Potentials of *Monechma ciliatum* as a Non-Conventional Feedstuff in Sheep Diet in Sokoto, Nigeria

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Abstract: An experiment was conducted to determine the effect of including *Monechma ciliatum* (MC) in the diet of sheep at 0(control) 10, 20 and 30% levels. The results show that increasing the level of supplementation of MC beyond 20% decreased the feed intake and subsequently liveweight gain. Except for total ash, nutrients digestibility follow similar pattern. The least cost of feed per kg liveweight gain of \$2.04 occurred at the 20% inclusion level and cheapest ration to feed to sheep. Whereas blo od parameters differed between treatments, they were mostly within physiological limits. The metabolizable energy content of 2435 kcal kg^{-1} of the 20% diet is also the highest amongst all treatments.

INTRODUCTION

Monechma ciliatum (MC) is a weed of the semi-arid areas of tropical Africa and belongs to the family *Acanthaceae*. It can grow up to about one meter in height making it possible to be grazed by domestic animals especially sheep and goats. Fadayomi *et al*. (1992) reported that *M. ciliatum* is the most dominant weed species in the Sudan Savannah ecological zone of Sokoto State of Nigeria. Hot Methanolic Extract (HME) of *M. ciliatum* had been reported to have potent oxytocic activity, while column chromatographic studies using silicon, accompanied by bioassay of the extract tested on isolated rat uterus enable partial isolation of the oxytocic principle (Uguru *et al*., 1999).

MATERIALS AND METHODS

Experimental diet and animals: Specimens of *M. ciliatum* were obtained from fallows of experimental crop farm of the Faculty of Agriculture, Usman Danfodiyo University, Sokoto and air dried on concrete floor in a ventilated room for 6 days during which they were turned over twice daily. On the seventh day, they were sun-dried for three days and thereafter pounded using local wooden mortar. Random samples of the prepared specimen were analysed for proximate composition. Other feed ingredients used to formulate experimental diet include wheat offal, yellow maize, groundnut cake, blood meal, bone meal, trace minerals and common salt, to prepare diets containing 0(control) (without MC), 10, 20 and 30% inclusion levels of *M. ciliatum.*

Ten 4-5 months old Yankassa breed of sheep, weighing between 11 and 14 kg liveweight were used in this study. Three animals were assigned to each dietary treatment and one group served as control. The animals were housed in metabolism cages and fed experimental diet for an initial seven days adjustment period, which was followed by experimental period of 56 days. Feed and water were given *ad libitum* and animals were weighed weekly.

Digestibility trial: Four weeks after the commencement of the experiment, digestibility trial was introduced which lasted for ten days. During this trial, daily feed intake and faecal output were measured. About 100 g of faecal samples were obtained from each animal and put in clean polythene bags and transferred into refrigerator. At the expiration of the 10 days digestion trial, the faecal samples were analysed for proximate composition using the methods of AOAC (1990).

Blood analysis: Ten mililitre blood samples from each experimental animal were collected through the jugular vein on the day they were introduced into metabolism cages and thereafter, samples were collected fortnightly. Haemoglobin was analysed using Dippelfarstab haemoglobinometer, total protein by biuret method; bilirubin, Serum Glutamic-Oxaloacetic Transaminase (SGOT) and Serum Glutamic-Pyruvic Transminase (SGPT) were assessed using Corning colorimeter. Alkaline phosphatase and urea were determined using diacetyl monoxine extraction by Tietz (1987). Sodium and potassium were analysed on Seac Fp 20 flame photometer while bicarbonate ion was determined by the tetrimetric method.

RESULTS

Chemical composition of experimental diet: The chemical composition of experimental diets is shown on Table 1. The Dry Matter (DM) and Crude Protein (CP) contents of the diets were similar. However, Crude Fibre (CF), Calcium (C) and Phosphorus (P) increased with increasing levels of MC, while nitrogen free extract levels decreased progressively. The Metabolizable Energy (ME) is similar in diets 1, 3 and 4 and higher than diet 2 (Table 1).

Feed intake and liveweight gain: Daily feed intake increased from 10-20% diet and then decreased at the 30% diet. The daily weight gain followed similar pattern. The feed conversion ratio of 6.7 at 30% level was highest of all the treatments including control. Similarly, the cost of diet consumed per day was highest for the 30% diet and the same for 10 and 20% diets. However, the cost of diet/kg live weight gain was lowest for the 20% diet amongst all treatments including the control (Table 2).

Nutrient digestibility: The dry matter digestibility was higher for the 20% diet compared to the 10 and 30% diets (p<0.5). This trend also exists in the crude protein, crude fibre and crude fat digestibilities while the reverse is the case with total ash. Calcium and phosphorus digestibilities were also higher for the 20% diet when compared to other treatments (Table 3).

Blood chemistry: Amongst the treatments, haemoglobin was higher in the control followed by the 20% diet (p<0.5), (Table 4). Total protein decreased progressively from the control diet up to the 30% diet. SGOT of 5.0 IU/L in 20% is the lowest while SGPT of 18.5 IU L^{-1} in the 10% diet is the lowest (p<0.5). Within the inclusion evels, Alkaline Phosphatase (ALP) increased from 83 KAU in 10% diet to 193 KAU in the 30% diet. This same scenario existed in the urea and creatinine levels in the blood. Sodium and chloride levels decreased progressively from 180-69 mmol L^{-1} and 130 -65 mmol L^{-1}, respectively (Table 4).

Table 1: Chemical composition of experimental diet fed to sheep

	Treatments (inclusion levels of MC %)				
Parameters	*M. ciliatum*	1(0)	2(10)	3(20)	4(30)
Dry Matter (DM)	97.09	92.39	92.70	92.82	92.63
Crude Protein (CP)	14.07	18.00	17.90	17.95	18.14
Crude Fibre (CF)	24.97	6.78	8.57	10.03	11.33
Crude fat (EE)	2.33	4.82	3.92	4.30	4.56
Nitrogen Free Extract (N.F.E)	36.73	65.81	63.21	59.69	56.44
Total Ash (TA)	22.76	4.59	6.40	8.03	9.53
Calcium (C)	1.65	0.12	0.28	0.43	0.58
Phosphorus (P)	0.30	0.21	0.56	0.67	0.77
ME (kcal kg^{-1})	2269.2	2412.3	2384.7	2435.4	2427.1

Table 2: Performance characteristics of sheep fed ration containing 10, 20 and 30% inclusion of *Monechma ciliatum* (MC)

	Treatments (inclusion levels of MC %)			
Parameters	1(0)	2(10)	3(20)	4(30)
Initial weight (kg)	14	10.5	11.8	11.8
Final weight (kg)	22.3	14.9	19.4	18.2
Final weight gain (kg)	8.3^{a}	4.4^{d}	7.6^{b}	6.4^{c}
Daily feed intake (g)	827.9^{a}	706.6^{d}	781.1^{b}	769.6^{c}
Daily weight gain (g)	148.8^{a}	131.5^{b}	120.6^{c}	113.2^{d}
Feed conversion ratio	5.6^{c}	5.4^{d}	6.4^{b}	6.7^{a}
Cost of diet (x/kg)	25.97	20.8	21.40	22.33
Cost of diet consumed (x/day)	47.5^{a}	38.0^{c}	38.1^{c}	39.5^{b}
Cost of diet/kg liveweight gain (x)	319.0^{b}	318.5b	316.0^{c}	349.1

[a]Means on the same row with different superscripts(a, b, c, d) are significantly different (p<0.05)

Table 3: Nutrients digestibility in sheep fed ration containing 10, 20 and 30% inclusion of *Monechma ciliatum* (MC)

	Digestibility (%)			
Parameters	1(0)	2(10)	3(20)	4(30)
Dry matter (DM)	69.59^{a}	67.80^{c}	68.99^{b}	62.76^{d}
Crude Protein (CP)	78.64^{a}	73.85^{c}	76.04^{b}	67.39^{d}
Crude Fibre (CF)	79.98^{a}	68.80^{d}	72.76^{b}	70.09^{c}
Crude Fat (EE)	71.40^{b}	68.45^{c}	89.70^{a}	54.06^{d}
Nitrogen Free Extract (NFE)	60.54^{d}	74.06^{b}	77.37^{a}	71.13^{c}
Total Ash (TA)	42.81^{c}	56.44^{a}	25.61^{d}	48.69^{b}
Calcium (C)	65.65^{b}	52.12^{c}	66.87^{a}	48.24^{d}
Phosphorus (P)	63.36^{b}	64.85^{b}	78.68^{a}	49.21

[d]Means on the same row with different superscripts(a, b, c, d) are significantly different (p<0.05)

Table 4: Blood chemistry of sheep fed ration containing 10, 20 and 30% inclusion of *Monechma ciliatum*

	Treatments (inclusion levels of MC %)			
Parameters	1(0)	2(10)	3(20)	4(30)
Haemoglobin (g 100 mL^{-1})	13.3[a]	10.2[d]	12.4[b]	11.8[c]
Total bilirubin (mg 100 mL^{-1})	0.9[a]	0.7[c]	0.8[b]	0.5[d]
Conjugate bilirubin (mg 100 mL^{-1})	0.1[c]	0.4[a]	0.4[a]	0.3[b]
Total protein (g dL^{-1})	8.0[a]	7.4[b]	6.0[c]	5.5[d]
Albumin (g dL^{-1})	2.5[b]	1.0[c]	3.5[a]	3.5[a]
SGOT (IU L^{-1})	9.0[b]	7.4[c]	5.0[d]	9.9[a]
SGPT (IU L^{-1})	22.3[c]	18.5[d]	41.5[b]	64.6[a]
ALP (King Armstrong Unit)	156.7[b]	82.8[d]	110.4[c]	193.2[a]
Urea (mg 100 mL^{-1})	7.8[a]	3.6[c]	7.1[b]	7.8[a]
Creatinine (mg 100 mL^{-1})	0.9[a]	0.7[c]	0.8[b]	0.9[a]
Na^+ (mmol L^{-1})	144.0[b]	188.0[a]	89.0[c]	69.0[d]
K^+ (mmol L^{-1})	6.6[a]	6.3[b]	6.7[a]	2.7[c]
Cl^- (mmol L^{-1})	110.0[b]	130.0[a]	75.0[c]	65.0[d]
HCO_{3-} (mmol L^{-1})	16.6[d]	21.0[c]	22.0[b]	23.0

[a]Means on the same row with different superscripts[(a, b, c, d)] are significantly different (p<0.05)

DISCUSSION

The daily feed intake and liveweight gain were higher for the control level. These parameters were higher at the 20% inclusion level of MC amongst the 10, 20 and 30% diets, and declined from the 20 to the 30% diet. This is also true of the final weight gain Ttable 2). A similar trend exists in the dry matter, crude protein, crude fibre, calcium and phosphorus digestibilities.

Bitter taste, odour Fajinmi *et al*. (1990), high crude fibre content in diet (Ikeda *et al*., 1986), adverse effects such as diarrhea and vomiting (Kelly *et al*., 1990) and palatability (presence of toxic principles) are some of the factors attributable to reduced feed intake leading to lower liveweight gain in animals. The use of leguminous fodder such as *macuna* spp in ruminant feeding is limited because of its low palatability and generally high concentration of toxic antinutritional factors (Ravindra and Ravindra 1988; Vaithiyanathan and Kumar 1993). Alkanoids present in *Zornia* species (Villaquiran and Lascano, 1986) and oxytocin present in *Monechma ciliatum* (Uguru *et al*., 1999) are examples of antinutritional factors. These compounds though present in small quantities in plant are said to be responsible for gastrointestinal disturbances when taken at higher levels leading to reduced feed intake. The oxytocic principle partially isolated from the leaves of *M. ciliatum* using hot methanolic extraction method caused contraction of the uterus of female rats (Uguru *et al*., 1999). The lower performance in sheep fed *M. ciliatum* diets could be attributed to the effect of oxytocin, an antinutritional factor present in MC (Ogunsan *et al*., 2010). This, in addition to the minty odour (palatability) of MC diet could contribute to the observed reduction in feed intake and subsequent reduced liveweight gain especially at the 30% inclusion level of MC (Ogunsan, 2009).

The Metabolizable Energy (ME) in *M. ciliatum* and control, 10, 20 and 30% inclusion levels of MC are 2269, 2412, 2384, 2435 and 2427 Kcal Kg^{-1}, respectively (Table 1). Temperate breeds of sheep on the same diet as tropical breeds tend to deposit more fat than tropical breeds. Thus their energy requirement for liveweight gain will be greater (Gomez and Hernandez, 1980). Church (1978) reported that the energy requirement of fattening lambs is 2300-2530 Kcal kg^{-1} of ME while that of early weaned lambs is 2600 Kcal kg^{-1} of ME. In this study, weaned lambs were used and the highest energy level of 2435 Kcal kg^{-1} recorded for 20% inclusion level of MC though highest amongst the diets seems not adequate, while the ME decreased to 2427 Kcal kg^{-1} at the 30% level, which could explain the reason for the reduced feed intake and subsequently liveweight gain seen in this study. The haemoglobin and total bilirubin values of 12.4 g% and 0.8 mg% at the 20% inclusion levels are next to the control values. Still at the 20% inclusion, the Alkaline Phosphatase (ALP) of 110.4 KAU, urea of 7.1 mg%, creatinine of 0.8 mg% are lower than the control and amongst the treatment group. Thus the best performance occurred at the 20% inclusion levels of *M. ciliatum* for the animals may not experience either liver or kidney dysfunction at this level. The progressive decrease of sodium and chloride ions from the 10-30% inclusion levels may be attributed to the activities of oxytocin causing contraction of smooth muscle of the gastrointestinal tract with resultant hypermotility which may lead to loss of electrolytes especially sodium and chloride through frequent defecation (Benjamin, 1970).

CONCLUSION

Cost of diet consumed per day is similar for diets 2 and 3 and lower than diet 1 and 4 but the cost of diet kg^{-1} liveweight gain of diet 3 is the lowest amongst all treatments including the control. This makes the 20% inclusion of MC the cheapest and most economical and no adverse effect on the animals at this level as judged by values of blood parameters.

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