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EFFECT OF TEMPERATURE ON WATER INTAKE OF SAVANNAH BROWN GOATS FED GRADED LEVELS OF MAXIGRAIN ENZYME TREATED RICE HUSK DIETS SUPPLEMENTED WITH SHEA BUTTER LEAVES

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This study was conducted to investigate the water intake and influence of temperature on savannah brown goats fed graded levels of Maxigrain® enzyme treated rice husk supplemented with shea butter leaves. A total number of 36 He- Savannah Brown Goats aged between 2-3 months with an average body weight of 5.5 kg were assigned to four dietary treatments in a completely randomized design. Treatments consisted of varied inclusion (0, 25, 50 and 75%) of Maxigrain® enzyme treated rice husk and given four (4) litres of water daily *ad libtum* for eight (8) weeks experimental period, during which parameters like; body weight, ambient temperature, evaporatory water loss, feed and water intake were measured. The result showed that the highest total body weight gain (4139.01g), daily weight gain (73.67g) and the lowest value (0.3533) of feed conversion ratio (FCR) were obtained in goats fed diet T2 which differed significantly ($P<0.05$) from other treatment groups. This study revealed that a strong correlation between body weight, feed intake and water intake. Therefore, feeding Maxigrain® enzyme treated rice husk up to 25% in the diets of savannah brown goats can be recommended.

Keywords: Maxigrain® Body weight gain, Feed conversion ratio, Rice Husk.

Goat is an important animal in livestock production and can adapt and adjust itself in harsh environmental conditions (Odeyinka and Okunade, 2004). In 2010, the estimated average goat meat consumption per person in Nigeria was 9.6kg which was less than the average of 24.9kg consumed in the Middle East and other parts of Africa (Anzaku *et al.*, 2013). Goats are stubborn and destructive in nature and adapt well to severe climate. Because of the feeding habits and physiological features of goat, they are able to browse on plants that would ordinarily not be eaten by other livestock (Gutierrez, 2003). The savannah brown goats are predominantly found in the Northern part of Nigeria, especially in Niger state. The ears are diminutive and engraved parallel. Both genders have horns. They are homogeneously brown in colour and have short fine hairs (Osinowo, 1992). High environmental temperature, its exposure, and humidity affects water intake of animal which is detrimental to livestock production in the tropics (NRC, 2007). Animals can be fed water from three sources: drinking water, feed water and metabolic water from nutrient catabolism (Esminger *et al*., 1990). Water use of animals exposed to high temperatures is affected in two ways; decrease dry matter intake and increased evaporation and skin cooling (NRC, 2007). Feedstuff and their by-products which are unaffected by digestive enzymes encompass some components which endogenous enzyme may be insufficient to degrade (Ravindran *et al*., 1999). These components may lead to reduction in performance by lowering the consumption of some dietary nutrients. Optimization of non- conventional feeds can be done through the addition of Maxigrain® enzyme which may ultimately improve the animal body weight gain, feed conversion ratio and considerably reduces incorporation of di- calcium phosphate levels in feeds (Polchem Innovative Solution, 2013). The aim of this work was to investigate the effect of ambient temperature and water intake on growth performance of Savannah Brown goats fed graded levels of

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Maxigrain® enzyme treated rice husk supplemented with shea butter leaves.

MATERIALS AND METHODS

The entire experiment was conducted at the livestock unit of the Teaching and Research Farm in the Department of Animal Production, Federal University of Technology Minna, Niger State.

Management of experimental animal

Thirty six (36) savannah brown male goats aged between 2-3 months with an average body weight 5.0±0.5 were purchased from Beji market in Minna Niger State. The goats were housed in wooden slatted floor pens (1.20 m × 0.80 m × 0.70 m) equipped with feeding and drinking facilities. Thereafter, routine management and vaccination followed. The animals were allowed ad libitum access to water throughout the trial. The goats were weighed and randomly allotted to four dietary treatments of three goats per replicate using a completely randomized design (CRD). The animals were allowed 7 days of acclimatization period to the experimental diets, during which they were observed for any symptoms of disease(s).

Diets

All diets were formulated to meet the nutritional requirements of growing goats based on (NRC, 2007) recommendations and animals were fed twice daily with ad libitum access to clean water. The proximate composition of the diets was determined following the method of (AOAC, 2007). Rice bran treated with Maxigrain® enzyme at 0, 25, 50, and 75 % was used in composing the diet. The table for composition of experimental diet is shown in Table 1. Shea butter leaves were supplemented alongside their experimented diet and were given to the goats in the evening. The goats were fed 450g each of the experimental diet at 7am-8am daily while the supplementary feed was offered at 4pm-5pm. Four (4) litres of water was offered to each goat daily. Ambient temperature was measured between 12am-2pm daily with a suitable thermometer hanged inside the goat's pen. Feed intake and water intake were measured daily.

Data collection

The initial body weights of the goats were measured using standing scale and subsequent weighing were done weekly throughout the experimental period. Feed and water offered, left over were also measured daily. The water intake was obtained by deducting the water leftover and the evaporatory loss from the water offered daily in accordance with NRC, (2007) recommendation that growing sheep and goats will consume 2-4 litres of water per day at higher ambient temperatures. Feed conversion ratio (FCR) was computed as the ratio of total feed intake to the body weight gain.

Statistical analysis

Data collected were subjected to analysis of variance (ANOVA). The means were separated using statistical package for SPSS (2008). Pearson's correlation analysis was carried out between feed intake, water intake, ambient temperature and evaporatory loss for all the treatment groups used in the experiment.

RESULTS

Table 2 showed the proximate composition of the experimental diets and shear butter leaves fed to Savannah Brown goats. The dry matter was higher in T4 (92.67%) and lowest in T2 (85.33%). Nitrogen free extract was higher in T3 (55.74%) and lowest inT2 (46.49%). T4 recorded the highest value in Ash (12.00%) and T3 has the lowest value (7.00%). Ether extract in T1 was higher in value (9.50%) and T4 has the lowest value (4.00%). T4 recorded the highest value in crude fibre (11.33%) and the lowest in T1 (8.33%). Crude protein in T4 recorded the highest value of (14.13%) and the lowest value in T2 (12.06%). Table 3 showed growth performance of Savannah brown goats fed graded levels of Maxigrain® enzyme treated rice husk diets were not significantly different (P>0.05) between all the treatment groups. Table 4 showed the water intake of Savannah Brown goats fed Maxigrain® enzyme treated rice husk diets and there were no significant differences (P>0.05) between all the treatment groups. The rectal temperature at week 2, 4 and 6

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Table 1: Composition of the experimental diets and calculated nutrients fed to Savannah Brown Goats.

	TREATMENTS			
INGREDIENTS	T1	T2	T3	T4
Maize	71.50	53.55	35.70	17.97
Rice husk	0.00	17.85	35.70	53.93
Groundnut cake	8.0	7.50	7.50	6.50
Maize bran	19.50	19.50	20.00	20.50
*Premix	0.50	0.60	0.60	0.60
Salt	0.50	0.80	0.60	0.60
Total	100.00	100.00	100.00	100.00
Calculated Metabolizable Energy (Kcal/kg)	3581.8	3074.6	3349.8	2973.6
Crude Protein (%)	14.12	12.06	13.38	14.13

T1 - Control (0% Maxigrain® enzyme treated rice husk diet)
T2 - 25% Maxigrain® enzyme treated rice husk
T3 - 50% Maxigrain® enzyme treated rice husk
T4 - 75% Maxigrain® enzyme treated rice husk

Table 2: Proximate Composition of Experimental Diets and Shea Butter Leaves

Proximate Composition (%)	T1	T2	T3	T4	SBL
Dry Matter	91.00	85.33	92.00	92.67	93.87
Crude Protein	14.12	12.06	13.38	14.13	7.00
Crude Fibre	8.33	11.14	9.38	11.33	30.00
Ether Extract	9.50	8.14	6.50	4.00	3.50
Ash Content	8.00	7.50	7.00	12.00	6.00
Nitrogen Free Extract	54.05	46.49	55.74	51.21	47.37

SBL- Shear Butter Leaves

Table 3: Growth Performance of Savannah Brown Goats fed Graded Level of Maxigrain® enzyme treated rice husk Diets

	TREATMENTS				
PARAMETERS(g)	T1	T2	T3	T4	LS
Initial body weight	5666.63±166.65	5444.43±96.24	5500.00±0.00	5666.63±166.65	NS
Final body weight	9083.33±2268.44	9583.00±877.97	9250.00±2222.05	9000.00±1322.88	NS
Total weight gain	3416.67±2171.8	4139.01±75.34	3750.00±22.05	3333.33±452.7	NS
Daily weight gain	60.67±39.07	73.67±15.50	66.67±39.71	59.00±26.15	NS
Weekly weight gain	426.67±271.59	517.00±109.53	468.33±277.62	416.33±181.58	NS
Daily feed intake	33.24±8.01	25.75±2.87	26.86±2.79	59.00±26.15	NS
Weekly feed intake	232.72±56.08	180.25±20.07	188.05±19.49	29.27±6.94	NS
Total feed intake	1861.00±448.64	1442.05±160.55	1488.41±147.57	1639.38±388.57	NS
Feed conversion ratio	0.6767±0,32	0.3533±0.04	0.6233±0.58	0.6433±0.53	NS

LS – Level of significance, ± - Standard error of mean, NS – Not significance

were significantly different (P<0.05) from other weeks. At week 2, rectal temperature of goats fed (0%) Maxigrain® enzyme treated rice husk diets were significantly (P<0.05) lower than the rectal temperature of goats fed 25% and 50% Maxigrain® enzyme treated rice husk diets. However, the rectal temperature of goats fed 25% and 50% were not significantly different (P>0.05) from each other. The rectal temperature of goats fed 75% Maxigrain® enzyme treated rice husk diets were

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Table 4: Water intake and Evaporatory Loss treatment period of Savannah Brown Goats fed graded levels of Maxigrain® enzyme treated rice husk diets

	TREATMENTS				
PARAMETERS	T1	T2	T3	T4	LS
Average daily water intake(L/day)	0.64±0.95	0.58±0.87	0.68±0.18	0.68±0.13	NS
Weekly water intake (L)	4.42±0.69	4.07±0.59	4.77±1.32	4.79±0.92	NS
Total water intake (L)	35.35±5.48	32.55±4.76	38.14±10.56	38.32±7.39	NS

Table 5: Mean weekly Rectal Temperature of Savannah Brown Goats fed Graded Levels of Maxigrain® enzyme treated rice husk diets

	TREATMENTS				
Weekly Rectal Temperature(^{0}C)	T1	T2	T3	T4	LS
Week 1	39.17±0.74	39.93±0.87	39.40±0.26	38.83±0.51	NS
Week 2	36.97^{a}±1.74	38.98^{b}±0.35	39.37^{b}±0.53	37.73^{ab}±0.15	*
Week 3	38.20±0.36	38.33±0.12	38.93±0.61	37.77±1.00	NS
Week 4	38.47^{b}±0.46	38.53^{b}±0.40	38.30^{b}±0.66	37.33^{a}±0.31	*
Week 5	38.97±0.23	38.93±0.05	38.97±0.81	38.63±0.21	NS
Week 6	38.87^{ab}±0.60	38.30^{ab}±0.00	38.93^{b}±0.90	37.77^{a}±0.38	*
Week 7	39.20±1.15	38.47±0.31	38.10±0.46	38.17±0.74	NS
Week 8	38.73±0.35	38.17±0.45	38.30±0.36	37.93±0.58	NS

*Significant difference (P<0.05)

Table 6: Correlation coefficient of Body weight, Feed intake, Feed conversion ratio and Rectal Temperature of Savannah Brown Goats fed Graded Levels of Maxigrain® enzyme treated rice husk diets

	TREATMENTS			
PARAMETERS (g)	T1	T2	T3	T4
Body weight & Feed intake	0.924	0.959	- 0.870	- 0.996
Body weight & Feed conversion ratio	-0.976	-0.985	-0.990	-0.997*
Body weight & water intake	0.995	-0.048	0.784	0.053
Feed intake & Feed conversion ratio	-0.986	-0.896	0.793	1.000*
Feed intake & water intake	0.958	-0.329	0.988	0.040
Feed intake & Rectal temperature	0.619	0.380	0.995	0.526
Water intake & Feed conversion ratio	-0.993	-0.123	-0.690	0.024
Water intake & body weight	0.958	-0.329	0.988	0.040
Water intake & feed intake	0.955	-0.48	0.784	0.053
Water intake & Rectal temperature	0.819	-0.999*	0.967	0.871

*Significant difference (P<0.05)

significantly comparable (P<0.05) to the rectal temperature of goats fed 0%, 25% and 50% Maxigrain® enzyme treated rice husk diets respectively. At week 4, rectal temperature of goats fed 75% Maxigrain® enzyme treated rice husk diets were significantly lower (P<0.05) than the rectal temperature of goats fed 0%, 25% and 50%. However, the rectal temperature of goats fed 0%, 25% and 50% were not significantly different (P>0.05) from each other. At week 6, the rectal temperature of goats fed 75% Maxigrain® enzyme treated rice husk diets is significantly lower(P<0.05) than the rectal temperature of goats fed 0%, 25% and 50% Maxigrain® enzyme treated rice husk diets. However, the rectal temperature of goats fed 0%, 25% and 50% Maxigrain® enzyme treated rice husk diets were significantly comparable to goats fed 50% and 75% Maxigrain® enzyme treated rice husk diets. Table 6 shows the correlation of body weight, feed intake, water intake and feed conversion ratio of Savannah Brown goats fed graded levels of Maxigrain® enzyme treated rice husk diets. There was no

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significant correlation (P>0.05) between body weight, feed intake and feed conversion ratio.

DISCUSSION

The non-significant difference observed in daily water intake and the ratio of water intake to feed intake could be due to the same ambient temperature which the goats were exposed to, also the level of Maxigrain® enzyme treated rice husk inclusion does not have any positive effect on daily water intake. Feed intake was observed to be positively correlated with water intake. This agrees with both Dozie, (2003) and Misra and Khub Singh, (2002) who reported that dry matter intake is correlated strongly with water intake in goats. Wani (2010) reported that the amount of water requirement for goats depends on their needs for the maintenance of normal water balance and for satisfactory levels of production. The ratio of water to feed intake obtained was lower than those of Daramola and Adeloye (2004), who reported that the ratio of water to dry matter intake of goats fed maize cob diet ranges from 2.96:1 to 7.04:1. Winchester and Morris (2009) reported that the ratio of water intake increases with an increase in ambient temperature. The negative correlations observed in some of the treatments among water intake with feed conversion ratio (FCR), body weight and feed intake were not in agreement with the report of (Abioja *et al*., 2010) who reported positive significant correlation between water intake and feed conversion ratio (FCR) for West African Dwarf goats (P<0.05, r=0.316). As the ambient temperature reduces, the goats losses more heat to the environment and more energy will be required to maintain a constant body temperature through increased feed intake (Abioja *et al*., 2010). The non-significant differences in rectal temperature observed in week1, 3. 5, 7 and 8 could probably be due to exposure of the goats to same ambient temperature. The result was in agreement with Adogla- Bessa (2000) who reported that animal drank less water in winter than in summer and they consume more feed, convert feed more efficiently and gain more weight in winter than in summer. Also, the significant differences in rectal temperature observed in week 2, 4 and 6 was in agreement with St-Pierre *et al*., (2003) who reported that animal health, growth and reproduction are adversely impacted by high temperatures. The better performance by goats fed 25% Maxigrain® enzyme treated rice husk diets in total weight gained and feed conversion ratio over control (0%) and T4 may probably be due to better utilization of feeds by the goats in the group and a positive effect of the enzyme in the diet.

CONCLUSION

The results of this study demonstrate that dietary level of 25% Maxigrain® enzyme treated rice husk fed to the Savannah brown goats had the best growth performance and highest correlation coefficient between body weight gain and feed intake. Ambient temperature and rectal temperature has no significant correlation on water intake, feed intake and body weight gain. Therefore 25 % inclusion of Maxigrain® enzyme treated rice husk supplemented with shea butter leaves in the diet of Savanna brown goats is recommended.

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