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EFFECT OF MACA (*Lepedium Meyenii*) POWDER SUPPLEMENT ON GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF YANKASA RAMS

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ABSTRACT

The use of phytochemical feed additives such as Maca (*Lepedium meyenii*) has been widely used by livestock farmers to reduce cost of production, toxic and residual effect of industrially chemical synthetic antibiotics and growth promoters. Therefore, this research was conducted to evaluate the effect of Maca power supplement on growth performance and nutrient digestibility of Yankasa rams. A total of twenty (20) grower Yankasa rams was divided into four treatment groups of 0, 5, 10, 15g/ Kg powdered Maca with five (5) rams each per treatment in a completely randomized design (CRD). The growth performance result revealed that all parameters were significantly ($P<0.05$) differences with the exception ($P>0.05$) of initial weight were T4 had the best growth performance attributes followed by T3. Profound ($P<0.05$) changes was recorded in Yankasa rams nutrient digestibility fed supplemented levels of Maca. There were significant ($P<0.05$) differences in feacal nitrogen, urine nitrogen, and nitrogen retained as percent feed intake while nitrogen intake and nitrogen retained were not significantly ($P>0.05$) affected with supplementation level of Maca. It could be concluded that Maca powder supplement has a profound effect of growth performance were T4 had the outstanding growth performance, considerable increases were recorded with increases level of Maca supplement on nutrient digestibility and nitrogen balances. For improvement of growth performance and nutrient digestibility, farmers are therefore recommended to supplement up to 15g/kg Maca powder into the diet of Yankasa rams, further studies are therefore recommended to fully explore its mechanisms of actions and nutritional activities.

Keywords: Maca, Growth, Digestibility, Yankasa Rams

INTRODUCTION

Small ruminants play significant roles in the nutrition, social and economic life of many Nigerians. In most cases, the small ruminants are not kept strictly to provide meat for the household, or as a regular source of cash income. The importance of scavenging sheep and goats is rather as a savings account or insurance policy, that is, they are sold when extra cash is needed. They also play a specific role in social life, like at weddings and other festivities they are presented as gifts or slaughtered as ceremonial meat (Ajala *et al.*, 2008).

Maca is considered as aphrodisiac plant, it is commonly known as ''*Gadali* or *Albasar Tamoji*'' in Hausa language. Maca has multiplicity of biological function. Maca is an adaptogen, which means it helps the body adapt to stress. Maca contains plant sterols which help the body produce the appropriate levels of hormone (Gaddafi *et al.,* 2023). Maca has been used as a food health-promoting food material, stamina builder, and fertility promoter due its various biological effects, including the regulation of metabolism and hormonal secretion, memory improvement, and antidepressant activity in humans (Zhang *et al.,* 2017). Recently, Maca has been consumed in juices, soups, extracts, and processed foods enriched with Maca flour (Lee and Chang, 2019). It is claimed by the nutrition industry that Maca has the ability to improve energy and modulate the response against oxidative stress. Previous studies reported that Maca comprises various classes of bioactive compounds, including saponins, alkaloids, steroid hormones, and polyphenol compounds (Tang *et al.,* 2017) and these compounds play a variety of biological role in human and animal body.

MATERIALS AND METHODS

Experimental Site

This experiment was carried out at Small Ruminant unit of Livestock Teaching and Research Farm, Department of Animal Science, Federal University Dutsin-Ma, Katsina State. The site lies between latitude 12º27`18`N and 7º29`29`E and 605 meters above sea level with an annual average rainfall of 700mm (Gaddafi *et al.,* 2019).

Experimental Animals

The experiment was consists 20 pubertal Yankasa rams which was divided into four treatment groups of 0, 5, 10, 15g/ kg powdered Maca with five (5) rams each per treatment in a completely randomized design (CRD).

Experimental Feed Preparation

All the feed materials that were used in the experimental diets preparation was purchased from selling and processing centers in Dutsin-Ma. Maize and cotton seed cake was ground and packed in sacks for experimental diets compounding. Whereas groundnut hay was chopped before mixing, other feed ingredients such as wheat offal, maize bran, bone meal, and table salt were purchased from the different centers in Dutsin-Ma town. Diet was formulated to meet the dietary requirement for breeder rams according to dietary recommendation of NRC, (2000) for tropical goat.

Preparation of Maca Powder

Fresh maca was procured from herbal vendor in Dutsin-Ma Market, the maca was washed by tap water, and the fibrous roots will be separated from the top. the roots were sliced to 2-mm-thick pieces and dried at 42ºC in oven drying machine for 24 hours at Animal Science Laboratory, Department of Animal Science, Federal University Dutsin-Ma to the moisture content of 6-9%. The Maca slices were then ground into powders, sieved through 1-mm wire-mesh, and stored at -20ºC before use.

Data collection

Performance

Data for initial live weight of the rams was taken by weighing the goat before introducing them to the experimental diets. Subsequently, weekly live weight and feed intake was recorded while average daily weight gain (ADG) and average daily feed intake (ADFI) was determined by dividing their totals against the number of days that the feeding trails. At the end of the experiment, the total feed intake (TFI) and the total weight gain was calculated and the feed conversion ratio (FCR) was determined by dividing the total feed intake by the weight gain.

Nutrient Digestibility

A total of four (4) rams from each treatment (one per replicate) was randomly allotted to metabolic cage housed individually for total faecal and urine collection. The animals were allowed fourteen (14) days adjustment period to the condition of the metabolic cage and followed by the sample collection period, which lasted for seven (7) days. The animals were fed experimental diets *Adlibitum* daily in the morning at 8:00AM and evening at 4:00 PM. Water was offered and intake was measured. Evaporative loss was determined by measuring water loss from same water through filled with known quantity of water in the animal pen and the loss was subtracted from the water intake.

Daily collection of urine and faeces was made daily. Urine of individual animals was collected in a container of 10% H_2SO_4 to keep the final pH of the urine lower than 3 all times in a container, since it is essential to acidify the urine to prevent bacterial activity. Urine sample of 20ml was taken and stored at -20ºC in the laboratory until analysis for the determination of urinary nitrogen (N). Daily faeces collects in each period at about 30g was collected. The sample of the faeces collected was oven dried at 105ºC for 48 hours and weighed to determine the dry matter weight of the faeces, after then the faeces were bulked and a 5% sub sample was taken and ground (1 mm screen) for proximate determination.

RESULT AND DISCUSSION

Effect of Maca (*Lepedium meyenii*) Powder Supplement on Growth Performance of Yankasa Rams

The result on the effect of Maca powder supplement on growth performance of Yankasa rams were presented in table 1 below. The result revealed that there were no significant (P>0.05) differences in the initial weight of rams this means that the rams used in this study are homogenous in body weight before the commencement of the experiment. The result on the final weight revealed that there were significant (P<0.05) difference in which rams in T4 diet had the highest final weight (23.16kg) followed by T3 diet with 23.11kg while T1 had the lowest final weight with 22.51kg.

Significantly (P<0.05) higher feed intake were recorded in T4 followed by T3 while lowest feed intake values were obtained in T2. Higher intake often leads to a faster rate of passage of ingested feed through the digestive tract of the animal and this could affect efficient degradation and hence the digestibility of feed (Kumar *et al.* 2016). This increase in feed intake may be associated with the addition of Maca which stimulated the rate of degradation of solid feeds in the rumen. Therefore, the animals can ingest more dry matter to fill their digestive compartment at the same level and this physical regulation could be involved to explain the higher feed intake in rams fed Maca with increased inclusion level of Maca. The result on average daily feed intake (ADFI) revealed that there were significant (P<0.05) differences. The result on the average weight gain of rams fed supplemented levels of Maca revealed that there were significant (P<0.05) differences were rams in T3 had the highest weight gain (2.700kg) followed by T4 (2.555kg), T2 (2.375kg) while T1 had the lowest (2.200kg) this clearly indicated that Maca had a profound effect on weight gain improvement of animal and this may be attributed as a result of proximate constituent and secondary metabolites contain in Maca that are responsible in enhancing feed intake, utilization and absorption thereby improving weight of the animal. The result revealed that average daily weight gain and feed conversion ratio were significantly (P<0.05) different across the treatment group.

Table 1: Effect of Maca (*Lepedium meyenii*) Powder Supplement on Growth Performance of Yankasa Rams

Parameters	T1	T2	T3	T4	SEM	LOS
Initial weight (kg)	20.30^{a}	20.38^{a}	20.41^{a}	20.63^{a}	0.071	NS
Final weight (kg)	22.51^{d}	22.76^{c}	23.11^{b}	23.16^{a}	0.007	*
Feed intake (kg)	19.70^{b}	19.48^{c}	19.71^{b}	19.74^{a}	0.007	*
ADFI (g)	328.3^{c}	324.7^{d}	328.6^{b}	329.1^{a}	0.051	*
Average weight gain (kg)	2.200^{d}	2.375^{c}	2.700^{a}	2.555^{b}	0.005	*
ADWG (g)	36.67^{d}	39.55^{c}	45.00^{a}	42.55^{b}	0.050	*
FCR	8.956^{a}	8.220^{b}	7.300^{d}	7.742^{c}	0.001	*

ADFI = Average daily feed intake, ADWG= Average daily weight gain, FCR= Feed conversion ratio, SEM = Standard error mean, LOS= Level of significance

Effect of Maca (*Lepedium meyenii*) Powder Supplement on Nutrient Digestibility of Yankasa Rams

The result on the effect of Maca powder supplement on nutrient digestibility of Yankasa rams were presented in table 2 below. The result showed that there were significant (P<0.05) difference of dry matter content of feacal output with the highest dry matter percentage at T2 while lowest were recorded in T1. The animals on maca supplemental diet had higher total dry matter intake and this agrees with Ayman *et al.*, (2017) who worked with Nadji ram lambs and reported lower dry matter intake for the animals on restricted feeding without supplement. However, the findings disagree with the result obtained by Fadel (2004) who stated that intake of dry matter was not influenced by feeding frequency of protein supplement. The result revealed that there were no significant (P>0.05) differences in crude protein digestibility, although the crude protein digestibility recorded in this study was similar to 59.18 and 60.82% reported by Tona (2011). The result showed a significant (P<0.05) differences in digestible ether extract, ash neutral detergent fibre and acid detergent fibre with a linear increases with increases level of Maca powder supplements.

Table 2: Effect of Maca (*Lepedium meyenii*) Powder Supplement on Nutrient Digestibility of Yankasa Rams

Parameters	T1	T2	T3	T4	SEM	LOS
Dry matter	68.850[c]	72.305[a]	70.205[b]	70.125[b]	0.025	*
Crude protein	61.445[a]	68.780[a]	66.485[a]	68.580[a]	1.934	NS
Ether extract	62.415[c]	64.265[b]	61.985[d]	64.725[a]	0.005	*
Ash	55.415[d]	63.225[c]	63.465[b]	65.105[a]	0.005	*
NDF	59.205[d]	60.125[c]	63.815[b]	65.145[a]	0.167	*
ADF	58.115[d]	61.515[c]	65.165[b]	65.475[a]	0.005	*
ADL	47.69	47.68	47.68	47.68	2.64	NS

NDF= Neutral detergent fibre, ADF= Acid detergent fibre, ADL= Acid detergent lignin, SEM= Standard error mean, LOS= Level of significant

Effect of Maca (*Lepedium meyenii*) Powder Supplement on Nitrogen balance of Yankasa Rams

The result on the effect of maca powder supplementation on Nitrogen balance of Yankasa rams were presented in Table 3. All the parameters measured were significantly (P<0.05) affected by the Maca supplementation except nitrogen intake and nitrogen retained. Fecal nitrogen at T1 was significantly higher (P<0.05) than others which were comparable and similar. Urinary nitrogen at T4 was significantly higher (P<0.05) than T2 inclusion. The percentage of nitrogen retained progressively increased significantly (P<0.05) as the inclusion level of Maca increased from 0 to 15g/kg diet. The similarity in nitrogen intake across all the treatments could indicate that the animals were able to obtain their required nourishment from all of the treatments. Likewise, the similar nitrogen retained could mean that similar amount of nitrogen was supplied to the animals by each of the treatment due to the iso-nitrogenous nature of the diet. The highest nitrogen retention and percent nitrogen retention in the animals fed at 15g/kg maca in the diet could however be attributed to better synchrony of dietary protein and energy than in other treatments (Longo *et. al.*, 2008).

The 15g/kg maca (T4) supplemented level had higher urinary nitrogen output than others and this could be due to the protective influence of the increased levels of tannins and other secondary metabolites in the diet on dietary protein, thereby encouraging the escape rate from rumen microbial fermentation (Yousuf *et. al.*, 2014). The range of nitrogen retained as percentage of intake obtained in this study was similar to the range of 44.9-63.59% reported by Lakpini *et al.* (2015) for Yankasa rams.

Table 3: Effect of Maca (*Lepedium meyenii*) Powder Supplement on Nitrogen balance of Yankasa Rams

Parameters (g/day)	T1	T2	T3	T4	SEM	LOS
Nitrogen intake	12.06	11.97	12.11	12.34	1.12	NS
Fecal N	5.17[a]	4.52[b]	4.38[b]	3.88[b]	0.29	*
Urinary N	1.11[ab]	1.10[b]	1.31[ab]	1.34[a]	0.06	*
N retained	5.66	6.42	6.64	7.22	1.14	NS
N retained as % of intake	47.02[b]	54.68[ab]	54.84[ab]	58.93[a]	5.16	*

N= Nitrogen, SEM= Standard error mean, LOS= Level of significance

CONCLUSION

It could be concluded that Maca powder supplement has a profound effect of growth performance were T4 had the outstanding growth performance, considerable increases were recorded with increases level of Maca supplement on nutrient digestibility and nitrogen balances. For improvement of growth performance and nutrient digestibility, farmers are therefore recommended to supplement up to 15g/kg Maca powder into the diet of Yankasa rams, further studies are therefore recommended to fully explore its mechanisms of actions and nutritional activities.

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