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Full Length Research Paper

Evaluation of *Trichoderma harzanium* treated cassava waste on the quality and quantity of milk of goat

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The effects of the fungus, *Trichoderma harzanium*, treated cassava waste on milk quantity and quality were investigated in a completely randomized design model with twelve lactating West African dwarf does. Goats were fed the experimental diets containing O (A), 20 (B), 30 (C) and 40% (D) *Trichoderma* treated cassava waste during a 13 week lactation trial. The results revealed significant differences in milk quantity and quality. The highest milk yield was recorded for diet D followed closely by diets C, B and A in that order. Inclusion of fungus treated cassava waste resulted in significant increasing milk fat, protein, solids not fat (SNF), and total solids. While the inclusion had little effect on milk pH and specific gravity. The yield of 40% fat corrected milk (FCM) and gross efficiency of milk increased significantly (P < 0.05) by the addition of fungus treated cassava waste in the diet. In conclusion, the addition of *Trichoderma* treated cassava waste was beneficial to lactating West African dwarf goats.

Key words: Goats, Lactation, *Trichoderma harzanium*, milk quality and quantity.

INTRODUCTION

Feed accounted for about 89% of the total cost of animal production (Jakonda, 1975); hence livestock farmers are worried by the effect of the rising cost of feed ingredients in livestock production. This has also created a growing awareness among nutritionist to search for alternative sources of energy and protein for livestock especially ruminant which can cope with high degree of lignocellulosic materials.

Lignocellulosic by-products are usually enriched in secondary cell wall with high cellulose and lignin content, both of which are barrier to enzymatic breakdown of the cell wall thereby depriving the nutrient (protein or more readily hydrolysed carbohydrate) availability to animal (Cowling, 1975).

Various methods (physical and chemical) have been used successfully in disrupting cell wall components thereby leading to extensive hydrolysis of cell wall polysaccharides by rumen microbes or enzymatic system. The most recent method is the biological method which involves the use of various microbes (bacterial and fungi) in the pre-digestion of different waste agricultural residues. Studies with *Trichoderma harzanium* on rice husk (Belewu and Okhawere, 1998) and sorghum stover (Belewu, 1999), and *Aspergillus niger* on rice husk (Belewu et al., 2002) are well documented.

The present work aimed at evaluating the efficacy of *Trichoderma* treated cassava waste on milk quality and quantity of West African dwarf goats.

MATERIALS AND METHODS

Fungal strain and cultivation condition

Trichoderma harzanium was collected from International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria. The fungus was maintained on potato dextrose agar containing in Petri-dish at ambient temperature.

Substrate preparation, inoculation and incubation

Cassava waste (containing the rinds, pulp plus rind and some smaller tubers) was collected from garri processing centres around Ilorin metropolis, Nigeria. The cassava wastes were sun-dried, milled and later autoclaved at 121°C, 15 psi for 15 min so as to destroy any microbes. The content was allowed to cool and hence inoculated with the spores of *T. harzanium*. Each bag (250 g) of sterilized substrate was inoculated with 10 ml of the spore suspension containing 10^7 spores/ml. The inoculated substrates were later incubated at ambient temperature. On the 10^{th} day, the substrate was fully covered by the fungus. The substrate was then oven dried at 70°C in a forced air dried laboratory oven for 24 h so as to ter-

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Table 1. Composition of the experimental diets.

Ingredients (%)	Diet			
	A	B	C	D
Untreated cassava waste	40	20	10	----
Fungus treated cassava waste	----	20	30	40
Sorghum dried brewers grain	15	15	15	15
Wheat Offal	15	15	15	15
Palm kernel meal	28	28	28	28
Salt	1	1	1	1
Vitamin – mineral premix	1	1	1	1
Total	100.00	100.00	100.00	100.00
Proximate composition (%)				
Dry matter	89.35	91.15	91.15	90.85
Crude Protein	12.49	16.32	18.72	23.36
Crude Fibre	11.84	9.53	8.82	7.48
Ether extract	7.72	6.26	6.28	6.49
Gross energy (Mcal/kg)	58.19	59.94	60.82	62.56

minate the fungus growth as well as prevent the protein from denaturing.

Animal and management

Twelve does aged between 2 and 3 years and weighing between 15 and 23 kg used for the experiment were treated against ecto and endo parasites using IVOMEC while long acting oxytetracycline injection was administered to protect the animals against cold and other related disorder. The does were randomized against the experimental diets (A, B. C and D) in a completely randomized design model.

Oestrus synchronization

Each does was given orally, two tablets of Janova once daily for two successive days and it was repeated after 10 days in case no oestrus or weak oestrus is observed (each capsule containing pippali 50 mg, sunthi 50 mg, indraraaruni 500 mg, marich 50 mg, and excipients 9.5). All animals were hand mated.

A matured aproned buck was used to detect oestrus (heat). Oestrus detection was carried out twice daily (am and pm) for 3 successive days post synchronization with the aid of vasectomised buck. Animals that showed oestrus were again given JANOVA tablets and later mated with the aspermatic buck until the end of oestrus period. Animals that did not show any signs of heat were again checked between 17 and 25 days and then bred if they showed any heat. Animals were assumed to have being pregnant after 30 days of non-return period.

Experimental diets

The animals were fed with experimental diets consisting of diet A with 40% of untreated cassava waste while diets B, C and D are having Trichoderma treated cassava waste in the proportion of 20, 30 and 40% respectively. Other ingredients were of fixed amount in the diets (Table 1). Watering and feeding were provided *ad libitum* while the does kidded after 150 days. The litter size and the weight of the kids at birth were recorded.

The kids were allowed to suck the does for 5 days before the commencement of milk collection and evaluation. The kids were separated from the does at the end of the colostrum period but allowed to stimulate the lactating does for milk let down. About 10% of the body weight of the kid was given (Banerjee, 1982) as the daily milk requirement. The does were hand milked twice daily (am and pm).

Milk collection

The milking parlour, utensils and other equipment are well cleaned and sterilized while the milker maintained high level of hygiene. The udders were washed clean with warm detergent water and later rinsed with warm water. Daily milk production per animal per treatment was recorded while the quality of milk was sampled for the total solids, solids not fat (SNF), fat, protein, fat corrected milk (FCM), ash, acidity, pH and specific gravity (AOAC, 1990).

Chemical analysis

Samples of the experimental diets were analyzed for dry matter and other proximate composition according to the method of AOAC (1990).

RESULTS AND DISCUSSION

There were variations in the chemical composition of the experimental diets due, probably, to the inclusion of varying levels of the fungus treated cassava waste (Table 1). The values of crude protein content obtained varied from 12.5 to 23.4% with diet D having the highest among all the diets. The lowest crude fibre content was recorded for diet D. This may be connected with the nutritional requirement of the fungus.

No sign of impaired health was recorded in the animals during the course of the experiment. However, the dry matter intake is shown in Table 2. Animal on the fungus

Table 2. Feed intake, milk yield and composition of the experimental animals.

Parameter	Diet				
	A	B	C	D	± SEM
Dry matter intake	539.72[a]	597.52[a]	721.91[b]	750.62[b]	8.75*
Organic matter intake	493.14[a]	557.78[b]	666.32[c]	700.70[a]	7.75*
Milk yield (kg/d)	0.09	0.14	0.15	0.20	0.02*
Fat (%)	5.58[a]	6.10[b]	6.03[b]	7.93[c]	0.11*
SNF (%)	6.86[a]	8.56[b]	9.90[b]	8.98[b]	0.13*
Total solids (%)	12.44[a]	14.66[b]	15.83[c]	16.90[d]	0.06*
Protein (%)	4.26[a]	5.71[b]	5.38[b]	5.59[b]	0.03*
Ash (%)	0.50[a]	0.55[a]	0.60[b]	0.60[b]	0.002*
Acidity (%)	0.25[a]	0.19[b]	0.21[b]	0.16[c]	0.003
Specific gravity	1.037	1.038	1.038	1.038	0.0003NS
pH	6.00	6.20	6.20	6.28	0.05NS
FCM yield Kg/d[a]	0.12[a]	0.18[b]	0.20[b]	0.30[C]	0.004*
Gross efficiency (milk)	0.004	0.006	0.006	0.007	0.0005*

*Mean along the same row with different superscripts is significant ($p < 0.05$). NS = Not significant ($p > 0.05$).

treated diets B – D consumed more dry matter and organic matter over the trial period. The increasing consumption of the fungus treated cassava waste could be due to the improved aroma impacted by the fungus (*T. harzanium* rifai).

The milk yield of the experimental animals was highest for the fungus treated diets B – D as follows: 0.09 (A), 0.14 (B), 0.15 (C) and 0.20 kg (D). The highest quantity of milk recorded for diet D could be related to the improved nutrient content (crude protein = 23.4% of this diet). However, the milk yield in this study was comparable to that of Red Sokoto goat (Devendra and Burns, 1983). The overall FCM yield of goats was affected ($P < 0.05$) by the inclusion of fungus treated cassava waste with the FCM yield of goats on diets B-D having higher values. Similar trend was observed for the gross efficiency of milk.

Milk protein content (Table 2) tended to be higher (5.59%) for does fed with fungus treated diets B – D due to the addition of the microbial protein synthesized during the pre-digestion of the substrate. Milk fat content increased significantly ($P < 0.05$) with the fungus treated diets. The ranges of fat content in the present study were comparable to the values in previous studies (Mba et al., 1975). The increasing fat and protein of the milk reported herein is a welcome development for cheese industries since milk used in cheese factories are paid for based on these two components (Cerbulis and Farrel, 1975).

The higher total solids content in milk of goats fed the fungus treated diets (B – D) can be interpreted to suggest that the microbial growth and microbial protein synthesized during pre-treatment of cassava waste might have enhance the content of the milk total solids. The pH and the specific gravity values were similar to values for lactating does reported elsewhere.

The differences in the ash content of the milk may be partially due to the addition of the fungus treated cassava waste. This agreed with the report of Jacqueline and Visser (1996) that pre-digestion of substrate with fungus enhanced the mineral content of such substrate. The decrease in solids not fat content accounted for 78% of the increase of the fat content. In this study SNF increased by 2.12 percentage units from the control diet to 40% fungus treated diet D.

Implication

Inclusion of *Trichoderma* treated cassava waste in the diet of lactating does is beneficial in enhancing milk quantity and quality (fat, SNF, protein and total solids). Also, added *Trichoderma* treated cassava waste in goats diet had significant effect on dry matter and organic matter intake of lactating goats.

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