Journal of Animal & Plant Sciences, 2009. Vol. 3, Issue 1: 170 - 173.
Publication date: 15 May 2009, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

Performance of West African Dwarf goat fed on cellphone recharge cards treated with *Trichoderma harzianum*

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Key words
Trichoderma harzanium, recharge cards, diet, performance, goat

1 SUMMARY

This study investigated the dietary effect of cellphone recharge cards treated with *Trichoderma harzanium* on performance of goats. Discarded cards (10kg) from the popular Nigerian mobile companies (MTN, GLO and Multlinks) were collected and incubated with *Trichoderma harzanium* in solid state fermentation for seven days. The resulting substrate was included in the diet of West African (WAD) goat (n= 12). The goats were allocated at random to three groups for eight weeks to examine the efficacy of three diets: A (control diet without cards, 0%); B (3.5% proportion of *Trichoderma*-treated card) and C (6.5% proportion of the *Trichoderma*-treated cards). Parameters assessed included feed intake, digestibility coefficient, weight gain and feed efficiency of WAD goat. Addition of the fungus-treated cards in the diet of goat significantly (p<0.05) enhanced the dry matter intake, crude fibre intake and ether extract intake. Digestibility of crude protein did not differ between diets A (control) and B (3.5% part). Crude fibre and ether extract digestibility were significantly increased (p<0.05) for diets with 3.5 and 6.5% treated cards. The weight gain of animals on diet with 3.5% cards was similar to that of the control diet. The results suggest that the addition of *Trichoderma* treated cards in the diet of goat holds a good promise in developing a novel feedstuff through biotechnology.

2 INTRODUCTION

Dry season feeding is one of the major problems facing livestock production in developing countries due to high cost and scarcity of feed. The use of unconventional ingredients, e.g. recharge cards is a potential way of helping farmers to reduce feed costs. Recharge cards are made of wood pulp and are used by mobile phone operators to sell airtime credit. The cards are discarded once the code has been entered and the value redeemed. Making use of the discarded cards in feed formulation, though unconventional, is also a way of adding value to byproducts that currently have little or no productive use to boost farm earnings.

The recharge cards are made from wood pulp and are printed on the surface using standard ink. The rapid growth rate, estimated at 125% p.a. in the telecommunication sector since 2001, the industry has had a positive impact on the social-economic activities of most African countries (Cyrille, 2005; MauroDalla, 2008). Despite these numerous positive impacts, environmental pollution is a major challenge of this new technology. In Nigeria and most developing countries, used cellphone recharge cards constitute an environmental nuisance as they are discarded indiscriminately, thus litter grounds and can also block drainage ways.

The problem could be solved if an economically viable use is identified for the used recharge cards. This could be, for example, by processing through biotechnological methods and recycling as novel feedstuff for ruminant animals. Numerous workers (Jacqueline *et al*., 1996; Abu *et al*., 1999;; Belewu, 2003; Belewu, 2006. Belewu & Popoola, 2007) have reported on the microbial treatment of waste agricultural residues (cassava wastes, rice husk, sorghum stover, corn cob, maize sheath) and non agricultural waste residues (saw dust, waste paper and greeting cards) with encouraging results.

The hypothesis in this study was that feeding animals with a novel feedstuff made from the recycled cards will provide the animal with additional ruminally undegradable protein (RUP) (microbial protein). The RUP will also provide additional MP (microbial protein) for tissue deposition. The objective of this study was to examine the effect of a diet comprising of cards treated with *Trichoderma harzanium* on the performance of West African dwarf goat.

3 MATERIALS AND METHODS

3.1 Animals: The experiment was conducted at the Animal Production Department, University of Ilorin, Nigeria. Twelve West African dwarf goats weighing between 4.6 and 5.8kg were bought from a local market in Ilorin metropolis and used for the experiment. The animals were treated against ecto and endo-parasites using Ivomec® while L-oxytetracycline was used against cold and pneumonia. The animals were randomly allocated to the experimental diets in a completely randomized design model.

3.2 Preparation of experimental diets: Used cellphone recharge cards were collected from vendors of GLO, MTN and Multilinks airtime credit. The cards were soaked in water to remove the ink, rinsed and later autoclaved at 121^{0}C for 15 minutes to kill any microbes. The cooled autoclaved cards were inoculated with a *Trichoderma harzanium* strain. The strain was obtained from the culture collection of the Department of Animal Production, University of Ilorin, and has been used in the treatment of cassava waste and sorghum stover (Belewu, 1999). The fungus strain was inoculated onto potato dextrose agar (PDA) in Petri dishes and incubated for 5 days at 37°C, prior to the inoculation of the cooled autoclaved cards. Spores of *Trichoderma harzanium* were harvested by flooding the Petri dish with Tween 80 solution followed by scrapping the mycelia surface. The spore suspension was adjusted to 10^7-10^8 spores /ml using distilled water and later used to inoculate the substrate. Inoculated substrate was incubated at ambient temperature until the fungus enveloped the substrate in 7 days. On the 8th day the fungus growth was terminated by oven drying the substrate at 70^{0}C for 48 hours. The fungus treated and oven dried cards were then used in the formulation of diet (Table 1). Diet A was the control (other ingredients without cards) while diets B and C contained cards treated with fungus at 3.5 and 6.5% substitution, respectively, to replace part of soybean meal. The animals were watered daily and fed *ad-libitum* for a 56-day period. The refused diets were collected and weighed daily.

3.3 Laboratory analysis: Feeds, refusals and faecal samples were analyzed for proximate composition (A.O.A.C. 1990).

3.4 Statistical analysis: All data were subjected to Analysis of variance of a complete randomized design model (Steel & Torrie, 1980) while treatment means were separated using Duncan multiple range test.

4 RESULTS AND DISCUSSION

4.1 Dry matter intake and digestion: Dry matter percentage (DM %) was numerically higher in the diets with fungus treated cards than in the control diet (Table 1). This resulted into a significant increase ($p<0.05$) in the dry matter intake. However, total DM intake was highest for diet with 6.5% fungus treated cards ($p<0.05$) followed closely by diets with 3.5% fungus treated cards (Table 2). The higher intake could probably be due to the slightly higher DM of diets B and C compared to the unsubstituted diet A. However, Belewu (2003) observed differences in the DM intake by rats consuming fungus treated waste paper and corn cob. However, the diet fed in the current experiment was of high dry matter digestibility (Table 2). The similarities in the dry mater digestibility in this study revealed the potential of the fungus treated cards to meet the DM requirement of goats of such age.

4.2 Fibre intake and digestion: The intake of crude fibre was superior in diets B and C (with 3.5 and 6.5% fungus treated cards) compared to diet A (control) (Table 2). This observation could probably be due to the pre-digestion of the cards by the fungus. The fungus synthesizes various enzymes (lipase, cellulose, hemicellulase, xylanase, valine arylamidase, N-acetyl-ß-glucoseaminidase and these could have helped in the pre-digestion of various fibre fractions of the cards (Kuquk & Kivanic, 2004).

Table 1: Composition of the experimental diets

Ingredients %	**Diet A (Control)**	**Diet B**	**Diet C**
Cassava waste	63.00	63.00	63.00
Rice husk	22.00	22.00	22.00
Fungus Treated Recharge card	-------	3.50	6.50
Soybean meal	13.00	9.50	6.50
Vitamin-mineral premix	1.00	1.00	1.00
salt	1.00	1.00	1.00
Total	100.00	100.00	100.00
Chemical composition %			
Dry matter	80.00	84.00	86.00
Crude protein	17.50	11.80	9.50
Crude fibre	15.00	38.00	38.00
Ether extract	7.00	6.00	4.50

4.3 Crude protein and ether extract intake and digestion: The crude protein intake (CPI) was affected by the inclusion levels of the fungus treated cards, with the least CPI recorded for diet C (6.5% replacement). The CPI followed a similar trend as the crude protein content of the diet. The CPI decreased linearly with increasing inclusion of the fungus treated cards (Table 2). However, the performance of the animal was not significantly affected. Additionally, the animals could have gained more microbial protein from diets B and C. This conclusion is supported by the possibility that rumen undegraded protein (RUP) was provided to the animals for tissue deposition. This resulted in significant differences ($p<0.05$) in the weight gain among the animals fed diets B and C. The weight gain increased in the order C >B> A (Table 2). Apparent crude protein digestibility was greater ($p<0.05$) for diets A and B (Table 2). In this study, CP digestibility followed similar trend as the CPI. Additionally, CP digestibility was least in diet C whereas DM percentage in the diets did not differ, thus the decreased CP digestibility observed can be attributed to the decreased microbial nitrogen flow to the duodenum.

Table 2: Feed intake and digestibility coefficient of the experimental diets.

Parameters(g/d)	**Diet A (Control)**	**Diet B**	**Diet C**	**±SEM**
Dry matter intake	120.00^{c}	134.40^{b}	146.20^{a}	3.50*
Crude Protein intake	26.25^{a}	18.90^{b}	16.20^{b}	7.50*
Crude fibre intake	22.50^{b}	60.80^{a}	64.60^{a}	6.10*
Ether extract intake	8.40^{a}	8.10^{a}	7.35^{b}	2.42*
Dry matter digestibility (%)	82.00^{a}	78.00^{b}	83.00^{a}	13.63*
Crude Protein digestibility (%)	65.00^{a}	64.00a	52.00b	12.37*
Crude fibre digestibility (%)	56.00^{b}	74.00^{a}	72.00a	11.83*
Ether extract digestibility (%)	57.00^{b}	48.00^{c}	64.00^{a}	9.82*
Weight gain(kg/d)	0.45^{a}	0.55^{ab}	0.68^{a}	0.024*
Feed efficiency	3.75^{b}	4.10^{ab}	4.65^{a}	1.56*

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Means with similar superscripts are not significantly different from each other ($p>0.05$).

There was no significant difference ($p<0.05$) in the ether extract intake (Table 2), probably due to the fact that the fungus secrets lipase mostly during growth and this could have improved the ether extract digestibility of diet C. The increased feed efficiency of diets B and C could be due to the secretion of lipase by the fungus during growth. Generally, the addition of fat to diets B and C could increase feed efficiency.

The results of this study demonstrated that *Trichoderma harzanium* treated cards has no detrimental effect on the performance of goats. However, the availability of rumen undegradable protein (RUP) in form of microbial protein may support greater production by supplying microbial protein for tissue deposition and better weight gain. Recycling used cellphone recharge cards by treating them with fungus and using them as diet for goat will benefit the farmers who are faced with the problem of dry season feeding as well as help in solving the problem of environmental pollution.

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