.36
T.BWG (Kg)	1.19 ^c	1.17 ^c	1.75 ^b	1.87 ^b	2.37 ^a	2.45 ^a	0.07
T.BWG m.	1.14 ^c	1.12 ^c	1.52 ^b	1.60 ^b	1.91 ^a	1.96 ^a	0.05
FFCR	16.96	16.29	15.19	14.79	14.64	14.55	0.79
D.WI (ml)	620 ^c	615 ^c	850 ^b	890 ^b	1030 ^a	1050 ^a	30.97

**MOBYS = Maize offal: Brewer yeast slurry mixture at ratio of 1:1

a,b,c,d,e---- Means on same row with different superscripts vary significantly (P=.05)

T1, T3 and T5 fed MOBYS and rice straw

T2, T4 and T6 fed MOBYS and PTTRS

PTTRS = Pleurotus tuberregium treated rice straw; m= metabolic weight; WI= water intake

RS= Rice Straw; TF= Total Feed; BW= Body Weight; D= Daily; BWG= Body weight gain.

(P=.00) from those of T1 and T2 which were the least and similar to each other. This pattern of performance was followed by mean daily metabolic body weight, total body weight gain as well as total metabolic body weight gain. Feed conversion ratios of T1 and T2 were the highest but values for all the treatments were not significantly different (P=.18) Mean daily water intake also followed the pattern exhibited by mean daily body weight gain.

3.3 Nutrient Intake (Dry Matter Basis)

The nutrient intake on dry matter basis by the WAD goats is shown in Table 4. Organic matter intake was highest in T6 being significantly different ($P=.03$) from the rest of the treatments. It was followed in the order of T5, T4, T3, T1 and T2 which were all significantly different ($P=.03$) from each other. Highest crude protein intake was recorded for T6, followed by T5, T4, T3, T2 and T1 which were also significantly different ($P=.01$) from each other. Crude fiber intake was highest for T5 and was significantly different ($P=.04$) from the remaining treatments, followed by T6 and T4, significantly different from each other and also from T1, T2 and T3 which were statistically similar. Ether extract intake followed the pattern of organic matter intake, except that T1 and T2 were not different ($P=.02$) from each other. Nitrogen free extracts intakes of T5 and T6 were similar to each other but significantly different ($P=.03$) from T3 and T4 which were also significantly different from T1 and T2. Ash intake generally followed the pattern of crude protein intake in quantities and statistical significance.

Table 4. Nutrient Intake of WAD Goats Fed Fungal Treated Rice Straw Supplemented With Maize Offal: Brewer Yeast Slurry Mixture (g) (Dry Matter Basis)

Nutrient	T1	T2	T3	T4	T5	T6	SEM
DM (%)	202.43 ^e	192.60 ^f	266.77 ^d	278.98 ^c	349.05	359.31 ^a	3.29
OM (%)	168.03 ^e	155.70 ^f	220.21 ^d	225.97 ^c	286.49 ^b	291.42 ^a	2.62
CP (%)	31.88 ^f	34.23 ^e	49.50 ^d	55.84 ^c	71.23 ^b	77.57 ^a	0.95
CF (%)	60.54 ^c	43.96 ^c	62.05 ^c	57.89 ^d	73.88 ^a	69.34 ^b	1.17
EE (%)	12.39 ^e	12.10 ^e	19.64 ^d	0.84 ^c	28.50 ^b	29.83 ^a	0.39
NFE (%)	90.36 ^c	83.06 ^d	115.14 ^b	117.42 ^b	146.96 ^a	148.61 ^a	1.32

a,b,c,d,e,f---- Means on same row with different superscripts vary significantly ($P=.05$)

T1, T3 and T5 fed MOBYs and untreated rice straw

T2, T4 and T6 fed MOBYs and *Pleurotus tuberregium* treated rice straw

DM = dry Matter; OM = Organic Matter CP = Crude Protein CF = Crude Fibre EE = Ether Extract NFE = Nitrogen free extracts

4. DISCUSSION

4.1 Nutrient composition of feed materials

The dry matter of the rice straw used in this study is lower than those reported by other workers [19]; [20]; [21]) but higher than reports of [8] but generally falls within the range given by [22]. The higher DM is advantageous, meaning less moisture and more nutrients. According to [23], dry matter is the portion of the feed material that contains the nutrients. The percentage compositions of crude protein of this rice straw is higher than values reported by other authors [24]; [8] but falls within the range of 2-9% given by [22]. This difference is explained by nitrogen fertilization of the rice farm. [8] reported that higher nitrogen fertilization of the rice plants yield higher crude protein in the straw. The crude fibre, ether extract and NFE values also fell within the range value of 20-45%, 1-4% and 29-48% respectively reported by [22]. The ash content falls lower than values reported by [22]. This variability could be attributed to higher values of the other proximate components on one side and the report by [8] that geographic location of the rice field in the rice growing region and days between harvest and baling of the straw affect nutritive quality of rice straw.

The dry matter, crude protein, and gross energy of the *Pleurotus tuberregium* treated straw were higher than that of the untreated straw while the crude fibre, ether extract and NFE were lower than those in the untreated straw. In principle, this shows an enhancement of nutritive quality. Similar reports of reduction in some proximate components and increase in others have been reported by [11]. Increases in some proximate components are attributed to higher nutritive values of the fungal biomass coupled with protein contents of the enzymes, while reductions are attributed to the fact that the fungus itself needs nutrients to survive and carry on with its developmental stages. Reduction in crude fibre of biologically treated feed materials has been attributed to the ligninolytic enzymes which degrade the lignin and other fibre components thereby rendering the residue less fibrous. [25] stated that increase in crude protein of fungal treated crop residues could be explained by increased fungal biomass and secretion of extra cellular enzymes which are proteinous in nature into the residues during their breakdown and subsequent metabolism. The author also explained that decrease in ether extract of the fungal treated material could be caused by consumption of some fatty acids by the fungus as a suitable energy source for growth.

4.2 Performance indices

The average daily rice straw intake of goats in the various treatments did not differ significantly, but showed a trend of decreased intake as the amount of MOBYS offered increased. This non significant

rice straw intake is reasoned to be caused by its fibrous nature. The intake values are lower than those reported by [19] (except T1) which also showed significant difference in intake. It has been reported that the fibrous nature of rice straw limits its intake by animals [26]; [27] because gut fill is experienced quickly.

The average daily PTTRS intake did not also differ significantly among the treatment groups. Its low intake, despite enhancement in nutritive value shown by increased DM, CP, Ash and GE, and decreased CF and NFE is reasoned to be caused by the smell of the PTTRS, because it absorbed the smell of the *Pleurotus tuberregium*. Goats, being inquisitive feeders and fastidious [28]; [29] usually do not eat much of feed which they do not relish the smell.

The average daily MOBYS intake pattern showed that the higher the intake of either RS or PTTRS, the lower was the MOBYS intake. With respect to intakes of either RS or PTTRS, higher intakes of MOBYS were recorded for the PTTRS than the RS fed groups, where intake of the PTTRS fed groups was 96.2, 93.87 and 95.2% compared to 95.7, 87.35 and 90.07% of the RS fed groups. That all the groups were not able to exhaust the amount of MOBYS offered is attributed to unique feeding habits of goats. In confinement, goats devote less time to feed intake causing low feed intake [30]. This explanation is most plausible, because, on some days the goats would eat just a little quantity of feed despite no sign of ill health while on some other days finish the daily ration, especially of the MOBYS. The tantalizing aroma of the MOBYS coupled with its reported bitter taste [14] were reasoned to be added advantage because goats have been reported to relish eating bitter feeds [28], moreover, feed intake in ruminants is influenced by a taste related attribute. The high crude protein of the MOBYS (25.6%) may also have placed a ceiling on its intake. In goats, one of the factors affecting feed intake is dietary crude protein.

The mean daily total feed intake picture shows an increasing trend as PTTRS was fed (except T2) and as amount of MOBYS offered increased. The total daily feed intake was actually a cumulative intake of RS, PTTRS and MOBYS, so followed the pattern of intake of cumulative amounts of combinations of the feeds offered.

The percentage dry matter intake of the experimental animals is low compared to the values of 3-5% body weight [23] or 4.1 to 6.0% [31] or the reported value of 4.1 to 5.67 % by [32].

Average daily body weight gain values obtained in this work had a direct relationship with the intakes of RS, PTTRS and MOBYS. In general, the weight gain improved with PTTRS intake as against RS (except T2) and increased MOBYS intake. This pattern of BWG is reasoned to be a direct response to nutrient availability and intakes, which would have been converted to body weight. [33] had reported that superior body weight of goats could be caused by diets providing the best balance of nutrients for growth and [34] reported that plane of nutrition markedly affects BWG. Values of BWG reported here are superior to those reported by [13], comparable to those of [35], [31] and inferior to those reported by [36].

The feed conversion ratio values herein are better than those of [37], less than those of [38]. In general the FCR values show efficiency of utilization of the dietary combinations by goats.

The final body weight values showed an increasing trend as amount of MOBYS offered increased and reflect availability of nutrients for body building. The values are comparable to those of other workers [39]; [40]

The average daily water intake had a direct bearing on MOBYS and PTTRS intakes. Increased MOBYS intake as well as intake of PTTRS caused higher water intake (except T2). The significant effect as well as amount of water intake agrees with the work of [41]. Water intake values also compared with reports of other workers [42] [43]. In general water is needed in protein digestion, and the higher the protein taken, the higher the amount of water required for protein digestion and the hydrolysis that continually goes on in cells (44).

4.3 Nutrient intake (dry matter basis)

The dry matter, organic matter and crude protein intakes of the experimental groups showed a pattern of increased intake as the amount of MOBYS intake increased, also it was better for the PTTRS than the RS fed groups (except T2 in case of dry matter and organic matter). The significant effect on dry matter intake agrees with the reports of [13] and [45] but contrasts the work of [35]. The values of DMI compare with values reported by [13]. The significant effect of organic matter and crude protein intakes agree with report of [45] but disagree with [35].

5. CONCLUSION

It was concluded that combined feeding of the fungal treated rice straw and MOBYS to goats in confinement significantly improved feed intake, body weight gain and water intake, thereby portraying the feeding regime as a useful alternative and reliable dry season feed.

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