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# Performance Characteristics of West African Dwarf Goat Fed *Aspergillus* Treated Cassava *(Manihot esculutus)* Waste Based Diets

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**Abstract:** The effect of Cassava waste incubated with *Aspergillus niger* on the performance characteristics of WAD goats (n=12) was studied in a Completely Randomized Design Model for 56 days in which the untreated cassava waste was used as the control and the fungus treated waste was included in diets B, C and D (20, 30 and 40% levels respectively). The feed intake, growth rate, weight gain, apparent digestibility and digestible nutrients parameters were monitored. The results revealed that the micro- fungus has greater affinity to dignify cassava waste and this leads to a greater decrease in the crude fibre content of the waste. The activities of the fungus on the cassava waste increased the crude protein content while the consumption of the fungus treated diets compared very well with diet A (control). Animals fed the fungus treated diets showed increasing weight gain. There was also increase in the nutrient availability from the treated cassava waste, thereby increasing the digestibility of this diet. To this effect, the inclusion of fungus treated cassava waste in the diet of WAD goat suggested that fungal treatment had improved effect on feed intake, digestibility and growth rate which holds a good promise as a converter of fibrous materials thereby enhancing it utilization by goat.

**Key words:** *Aspergillus niger* · cassava waste · intake · digestibility · WAD goat

## INTRODUCTION

Livestock farmers in developing countries are faced with various challenges that led to a considerable fall in the production of certain livestock species like goats, cattle, swine and poultry. Most of the problems originated from high cost of production due to increase in prices of locally available feed ingredients and livestock species.

The effects of these challenges have reflected on the quality and amount of animal protein available for human consumption in the third world.

Waste agricultural residues (Tapioca or cassava waste) which constitute a nuisance to the environment can be used to greater extent if properly processed. The various processing methods include physical, mechanical, chemical and biological. The physical, mechanical and chemical methods are well documented in literature [1, 2] while the biological method is still at its infancy in Nigeria but Belewu and Afolabi, [3]. Belewu [4], Belewu, [5] reported on the efficacy of this method and/or compared to the chemical method. There were improvement in the feed intake (CP, CF, EE, NFE, ADF, NDF) of animal fed fungi treated rice husk, cotton waste, sorghum stover and saw-dust [6, 5]. The effect of feeding fungus treated cotton waste on *In vitro* dry matter enzymatic digestibility (FVDMED) are well documented [7]. Similarly, the effect of fungi on IVDMED of lemon grass and bagasse was reported [8]. The resultant effects of this method are the pre -digestion of the fibrous materials, the availability of fungal protein and the addition and release of bound minerals [9]. Hence, the objective of the work reported in this paper was to determine whether the *Aspergillus* treatment of cassava waste (Manihot ) would affect the performance characteristics of growing WAD goats fed rations in which the fungus treated cassava waste was included at various levels. Previous work in this laboratory showed that, the rate of fibre degradation was high by such treatment (fungus) concomitant with increased digestibility in nitrogen and structural carbohydrate.

## MATERIAL AND METHODS

**Fungus and subtrate used:** *Aspergillus niger* used for the experiment was isolated from soil through serial dilution method, later identified and characterized accordingly.

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Table 1: Composition of the Experimental Diets

| | A | B | C | D |
|---|---|---|---|---|
| Ingredients (%) | Control | | | |
| Cassava waste | 40.00 | 20.00 | 10.00 | - |
| *Aspergillus* treated Cassava waste | - | 20.00 | 30.00 | 40.00 |
| Sorghum brewers dried grain | 15.00 | 15.00 | 15.00 | 15.00 |
| Wheat offals | 15.00 | 15.00 | 15.00 | 15.00 |
| Palm kernel cake | 28.00 | 28.00 | 28.00 | 28.00 |
| Common salt | 1.00 | 1.00 | 1.00 | 1.00 |
| Vitamin-mineral premix | 1.00 | 1.00 | 1.00 | 1.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |
| Proximate composition | | | | |
| Dry matter | 94.50 | 94.00 | 94.10 | 95.11 |
| Crude Protein | 14.39 | 16.60 | 16.80 | 17.95 |
| Crude fibre | 11.10 | 10.20 | 9.10 | 8.40 |
| Ether extract | 8.00 | 6.00 | 6.50 | 5.50 |
| NFE | 60.34 | 65.10 | 63.42 | 64.81 |
| Acid detergent fibre | 60.90 | 47.30 | 37.80 | 32.80 |
| Lignin | 53.22 | 48.63 | 39.11 | 33.96 |

* Containing per kg, Vit. A, 10000iu; Vit. $D_3$,1500000iu, Vit. E, 300iu; Vit. $K_3$, 300g; Vit. $B_2$ 250g; Nicotinic acid, 8.00g; Calcium D-Panlhothenate, 30g; Vit. $B_6$ 0.03g; Vit. $B_{12}$, 800mg; Mn 10,000g; Fe, 5.00g; Zn, 4.50g; Cu 0.20g; Iodine, 0.15g; Co, 0.02g; Selenium,0.01 g.

Stock culture of the fungus was maintained on potato dextrose agar (PDA) kept in a MacCarthy bottle and stored at room temperature till needed for inoculation.

Cassava waste used was obtained from the garri processing centers around Ilorin metropolis, Nigeria. The waste was sundried, later milled and packed into polyprothene bags. At the start of the experiment, the waste was sterilized by autoclaving at 121°C, 15 kg $cm^{-2}$ for 15 minutes. It was allowed to cool and then inoculated with *Aspergillus niger*.

**Inoculation and incubation:** *Aspergillus niger* was harvested with Tween 80 solution (10ml, 0.01% V/V) and adjusted to $l0^7$ - $10^s$ spores per ml with sterile water. Each bag (50g) was inoculated with 5ml of the spore suspension containing $1O^7$ spore per ml of each microoganism. The inoculated substrate was covered partially with cellophane and in about 7 days the fungus covered the surface of the substrate. The fungus growth was later terminated by oven drying at 70°C for 48 hours in a laboratory air forced draught oven.

**Preparation of the experimental diets:** Four experimental diets were formulated in which diets B, C and D contained graded levels (20, 30 and 40% respectively) of fungus treated cassava waste while diet A (control) has untreated cassava waste (40%). Other ingredients are of similar quantities as shown in Table 1.

**Animals and management:** West African dwarf goals (n=12) treated against ecto and endo parasites and weighing between 2.80 and 5.4 kg were randomized against the experimental diets in a Completely Randomized Design Model for a 56 day period. Feeding and watering were given *ad libitum* while feed intake, growth rate and weight gain were monitored weekly. Digestibility study was conducted in the last week of the experiment using a total faecal collection method [10].

**Chemical analysis:** The experimental diets (A, B, C, D) were subjected to chemical analysis using the method of A.O.A.C [11] while fibre fractions were determined according to the method of Goering and VanSoest [12].

**Statistical analysis:** All data collected were subjected to analysis of variance [13] of a Completely Randomized Design Model while treatment means were separated by Duncan [14] multiple range test.

## RESULTS AND DISCUSSION

Data on digestibility (Table 2) trial show that fungus treatment resulted in a substantial increase in intake and digestion of the various organic components shown ($p<0.05$). For example, dry matter and crude protein consumption were increased by 79.01 and 113.56% respectively while the dry matter and crude protein digestibilities were 19.88 and 6.73%. Thus, the data suggest that the effects of treating cassava waste with fungus are similar to those noted for other fungi treated lignocellulose materials [3, 4, 10]. The untreated cassava waste (control diet) was poorly consumed (DM, 17.01 gld; CP, 1.18 g/d). Treating the waste with *Aspergillus niger* resulted in improved ADF and lignin intake but dry matter and ether extract intake were similar in diets A and C.

In addition, there was considerably improvement in the digestibility of the fungus treated waste over the untreated waste (control diet). The fibre fraction (ADF and lignin) was higher in the control (97.9 and 53.72% respectively) than in the fungus treated diets. This is expected, since there was no treatment of the cassava waste by the fungus. The coefficient of digestibility for CP, ADF and lignin were significantly higher in the fungus treated cassava waste of diets B - D. This agreed with the results of Belewu [4] Belewu and Adenuga [10],

Table 2: Feed intake, digestibilities and weight gain of WAD goat fed fungus treated cassava waste

| Parameters | A | B | C | D | ±SE |
|---|---|---|---|---|---|
| Dry matter intake (g/d) | 17.01 [a] | 26.32 [b] | 40.50 [c] | 30.45 [d] | 3.52* |
| Digestibility % | 51.40 [a] | 59.72 [a] | 86.66 | 81.28 [b] | 5.27* |
| Crude protein intake (g/d) | 1.18 [a] | 2.13 [b] | 3.34 [c] | 2.52 [b] | 0.39* |
| Digestibility % | 66.52 [a] | 85.43 [b] | 94.97 [c] | 93.25 [c] | 8.23* |
| Crude Fibre intake (g/d) | 1.99 [a] | 2.86 [b] | 3.91 [c] | 2.69 [b] | 0.40* |
| Digestibility % | 76.93 [a] | 89.16 [a] | 96.00 [b] | 94.94 [b] | 6.12* |
| Ether extract intake (g/d) | 1.44 [a] | 1.68 [a] | 2.79 [b] | 1.76 [a] | 0.32* |
| Digestibility % | 83.33 [a] | 80.35 [a] | 94.62 [b] | 93.18 [b] | 7.33* |
| NFE intake (g/d) | 10.86 [a] | 18.22 [b] | 27.27 [c] | 1.76 [a] | 0.32* |
| Digestibility % | 50.27 | 51.97 | 83.16 | 76.41 | 5.14* |
| Lignin intake (g/d) | 9.14 | 12.80 | 15.80 | 26.80 | 2.95+ |
| % Digestibility | 60.85 [a] | 78.82 [a] | 93.25 [b] | 96.10 [b] | 6.38* |
| Acid detergent intake (g/d) | 16.01a | 24.70b | 38.11c | 28.76bs | 3.72* |
| % Digestibility | 72.08 [a] | 76.60 [a] | 92.23 [b] | 90.64 [b] | 8.75* |
| Metabolizable energy | 60.73 | 60.18 | 60.93 | 60.83 | 4.25NS |
| % TDN'' | 2.47 [a] | 33.25 [b] | 46.94 [c] | 47.95 [c] | 3.13* |
| Weight gain (kg/d) | 0.75 [a] | 0.86 [a] | 1.04 [b] | 1.14 [b] | 0.02* |

+ Capenter and Clegg (1956)
++Church and Champe (1980)

Belewu *et al*., [2] who noted that treatment of lignocellulose materials with fungi improved animal performance significantly. Weight gain was increased markedly when goats consumed the diets containing fungus treated waste. Animals on diet D recorded the highest weight gain followed by animals on diets C, B and A in that order. Thus, the method seems an appropriate one for evaluating digestibility of low quality waste agricultural residues. The chief advantage of the method is that a diet containing low quality waste agricultural residues fed alone is not required, so few treatments less analytical method should be done to break the bond and upgrade the material for better animal performance.

Calculated ME and TDN values (Table 2) showed that the fungus treated cassava waste based diets resulted in higher performance compared to the control diet (A). In conclusion, the results of the study show that WAD goat production performance was different on diets containing fungus treated and untreated cassava waste based diets. Diets may be more cost effective in particular circumstances. Moreover, a comparable performance at dietary concentrations up to 40% of the fungus treated waste was attained without any detrimental effect on the performance of the animals and in contrast to the previously held opinion and practice on the feeding of biological (microbes) treated materials, to livestock.

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