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# Cocktail of Fungi Blend on *Jatropha curcas* Kernel Cake: Effect on Feed Intake and Blood Parameters of Goat

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**Abstract:** West African dwarf goats (n=12) were randomly divided into three groups of four goats each to evaluate the efficacy of cocktail of fungi blend treated *Jatropha curcas* kernel cake. Each group was randomly assigned one of the diets {A = Soybean cake based diet (control); B =50% cocktail of fungi blend treated *Jatropha curcas* kernel cake plus 50% soybean cake; C = 100% cocktail of fungi blend treated *Jatropha curcas* kernel cake. A completely randomized design model was used for the study. Animals were individually fed the experimental diets and water *ad-libitum.* During the feeding trial (112days) the feed consumed and blood parameters of the experimental animals were evaluated. Dry matter, crude protein and crude fibre consumed were higher for diet B compared to other diets. Conversely, the least ether extract intake was noted in diet C. Additionally, the ash intake was 64.63% (A), 65.50% (B) and 78.0% (C). Weight gains differ significantly between treatment groups although; goats fed diet B were heavier than the rest. Packed cell volume (PCV) in goats fed cocktail of fungi blend *Jatropha curcas* kernel cake were similar and significantly ($p<0.05$) lower than goats fed the control diet. The haemoglobin (Hb), white blood cell (WBC, red blood cell (RBC), lymphocyte and eosinophil were similar ($p>0.05$) across all diets. It could be concluded from this study that all the diets did not depress voluntary intake nor alter the allometry of growth of the experimental animals.

**Key words:** Cocktail · Fungi blend · Feed consumption · Blood indices

## INTRODUCTION

The continuous rise in human population all over the world with annual average of 7 billion has brought an increase demand for animal protein. The current level of consumption of meat and animal protein is estimated at 8g per caput per day [1]. In Nigeria, the average daily consumption of 54 g protein with 6.5 g from animal sources falls below the recommended daily protein intake of 86g and 8.4 g of animal protein. It has been reported also [2] that poor quality roughage fed to ruminants without supplementation during dry season caused considerable weight loss and finally death of the animal. Hence, protein supplementation is very vital in livestock ration. The various sources of protein include conventional (soybean, groundnut, etc) and unconventional. The price of the conventional source of protein in livestock ration had risen due to competition between man and livestock. The aforementioned problem thus requires sourcing for alternative non-conventional protein feedstuff. This contention stimulated animal nutritionists thereby focusing their attention on researching into alternative novel feedstuff that can appropriately be substituted for the conventional feedstuffs without compromising quality. Example of such novel feedstuff includes *Jatropha curcas* kernel cake.

The cake which is very rich in nutrients is hindered by the presence of antinutrients like Lectin, tannins, saponin, phytates, cyanides, trypsin inhibitor and phorbolester [3, 4].

Various processing methods of detoxifying the cake are reported elsewhere in literature [3, 4]. The chemical method of detoxification are well documented Makkar and Becker [3], Aregheore *et al*. [5] and Martinez –Herera *et al*. [6] but not with encouraging results. However, the biological method of detoxification is still at the infancy stage. The utilization of fungal in the fermentation of substrate can improved the protein and the digestibility contents between 10 and 15 % [7].

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Additionally, it was noted that the total lipid and fatty acids were enhanced after solid state fermentation [8, 9]. Abu *et al*. [8], reported increasing protein (7-8%) content of potato processing waste when it was incubated with yeast. Belewu and Okhawere [10] noted decreased neutral detergent fibre, Acid detergent fibre and hemicellulose contents of lignocellulosic fibre. There was reduction in the antinutritional factors like phytic acid, polyphenol and tannin. Additionally, there was an increase in the bioavailability of various nutrients. This biological treatment is an option that has received significant attention in recent time Belewu and Okhawere, [10], Belewu and Banjo, [11] Belewu *et al*. [4]. It is interesting to note that biological treatment of substrates mimics the effect of pre-digestion of fungi on the substrates. Hence, the objectives of the study include the evaluation of the efficacy of fungi blend treatment on the detoxification, feed intake and blood indices of West African dwarf goats.

## MATERIALS AND METHODS

**Collection of *Jatropha curcas* Fruits:** Dried *Jatropha curcas* fruits were harvested from the Jtropha Plantation, University of Ilorin, main campus, Nigeria. The pericarps were removed to obtain the seeds which were later dehusked manually to obtain the kernel. The kernel obtained were milled using milling machine so as to obtain the meal.

**Processing and Preparation of *Jatropha curcas kernel* Cake:** The meal was defatted using both the mechanical and chemical methods. The meal was pressed using hydraulic press to expel the oil. After which the residue was soaked in petroleum ether containing in an air tight container for one hour and later decanted. The final residue which was whitish and dried, was later autoclaved at 121°C to get rid of any possible microbes. The substrate was then allowed to get cool before inoculation and incubation with cocktail of fungi blend.

**Fungi Blend Used:** The Fungi (*Asper gillus niger, Penicillium chrysogenum, Trichoderma harzanium)* used were obtained from the Institute of Agricultural Research and Training (IAR and T), Ibadan and maintained on potato dextrose agar (PDA). Each of the fungus was sub-cultured and multiplied on Potato dextrose agar (PDA) containing in petri-dishes and hence incubated for 7 days at ambient temperature to enhance their growth.

**Inoculation and Incubation of the Substrate:** The cooled autoclaved substrate (10kg) was later inoculated in layers with each of the spores of *Aspergillus niger, Penicillium chrysogenum* and *Trichoderma harzaniumm* containing $10^7$ spores per ml for each fungus. The inoculated substrate was incubated at ambient temperature for 7 days till when the fungi enveloped the substrate. The growth of the microbes was terminated by oven drying the inoculated substrate at 70°C.

**Animal and Management:** Twelve weaned bucks of West African dwarf goats used for this study at the Animal Production Department of the University of Ilorin, were purchased from a local market in Ilorin, Nigeria. The animals were treated against ecto and endo parasites using IVOMEC. The goats were allowed to adapt to the experimental diets before data collection.

The animals were randomized against the experimental diets in a completely randomized design model (Table 1). Feeding and watering were *ad-libitum* throughout the study.

Parameters evaluated include feed intake and blood parameters. Feed intake was obtained by subtracting feed orts from feed offered while blood was collected fortnightly for blood indices.

**Analyses:** Proximate composition of the feed and ort were determined according to the method of A.O.A.C. [12]. While packed cell volume (PCV), haemoglobin concentration (Hb) was determined by cyanomethemoglobin method, Red Blood cell (RBC)

Table 1: Composition of the Experimental Diets

| Ingredients | Diet (A) Control | Diet B | Diet C |
|---|---|---|---|
| Cassava waste | 53.00 | 53.00 | 53.00 |
| Soybeans cake | 10.00 | 5.00 | - |
| Fungi blend treated 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 |
| Toatl | 100.00 | 100.00 | 100.00 |

was determined by Neubaner haemocytometer method [13]. The differential white blood cell (WBC) counts was by making a differential smear stained with Wright stain and percentage counts were taken for lymphocytes and neutrophils.

All collected data were subjected to analysis of variance of a completely randomized design model [14] while means were separated using Duncan [15] multiple range test.

## RESULTS

The chemical composition of the feeds show that all the diets have high nutrient contents (Dry matter, crude protein, crude fibre and ash) for ruminant animals. The crude protein content of the feeds is enough to stimulate rumen microbial activity with resultant high intake of feed and optimal supply of protein to the animal. In this context all the diets contained higher nitrogen for proper rumen function.

**Feed Intake:** Data in Table (3) shows the feed intake of the experimental animals. Dry matter intake is a vital factor in the determination of energy intake and performance in small ruminant animals. The highest significant difference of dry matter, crude protein and crude fibre intake indicate strong substitution of Soybean cake by the cocktail of fungi blend *Jatropha curcas* kernel cake. It is evidence from this study that treatment of *Jatropha curcas* kernel cake with cocktail of fungi blend did not depress voluntary feed intake of the animals.

**Growth and Feed Conversion Efficiency:** The plane of nutrition of livestock is one of the factors that can markedly improve weight gain of goats and the degree of response varies with breeds and types of animals. In this study the goats fed the experimental diets did not loss weight however; animals on diet B recorded the highest weight gain (Table 3). The positive weight gain shows that all the diets have adequate crude protein and energy contents which are crucial for the growth of goats.

Table 2: Proximate Composition of the Experimental Diets

| 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 |

Table 3: Feed intake and weight gain (g/d)of the Experimental Animals

| Parameters | Diet A | Diet B | Diet C | ±SEM |
|---|---|---|---|---|
| Dry matter intake | $553.75^{b}$ | $606.25^{a}$ | $543.75^{b}$ | 12.43* |
| Crude protein intake | $101.50^{b}$ | $113.75^{a}$ | $105.00^{b}$ | 2.76* |
| Crude fibre intake | $335.50^{b}$ | $368.63^{a}$ | $304.63^{c}$ | 7.24* |
| Ether extract intake | $80.00^{a}$ | $72.75^{b}$ | $62.75^{c}$ | 1.18* |
| Ash intake | $64.63^{b}$ | $65.50^{b}$ | $78.00^{a}$ | 1.64* |
| Weight gain | $703.00^{b}$ | $1380.00^{a}$ | $860.00^{b}$ | 160.23* |
| Feed efficiency | | | | |

Mean along the same row with similar superscripts are not significantly different from each other (p>0.05)

Table 4: Effect of Fungi blend treated *Jatropha curcas* kernel cake on the blood parameters of the Experimental Animals

| Parameters | Diet A | Diet B | Diet C | ±SEM |
|---|---|---|---|---|
| PVC (%) | $33.00^{a}$ | $30.67^{b}$ | $29.50^{b}$ | 0.93* |
| Hb(g/dl) | 12.50 | 11.53 | 11.28 | 0.45NS |
| WBC x $10^{9}$/l | 10.30 | 10.70 | 9.23 | 0.53NS |
| RBC X$10^{9}$/l | 11.95 | 11.67 | 11.63 | 2.73NS |
| Neutrophil (%) | $36.00^{a}$ | $33.33^{b}$ | $29.25^{b}$ | 1.17* |
| Lymphocytes (%) | 62.00 | 61.33 | 59.00 | 1.84NS |
| Eosinophils (%) | 3.25 | 2.67 | 2.25 | 0.47NS |
| Basophils (%) | - | - | - | - |
| Monophils (%) | - | - | - | - |

Mean along the same row with similar superscripts are not significantly different from each other (p>0.05)

**Blood Indices:** Blood parameters are similar among the experimental diets (Table 4). However, the values of Red blood cell, eosinophil, lymphocyte and neutrophil were numerically higher in diet A compared to other diets. The highest values of PCV (33.00%), Hb (12.55g/dl), RBC ($11.95x10^9$/l), Eosinophil (3.25%), Neutrophil (36.0%) and lymphocyte (62.5%) were recorded for animals fed diet A.

## DISCUSSION

The higher nutrient content of the experimental diets supported the report of Elliot and Topps [16] who observed a proper rumen function with high nutrient content of a feed.

The dry matter intake of goats which ranged from 543.75g/d - 606.25g/d was a little higher than 506-507g/d reported by Zhao *et al*. [17]. The increased feed intake was due probably to the inclusion of fungi blend treated *Jatropha curcas* kernel cake in the experimental diets. The result corroborated with the results reported elsewhere on the effect of fungi treated substrate on feed intake.

The highest crude protein intake recorded for diet B could be due to the complementary effect of the fungi blend treated *Jatropha curcas* kernel cake and soybean cake while the similarity between diets A and C show that fungi blend treated *Jatropha curcas* kernel cake could be used as a substitute to Soybean cake at 100% inclusion level. The result could be due to the microbial protein which the fungi blend could have added to the *Jatropha curcas* kernel cake. Additionally, the increased crude protein intake of diets B and C could also be accounted for by the relative crude protein content of the two diets. This agreed with report of Chalhal, [18] that there is a direct relationship between crude protein of the feed and crude protein intake by ruminant animals.

The significant intake of the crude fibre content of diet B could be due to the pre-digestion and solubilization of the crude fibre by the microbes. The solubilization of the crude fibre is expected due to the synthesized of various enzymes and acids by the microbes (Citic acid, amylase amyloglucosidae, cellulose, lactase, invertase, pectinase, protease etc [19].

The ether extract intake was significantly higher in diet A (control) due probably to the presence of ether extract in the Soybean cake which could have been subjected to only mechanical process. While the *Jatropha curcas* kernel cake was subjected to both the mechanical and chemical (petroleum ether) processing methods thereby removing the ether extract to negligible rate.

The increasing intake of the ash content corroborates the report of Jacquline and Visser [20] who noted that biotechnology process tends to enhance the mineral content of test substrate(s).

The significant weight gain of animals on diet B could presumably be due to highest dry matter and crude protein intake of this diet. This supported the findings of Apori [21] who noted that feeding of high level of protein in diet could promote animal performance. Additionally, diet C was numerically higher than diet A (control). This study shows that animals on both diets B and C were able to utilize the diets better for tissue development than diet A. The weight gain reported herein was higher than values obtained (9g/d) in Uganda [22, 23]. Higher growth rate and feed conversion efficiency of the fungi blend treated *Jatropha curcas* kernel cake can compared to the control diet (Soybean cake based diet) probably due to reduction of methanogenesis [24]. Additionally, the improved growth rate of animal fed diets B and C could be due to improved microbial and dietary protein flow to duodenum [25, 26].

The better performance of animals on both diets B and C was in consonance with the report of Jacquline and Visser [20] who found that a growing body evidence exists in support of improvement in animal productivity and performance when feed are treated with enzymes prior to feeding it to the animal.

**Blood Indices:** The fungi blend treated *Jatropha curcas* cake had no effect on the blood chemistry namely: PCV, Hb, WBC, RBC, Neutrophil, Lymphocyte, Oesinophil, Basophil and Monophils. All the blood indices evaluated showed that the animals were in normal physiological states and the values were in normal ranges, which revealed that feeding fungi blend treated *Jatropha curcas* kernel cake to goats did not damage the liver and thyroid gland. Similar finding was reported by Belewu *et al*. [4] who noted that inclusion of fungi treated substrate in a mixed ration for goats did not affect the blood chemistry and animal performance.

There was significant difference in the PCV value among the diets however; the PCV value reported in this study was within the range reported by Tambuwal *et al.* [27]. This could be due to Compensatory Accelerated Production (CAP) of packed cell volume which returns the PCV levels to normal level Ganong, [28], Tambuwal *et al*. [27].

The neutrophil value reported herein was in agreement with the results of Tambuwal *et al.* [27] and Belewu and Ogunsola [29]. However, the higher neutrophil content of diet A indicates that the cellular digestion of offending agents like bacteria was more in diet A (control) compared to diets B and C. The WBC reported in this study was within the value noted by Tambuwal *et al.* [27]. This indicates that the animals possess a protective system suggestive of a well adapted immune system [27. The similarities in the RBC shows that the animals are not aneamic. Other blood parameters like Hb, eosinophil, lymphocytes etc) followed similar trend.

## CONCLUSION AND IMPLICATION

- The results of this study show that the cocktail of fungi blend on *Jatropha curcas* kernel cake holds a very promising value as an effective method of detoxifying the cake due to improved performance that was recorded for the West African dwarf goats fed the treated diets.
- Animals fed the 50% Soybean cake plus 50% Fungi blend treated *Jatropha curcas* kernel cake (diet B) gave the best performance compared with diets A and C.
- It could be concluded that the 50% inclusion level of fungi blend *Jatropha curcas* kernel cake to compliment 50% Soybean cake should be encouraged as it greatly increased weight gain and tissue deposition in goats.

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