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Performance Characteristics of West African Dwarf Goats Fed Trichoderma Treated *Jatropha Curcas* Seed Cake.

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ABSTRACT

In a study of dietary effects of fungi (Trichoderma ghanense and Trichoderma asperellum) treatment on Jatropha curcas meal. Defatted Jatropha curcas cake was inoculated with the fungi and then used to replace soybean meal in a formulated diet for West African Dwarf goats. The fungi Trichoderma ghanense was included at 0%, 4%, 2% level in diets A, B, C, respectively and Trichoderma asperellum was included at 4%, 2% level in diets D and E respectively. The initial average weight of the goats was 7.00± 1.00 kg. Water and feed were given ad-libitum for the entire duration of experiment. Fungi treatment considerably reduces crude fibre with increased ash content. There were marked decrease in weight as a result of poor feed intake and utilization. The fungus treatment did not completely detoxify the Jatropha curcas cake resulting in 100 percent death before the end of the experiment. There is the need to find better method of detoxifying the toxins and antinutrients present in Jatropha curcas cake without trading off the high crude protein content.

KEY WORDS: WAD goats, Phorbolesters, *Jatropha curcas* cake, Fungi.

INTRODUCTION

Jatropha is a plant of the family *Euphorbiaceae* and well documented throughout continents like South America, Asia and Africa. It has over two hundred names which suggests it various uses (Trabi *et al.*, 1997, Chevanadi *et al*., 2004, Belewu, 2008). One of the varieties of *Jatropha* plant known as *Jatropha curcas* has been found to possess a very high potential to replace the conventional protein feed stuffs such as soybean and groundnut cake. This is due to its high crude protein of 58-64%, 17.3% carbohydrate, 15.5% Fiber, 4.4% Ash, 38.0%, fat and 6.6% Moisture (Marker and Becker, 1997) besides been adaptable to marginal area with poor soils and low rainfall (430mm per annum, 28.5C) (Heller, 1996, Marker *et al.*, 1997). However, it has the disadvantage of having toxic, thermostable, liposoluble phorbolesters (PES) (Trabi *et al.*, 1997) in addition to the thermo-labile saponin, tannin, lectins and trypsin inhibitors that are

problems of antinutritional factors in soybean (Chevandi *et al.,* 2004). Phorbolesters (Phorbol-12-myristate 13-acetate) are bioactive diterpens derivatives that have a multitude of effects in cells (Panigrahi *et al.,* 2007) must be removed or lowered to a level that does not result in toxic response when its seed meal or cake is included in animal diet (Marker *et al.,* 1997, Chevandi *et al.,* 2004).

The concentration of phorbolesters in degreased or defatted meal was 1.81mg/gDM. The level in the kernel is 58%, so it could be evaluated that about 72 of the total phorbolesters get extracted with the oil using ether (Marker and Becker, 1997). Phorbolesters have been found to be responsible for purgative, skin-irritant effect and tumor promotion since it stimulate kinase C involved in singal transduction and developmental processes of most cells and tissues (Marker and Becker, 1997).

The use of heat treatment, chemical treatment and solid state fermentation using fungi had produce little or no result and where result are encouraging there were side effects such as chemical load and protein denaturation (Gross *et al.,* 1997; Chevandi *et al.,* 2000; Samson *et al.,* 2001; Belewu, 2008). Hence the dire need for a better and reliable method of turning *Jatropha curcas* into a highly nutritious and safe ingredients in animal diet.

The objective of this study therefore, was to investigate the potential of fungi (*Trichoderma ghanenese* and *Trichoderma asperellum*) in detoxifying defatted *Jatropha curcas* seed cake and the performance response of West African Dwarf goats fed the diet containing the spent substrates.

MATERIALS AND METHODS

The mature seed of *Jatropha curcas* were collected from Ilorin, Kwara State of Nigeria while the fungi (*Trichroderma ghanenese* and *Trichoderma asperellum* were obtained from the International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria, and maintained on potato dextrose agar (PDA).

The seeds were cleaned and cracked to remove the seed from the hard seed coat. It was later sun-dried and milled. Oil was extracted by hydraulic press method after which the seed cake was sun-dried and later autoclaved (121C, 30 minutes) to destroy any micro organism that may be present, and allowed to cool.

The autoclaved *Jatropha curcas* cake was inoculated with about 10^8-10^9 spores of *Trichoderma ghanense* and *Trichoderma asperellum* in two separate plastic bowl. They were covered with black cellophane and allowed to grow under room temperature and pressure for 10 days after which the growth was terminated by oven drying the substrate at 70^oC for 48 hours in a forced air oven.

The spent substrates from the different *Trichoderma* species of fungi were used in the formation of diets for fifteen mixed sex West African Dwarf goat at inclusion levels of 2 and 4 percent (table 1).

The animals were procured from the goat market in Ilorin metropolis, dewormed, vaccinated against PPR and allowed to acclimatize for two weeks before the introduction for the experimental diets. A total of 15 mixed sex West African Dwarf goats of about 1-2

years of age with live weight of 6-10kg were randomly allocated to five treatment diets with three replicates in each treatment group in a Completely Randomized Design (CRD). Allocation of experimental animals was done on weight and sex equalization basis diets containing fungi treated *Jatropha* seed cake and soybean cake were given *ad-libitum* with clean to pens and water for a period of eight weeks. Animal were weighed fortnightly and blood collected at the forth week of experiment for haematological study. All data collected were subject to a completely randomized design model and significant treatment means were compared using the Duncan Multiple range test (Steel and Torrie, 1990).

RESULTS AND DISCUSSION

Table 1 shows the composition of the experimental diet, crude protein of the test diets B, C, D, E were relatively higher, though not significant ($p>0.05$) than the control due to the addition of fungal protein while crude fibre in the control was higher ($p<0.05$) than in the test diets due to the utilization of fibre by the fungi. The dry matter and crude protein were more than 80% digestible in the control and test diets except in diets B where the CP was 68.2%

Table 1: Proximate Composition of Experimental Diets (%)

INGREDIENTS	**CONTROL**	***Trichoderma ghanense* treated JC**		***Trichoderma asperellum* treated JC**	
	A	**B**	**C**	**D**	**E**
Dried Cassava Peel	63.0	63.0	63.0	63.0	63.0
Rice husk	31.0	31.0	31.0	31.0	31.0
Soybeans meal	4.0	-	2.0	-	2.0
Fungus treated Jatropha seed cake		4.0	2.0	4.0	2.0
Salt	1.0	1.0	1.0	1.0	1.0
Vitamin premix	1.0	1.0	1.0	1.0	1.0
Total	100.0	100.0	100.0	100.0	100.0
Dry matter, %	24.05	91.56	94.20	92.70	93.60
Crude protein, %	8.75	8.60	9.10	9.65	9.68
Crude fibre, %	37.30	35.80	35.30	35.80	34.50
Ether extract, %	4.76	6.93	6.93	6.86	78.77
Ash, %	7.39	8.40	8.40	7.43	7.21
NFE, %	36.35	24.43	26.34	32.46	34.15

Parameters	**Untreated**	***Trichoderma ghanense* treated Jatropha caucas seed cake**	***Trichoderma asperellum* treated Jatropha caucas seed cake.**
Dry matter	93.17	94.00	92.60
Crude protein	53.30	79.20	73.30
Crude fibre	32.80	30.40	31.60
Ether fibre	45.55	48.04	50.40
Ash	5.88	9.52	8.00

(Table 2). The digestibility of crude fibre, Ash and ether extract were higher ($p<0.05$) in the control (diet A) than the test diets due to the presence of antinutritional factors in the test diets. The treatment of *Jatropha curcas* cake with *Trichoderma ghanense* and *Trichoderma asperellum* resulted into a reduction in the crude fibre because the fungi secretes some enzymes such as amyloglucoside, cellulose and pectinase which help in the break down of fibre to carbohydrate and consequently the carbohydrate content increased (Belewu, 2008).

Moreso, the ash content increased probably because the fungus break down some antinutrient present releasing chelated minerals from organic molecules into the organic phase. There was reduction in intake of the tested diets which could be due to the inability of the fungus treatment to completely detoxify the *Jatropha curcas* cake

TABLE 2: Percent Digestibility of Experimental Diet.

Parameters	Diet A	Diet B	Diet C	Diet D	Diet E	± SEM
Dry matter	88.00	80.40	81.30	81.30	81.56	0.63
Crude protein	82.40	68.20	80.40	80.20	81.10	0.32
Crude fibre	90.80	83.50	86.50	87.40	82.10	0.28
Ash	86.60	82.50	84.80	86.60	85.00	1.45
Ether extract	85.80	82.10	80.50	84.80	81.00	0.72

The intake of CP, DM, CF, Ee, Ash and weight were higher ($p<0.05$) in the control (diet A) relative to those animals placed on the test diets. This could be due to the presence of antinutritional factors in the test diet, the tastes of the feed as well as the presence of residual toxic components leading to reduced feed intake and loss of weight (Table 3).

TABLE 3: Feed Intake and Weight Gain/Loss of Experimental Animals

Parameters	Diet A	Diet B	Diet C	Diet D	Diet E	± SEM
Dry matter	64.40	56.60	62.50	64.00	55.66	90.53
Crude protein	9.71	6.46	8.70	6.66	6.75	0.04
Crude fibre	28.52	26.86	25.43	24.70	20.49	0.72
Ether extract	5.28	3.79	3.98	4.73	4.62	0.17
Ash	8.20	4.58	4.95	5.13	4.46	0.17
Weight/loss in gram(g) per day(g/d)	0.09	-0.031	-0.031	-0.031	-0.032	0.26

Although, there were differences in the percent packed cell volume PCV though not significant (p>0.05), diets A (control) and diets B (4% *T. ghanense* JC) had the highest while the lowest was recorded in diet E (2% *T. asperellum* JC) (Table 4). This could be as a result of the low intake of the experimental diets and the destruction of the cells by toxins. The red blood cell (Erythrocytes) also followed the same order with the control (diet A) having the higher followed by diet B, with the lowest recorded in diet D, though not significant.

The result of the haemoglobin were not significantly different in all the treatment but the control had the highest while diet E had the lowest while blood cell and all its components such as neutrophils, lymphocytes, monocyte and eosinophils were not significantly different (P>0.05).

Animal on test diet showed toxic responses on the third week of experiment. They show persistent diarrhoea which has a lot of undigested ingesta, some of the goat later developed skin irritation particularly around ear. This corroborates the work of Marker *et al*. (1997) that diarrhoea and weight loss characterized the maldigestion and malabsorption syndrome. The skin lesions observe were similar to those characteristic of saponin induced phyto-toxicity causing photosensitivity described by Gross *et al*. (1997). The residual phorbolester level of the *Jatropha curcas* meal treated with *Trichoderma* is higher than that of O.11mg/g reported by Marker and Becker (1997) in the toxic varieties. There was 33.3% mortality in week 3, 4 and 5 from treatments E, D, B and C respectively and a total of 100% in week 5. *Jatropha* has been shown to be highly toxic to mice at a level of 40 -50% in diet, the mice died within 3-16 days of dosing, with mortality rates of 87% and 67% respectively even at lower concentrations of the diet

(37%) (Gross *et al.,* 1997). Belewu (2008) reported 100% mortality within 2-3 days in rats. The feeding of *Jatropha* seeds led to damage and necrosis of liver, kidney, heart, lungs, gastro-intestinal tract, blood vessel, nervous system and bone marrow supporting the report of Marker and Becker (1997) and Chevandi *et al*. (2000).

Various researchers has been done to remove the toxin in *Jatropha* seeds the most effective been the use of heat treatment (moisture 66%, 121C for 30 min) in the presence of both NaOH (2%) and NaOCl (0.5% active chorine) (Marker and Becker, 1997). This treatment was effective in reducing phytate, saponin, phobolesters, trysin inhibitors and lectin by 18, 13, 75, 99 and 100% respectively. However, reduced growth rate was observed which was due to the loss of endogenous protein in the form of faecal mucus on the second day of feeding and it increase with each day of feeding.

CONCLUSION

This study did not achieve complete detoxification of *Jatropha curcas***.** The potential of Jatropha plant as a feed resource cannot be underestimated hence the need to continue research into other ways of making the high protein available to animals while reducing the deleterious effects of the anti-nutrients in it.

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