British Biotechnology Journal
1(2): 46-52, 2011

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Effect of Cocktail of Fungi Blend on the Digestibility Coefficient and Digestible Nutrients of Goat *(Capra hircus)*

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Research Article

Received 15th June 2011
Accepted 22nd June 2011
Online Ready 17th July 2011

ABSTRACT

Nine West African dwarf goats (3 goats per diet) initially averaging between 4.5 and 6.5kg body weight, were fed either *Jatropha curcas* untreated diet A (control), 50% cocktail of fungi blend treated *Jatropha curcas kernel* cake (diet B) and 100% cocktail of fungi blend treated *Jatrpoha curcas* kernel cake (diet C) *adlibitum* for 56 days followed by a 7 day total faecal collection. All the diets have a crude protein content of between 17.99 and 19.23%. Total dry matter intake (TDMI) (543.25 – 606.25g/d) showed significant differences among the diets ($p<0.05$). The digestibility coefficient of dry matter which was similar ($p>0.05$) among the diets ranged between 91.84% and 94.31%. The digestibility of crude protein was numerically highest for diet B and least for other diets (A and C). The digestible dry matter intake was significantly ($p<0.05$) higher for diet B compared to other diets. The digestibility of crude fibre and ether extract followed same trend as other nutrients. The digestible crude protein intake was 481.6g/d (A), 544.63g/d (B) and 472.6g/d (C). The digestible crude fibre intake was greater ($p<0.05$) for diet B (576.25) followed closely by diet A (520.5g/d) and C (516.75g/d). Digestible ether extract intake tended ($p<0.05$) to be lower for goat fed diet C (500.00g/d) compared with diet A and diet B which were similar ($p>0.05$). In conclusion, inclusion of cocktail of fungi blend *Jatropha curcas* kernel cake in a mixed ration appear to be viable feed ingredient for goat diet.

Keywords: Fungi blend; goat; digestibility coefficient; digestible nutrients;

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1. INTRODUCTION

Nutrition constitutes a great challenge militating against optimal livestock production in developing countries. The nutritional value of many of the feedstuffs especially forage are not constant as their nutritional qualities ranges from high during the rainy season to low in dry season (Bayer *et al*., 1998). To this extent the palatability, feed intake, digestion and absorption are seriously hampered.

It is interesting to note that there is enormous availability of the various unconventional feedstuffs which could be used as animal feed if properly processed. These wastes amounted to approximately 194x 10^6 million tons from feed and tree crops and constitute approximately 45 % of total available by-product from annual and perennial tropical crops (Belewu, 2001). In many parts of the tropics, protein rather than energy is the main limiting nutritional factor hence special attention is needed in this direction. Although, energy may be adequate, but a deficiency of protein can interfere with voluntary feed intake and delay growth, oestrus, puberty and reproduction. Practical diet for goat must be nutritionally adequate, realistic and cheap.

Jatropha curcas kernel cake is a locally available crop residue from Jatropha seed. The cake is nutritious (Crude protein =56 - 64 %) Aderibigbe *et al*. (1997) but contains some toxins like tannins, saponin, lectins cyanide, phytates, trypsin inhibition, phorbolesters (Makkar and Becker (1999). However, there has been careful effort to detoxify the toxins using chemical method with little or no detrimental consequence on animal and their products. Numerous researchers (Aderibigbe et al., 1997; Makkar and Becker, 1999) reported on the chemical method of detoxification with no encouraging results. Conversely, the biological method is well documented in literature (Shahera and Sanaa, 2002. Belewu and Akande 2010., Belewu *et al* 2010[a,b]) with encouraging results. In the current study therefore, effort was made to adopt harmless and reliable biological method of detoxifying toxins in Jatropha curcas kernel cake. Solid state fermentation (SSF) was unleashed in this work (*Trichoderma harzanium, Penicillum chrysogenum and Aspergillus niger*) holds high potential in the production of potent enzymes that aid in the detoxification process. Hence the thrust of this study was to evaluate the efficacy of cocktail of fungi blend on the digestibility of West African dwarf goat.

2. MATERIALS AND METHODS

2.1 COLLECTION OF JATROPHA CURCAS FRUIT

Sundried *Jatropha c urcas* fruits were collected from Osun State and Kwara State , Nigeria. The pericarps were removed to obtain the seeds which were later dehusked manually to obtain the kernel. The kernels obtained were milled using the milling machine to get the meal.

2.2 PROCESSING AND PRESERVATION OF THE KERNEL CAKE

2.2.1 Extraction of the Oil

The meal was defatted using both the mechanical and wet chemical method (Petroleum ether). The meal was soaked with Petroleum ether in an airtight container. The container was constant shaken and allowed to stand for an hour. After which the liquid was decanted

into a separate airtight container so as to avoid evaporation of the highly volatile petroleum ether. The residue was strained through muslin cloth to obtain both the filtrate and the cake. The cake was dried and later inoculated with fungi

2.2.2 Fungi Used

The inoculi (*Aspergillus niger, Penicillum chrysogenum* and *Trichoderma harzanium*) were collected from the Institute of Agricultural Research and Training , Ibadan and maintained on Potato dextrose agar (PDA).

2.2.3 Substrate

The processed *Jatropha curcas* kernel cake was autoclaved at 121^{OC} and 15psi for 15 minutes so as to get rid of any possible microbes. The substrate was later allowed to cool before inoculation and incubation with the inoculi.

2.3 INOCULATION AND INCUBATION

Each of the fungi (*Aspergillus niger, Trichodermma harzanium and Penicillum chrysogenum*) was sub-culture and multiplied on Potato dextrose agar (PDA) containing in petri-dishes and incubated for 7days at room temperature to enhance their growth. The substrate was inoculated in layers with 5ml each of *A. niger, T. harzanium and P. chrysogenum* spore suspensions containing 10^7 in clean basin and covered with black polythene for 14 days. The microbes covered each of the substrate in 14 days and the growth was terminated by oven drying the inoculated cake at 70°C.

2.4 ANIMAL AND MANAGEMENT

Nine West African dwarf goats were bought from a market in Ilorin metropolis, Nigeria and treated against Ecto and Endo parasites using Ivermectin. The animal were randomized against the experimental diets in a completely randomize design model.

2.5 EXPERIMENTAL DIETS AND FEEDING

The diets consist of A (Control) – a Soybean cake based diet; B (50% Soybean cake plus 50% Cocktail of fungi blend treated *Jatropha curcas* kernel cake) and C (100% of cocktail of fungi blend treated Jatropha *curcas* cake). The animals were fed and water *adlibitum.* The experiment lasted for a 56 day while digestibility coefficient was carried out during the last two weeks of the experiment. The digestibility was by total feacal collection method (intake – feacal output/ intake x100). The result is expressed in percentage and this shows the degree of digestibility of various nutrients. The digestible nutrients were calculated by multiplying the feed intake by the digestibility coefficient.

2.6 ANALYSES

Samples of the fungi blend treated and untreated *Jatropha curcas kernel* cake were subjected to chemical analysis (Crude protein, crude fibre ether extract ash) using the method of A. O. A. C. (1995).

Table 1. Composition of the Experimental Diets (%)

Ingredients	Diet A	Diet B	Diet C
Cassava waste	53.00	53.00	53.00
Soybean cake	10.00	5.00	-
Fungi blend *Jatropha curcas* kernel cake	-	5.00	10.00
Cowpea husk	35.00	35.00	35.00
Vitamin-mineral premix	1.00	1.00	1.00
Salt	1.00	1.00	1.00
Total	100.00	100.00	100.00

2.7 STATISTICAL ANALYSIS

All collected data were subjected to analysis of variance of a completely randomized design model while significant means were separated using Duncan (1955) multiple range test.

3. RESULTS

The dry matter % of diet C (91.00) was numerically highest among the experimental diets which was followed by A and B in that order (Table 2). The crude protein content of the fungi blend treated *Jatropha curcas* kernel cake was higher than the control diet (A).The crude fibre percentage recorded for diet C was 56.04% while diets A and B were 60.56% and 60.80%, respectively. The percentage of ether extract decreases from diet A (14.4%) to C (11.54%). The ash content of diet C (14.30%) was higher than the remaining diets.

Table 2. Proximate Composition of the experimental diets (DM Basis)

Parameters (%)	Diet A	Diet B	Diet C
Dry matter	90.00	88.00	91.00
Crude Protein	17.99	18.64	19.23
Crude fibre	60.56	60.80	56.04
Ether extract	14.44	12.50	11.54
Ash	11.67	10.80	14.30

The dry matter digestibility (Table 3) was similar among diets with diet B having numerically highest value. The crude protein digestibility which was numerically greater for diet B was similar to other diets ($p>0.05$). The crude fibre digestibility of diet B (95.18%) was similar to that of diets A and C ($p>0.05$).

Increasing the proportion of fungi blend treated *Jatropha curcas kernel* cake from 50% (diet B) to 100% (diet C) inclusion level in a complete diet for goats was similar to the control diet A ($p>0.05$) in most of the parameters (crude protein, crude fibre, ether extract and dry matter) evaluated.

Table 3. Apparent digestibility coefficient of the experimental diets

Parameters (%)	Diet A	Diet B	Diet C	±SEM
Dry matter Intake(g/d)	553.75[b]	606.25[a]	543.25[b]	12.43*
Dry matter digestibility	92.25	94.31	91.84	1.60NS
Crude Protein digestibility	87.00	89.90	87.70	2.60NS
Crude fibre digestibility	94.09	95.18	95.22	1.02NS
Ether extract digestibility	96.18	93.10	92.26	1.56NS

Means with different superscripts are significantly different from each other (p<0.05); NS= Not significant at P>0.05

Conversely, the digestible dry matter intake was significantly differently among diets A to C. The highest digestible dry matter intake (Table 4) was diet B while diet C recorded the least value. Goat on diet B recorded significant amount of digestible protein intake, digestible ether extract intake and digestible crude fibre intake.

Table 4. Digestible nutrients of the experimental diets

Parameters (%)	Diet A	Diet B	Diet C	±SEM
Dry matter	511.00[b]	571.09[a]	498.62[b]	11.47*
Crude Protein	481.60[b]	544.63[a]	472.63[b]	4.20*
Crude fibre	520.50[b]	576.25[a]	516.75[b]	11.73*
Ether extract	532.00[ab]	564.00[a]	500.00[b]	11.59*

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

4. DISCUSSION

The fungi blend treated *Jatropha curcas* kernel cake was readily consumed by the goats which suggest that the diets were palatable. No health problems were noted throughout the experimental periods.

The highest crude protein content of diet B might be due to the addition of microbial protein coupled with the presence of soybean cake in such diet. This was similar to the result reported elsewhere (Belewu et al., 2010). Belewu et al. (2011) also reported higher dry matter content of fungi treated based diets and noted that feeding of the fungi based diet resulted in increasing dry matter digestibility. Additionally, the better dry matter digestibility could be accounted for by the interaction between animal (physiological and biological factors) and nutrition.

The numerical higher digestibility of dry matter, crude protein and crude fibre of diet B could be due to the synergistic effect of two different protein sources which might have influenced the digestibility of the feed. The result also suggests that the inclusion of both fungi treated *Jatropha curcas* kernel cake and soybean cake in the diet could have had a prominent

influence on the taste of the feed which could have enhanced dry matter intake. The higher crude protein digestibility of diets B and C could be attributed to the pre-digestion activities by the fungi blend on the substrate which might have enhanced better digestion and absorption (Belewu *et al*., 2001). Crude fibre digestibility of diets B and C were similar but higher than the value obtained for diet A. This is consistent with the works of many researchers who reported increased crude protein and fibre digestibility when fungi treated samples were fed (Belewu, 1999; Belewu, 2001).

The digestible nutrient intake (Table 4) of dry matter, crude protein, crude fibre and ether extract of diet B were significantly higher compared to other diets (A and C). This shows an improvement on the result from similar experiment reported by Belewu et al. (2010). This could be due to the utilization of cocktail of fungi in the present study.

The biological method of treatment employed in this study seemed to be more effective and could improve the digestibility of *Jatropha curcas* kernel cake. It can also enhance the acceptability of the feedstuff due to better feed taste, texture and aroma (Hanna et al., 2004) after fungi treatment.

5. CONCLUSION

Goats readily ate the fungi blend *Jatropha curcas kernel* based diets B and C as well as the control. The diets appear to be viable feed for goats. In conclusion, the inclusion of fungi blend treated *Jatropha curcas* kernel cake in the diet of goat had a positive impact on the digestibility and digestible nutrient of goat.

REFERENCES

Aderibigbe, A.O., Johnson, C.O., Makkar, H.P.S., Becker, K. (1997). Chemical composition and effect of heat on organic matter and nitrogen degradability and some antinutrientional component of Jatropha meal. Anim. Feed Sci. Tech., 67, 223-243.

A.O.A.C. (1995). Association of Analytical Chemist. Official methods of Analyses. 16th edn. Washington DC.

Belewu, M.A. (1999). Conversion of sorghum stover into feed by Trichoderma harzanium and the feeding of resulting materials to Red Sokoto goats. Biosci. Res. Comm., 13, 25-35.

Belewu, M.A. (1999). Treatment of sorghum stover by application of fungus *Trichoderma harzanium*. Nig. J. Appl. Sci., 4, 811-815.

Belewu, M.A., Akande, B.A. (2010). Biological Upgrading of nutritional quality of *Jatropha curcas* kernel cake: Effect on Performance characteristics of Goat. Int. Res. J. Biotech., 1(2), 19-22.

Belewu, M.A. (2001). Effect of fungus (*Volvariella volveceae*) treated cotton waste as replacement for cotton seed cake and meal by Wad goats. Trop. J. Anim. Sci., 4(10), 93-98.

Belewu, M.A., Belewu, K.Y., Ogunsola, F.O. (2010a). Nutritive value of dietary fungi treated *Jatropha curcas* kernel cake: voluntary intake, growth and digestibility coefficient of goat. Agric. Biol. J. North Am., 1(2), 135-138.

Belewu, M.A., Eniolorunda, O.O., Ilori, G. (2010b). Response of Goat to Fungi (*Rhizopus oligosporus*, *Rhizopus nigrican*) treated *Jatropha curcas* kernel cake. Arch. Appl. Sci. Res., 2(4), 255-261.

Belewu, M.A., Ahmed, O., Ibrahim, S.O. (2011). Solid state fermentation of *Jatropha curcas* kernel cake with cocktail of fungi. Int. J. Biosci. 1(1), 12-19.

Duncan, D.B. (1955). Multiple range and multiple F-test. A Biometrics Approach 11, 1-42.

Hannan, M., Marcin, B., Anita, R., Stanishlaw, B. (2004). Physiological properties and enzymatics activities of Rhizopus oligosporus in solid state fermentation. Elect. J. Polish Agric. Unii Biotech 1(1).

Makkar H.P.S., Becker, K. (1999). Nutritional studies on rats and fish (*Carp cyprinus carpio*) fed diets containing unheated and heated *Jatropha curcas* meal of a non toxic provenance. Plant Food Human Nutr., 53, 182-292.

Shahera, H. Ahyia, Sanaa, M. Ashou. (2002) Biodegradation of agro-industrial waste under solid state fermentation and nautral environmental condition. Egyptian J. Bio., 4, 23-40.

Wolfgang, Bayer, Ann –Bayer. (1998). Forage Husbandry, pp. 58-80.
