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# MILK QUANTITY AND QUALITY OF WAD GOATS FED BIO-CHEMICALLY TREATED *Jatropha curcas* KERNEL CAKE

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## ABSTRACT
In Nigeria, local dairy farmers are faced with production challenges of which nutrition is a major factor leading to low productivity and poor economy of smallholder farmers and this also affects the value of the dairy products. There are great potentials of the shrubs and trees which can help to tackle the challenge of all season availability of pastures and the expensive nature of the conventional feedstuffs; are impeded by the antinutrients and toxins in the leaves and seeds of most of these shrubs and trees. Jatropha curcas has a potential as a protein source for the animal industry because of the high crude protein. The effect of 50% replacement of soybean content with Bio-chemically treated Jatropha curcas kernel cake on the milk composition and yield of West African Dwarf (WAD) dams fed cassava-based diet was investigated. Twenty-eight lactating WAD dams of average weight of 13kg ± 0.2 were randomly assigned into five dietary treatments in a Completely Randomized Design (CRD) layout. Each treatment group consists of seven replicates of lactating does. The does were individually housed and offered the cassava-based diet ad libitum (A = control, B = 50 mg H 2 0 2 kg -1 cake, C = 100 mg H 2 0 2 kg -1 cake, D = 150 mg H 2 0 2kg -1 cake) for 171 days. The 50% replacement of soybean with Bio-chemically treated Jatropha curcas kernel cake had significant ($p \leq 0.05$) effect on the Milk Yield, Protein, Total Solid (TS%) of the milk of the treatments. The improvement in the total solids in the treatment groups suggest that the microbial protein in the fermented cake may have been passed into the milk. The ash content of the milk of the treatment group was also higher than that of the control; this may be due to the increase in the ash content of the fermented cake. The milk protein of the treatment groups especially the 120mg/kg group. Based on this result it can be concluded that the inclusion of fermented Jatropha curcas kernel cake at 50% in the diet of WAD goats enhanced the milk composition of the WAD goats.
**Keywords:** Jatropha, WAD Goats, Milk, Fermentation, *Penicillum expansum*

## INTRODUCTION
Global food security can be aided by the small holder enterprise of milk production which can serve as a source of income for peasant farmers (HLPE. 2013; FAO, 2010b). In Nigeria, local dairy farmers are faced with production challenges of which nutrition is about 70%; hence productivity and economy of small-scale producer is low and this also affects the value of the dairy products. There are great potentials in the tropics because of the shrubs and trees which can help tackle the challenge of all season availability of pasture. *Jatropha curcas* has a potential as a protein source for the animal industry because of the high crude protein (Makkar and Becker, 2010) and its essential amino acid (except) lysine; this potential is however impeded by the antinutrients that itn contains especially phorbolester which makes its incorporation as a feedstuff impossible. Various methods of detoxification have been used to try to remove, or reduce the toxin and antinutrients to tolerable levels that would not elicit toxic responses. The objective of the study are: To evaluate the effect of bio-chemically treated *Jatropha curcas* kernel cake on milk quantity and quality of WAD goats.

## MATERIALS AND METHODS
This experiment was carried out at the Ruminant Unit of The Teaching and Research Farm, University of Ilorin, Nigeria. Matured and sundried seeds of *Jatropha curcas* were purchased around Ilorin metropolis. The seed coat was singly removed manually to obtain the kernel. The kernel was milled using the Industrial Grinding Mill Gx200 Petrol Engine - 6.5hp mechanical grinder with 12-inch blade, and the oil extracted using the mechanical hydraulic oil press after which further oil extraction was

carried out using petroleum ether. The cake was then packed in polythene bags for autoclaving at 121°C for 15minutes so as to get rid of any microbes that could be present in the cake. Chemical Treatment was done according to the methods described by Zhang *et al*., 2014. The treated kernel cake was dried at 50°C prior to fermentation. *Penicillium expansum* maintained on Potato Dextrose Agar contained in petridishes were used. The whole content was incubated in an incubator at room temperature (21°C) for 7 days. The autoclaved kernel cake was incubated separately with the fungus and later incubated at room temperature for 14 days. The growth was terminated by oven drying at 80°C for 24 hours. Twenty-Eight (28) West African Dwarf goats (Does) were used for the experiment for the duration of 171 days. Each doe was given Estradiol benzoate (Estra-P 0.2%) once daily for two successive days (Each ml contains estradiol benzoate 2mg). The plane of nutrition given to the pregnant does was the experimental feed and water *ad libitum* for the duration of pregnancy. The does were hand milked twice daily (8am and 6pm). Milk was collected twice daily (07:00 GMT+1 and 17:00 GMT +1). Milk yield per animal per treatment were recorded, while the quality of milk were sampled for total solids, solid non-fat (SNF), fat, protein, fat corrected milk (FCM), ash, acidity, pH and specific gravity (AOAC, 1990). FCM was calculated using the equation below. FCM= 0.4+15F ……Maynard *et al.*, 1979 Energy ($MJKg^{-1}$) was calculated using Y=0.386F+0.205SNF-0.236…… MAFF, 1975 equation. The proximate composition of the diets and milk were determined using AOAC (1990) method. The total solids were determined by (AOAC, 1995). Fat was estimated by the Gerber method (AOAC, 1995). Solid not fat (SNF) content was calculated as the difference between the total solids and fat content, protein (Nx6.38) was determined by Kjeldahl methods IDF standard 20A (IDF, 1986) and lactose content was assessed by the method of Barnet and Tawab (1957). Ash content was determined by (AOAC 1995). All data collected were subjected to analysis of variance (ANOVA) of a completely randomized design model using the SPSS 16; the treatment means were separated using Duncan multiple range test.

**Table 1: Experimental Diet Composition**

| PARAMETERS | DIET A | DIET B | DIET C | DIET D |
|---|---|---|---|---|
| CASSAVA | 53.00 | 53.00 | 53.00 | 53.00 |
| RICE HUSK | 31.00 | 31.00 | 31.00 | 31.00 |
| SOYABEAN CAKE | 14.00 | 7.00 | 7.00 | 7.00 |
| BIOCHEMICALLY TREATED JKC | - | 7.00 | 7.00 | 7.00 |
| SALT | 1.00 | 1.00 | 1.00 | 1.00 |
| VITAMIN-MINERAL PREMIX | 1.00 | 1.00 | 1.00 | 1.00 |
| TOTAL | 100 | 100 | 100 | 100 |

A = control, B = 50mg $H_20_2$/kg cake/*Penicillum expansum*, C = 100mg$H_20_2$/kg cake/*Penicillum expansum*, D = 150mg$H_20_2$/kg cake/*Penicillum expansum*

**Table 2: Proximate Composition of Experimental Diets**

| Parameters (%) | Diet A | Diet B | Diet C | Diet D |
|---|---|---|---|---|
| Dry matter | 91.10 | 91.74 | 91.67 | 91.30 |
| Crude protein | 13.10 | 13.11 | 13.23 | 13.25 |
| Ether Extract | 11.74 | 13.71 | 13.84 | 13.87 |
| Crude Fibre | 24.21 | 24.64 | 24.28 | 24.53 |
| Ash | 14.41 | 14.36 | 14.13 | 14.72 |
| NFE | 36.54 | 34.18 | 34.52 | 33.63 |
| NDF | 17.10 | 17.21 | 18.18 | 18.93 |
| ADF | 41.00 | 45.00 | 46.30 | 46.63 |
| ADL | 25.35 | 27.41 | 28.76 | 28.56 |
| Cellulose | 15.65 | 17.59 | 17.54 | 18.07 |
| Hemicellulose | 23.90 | 27.79 | 28.12 | 27.70 |

**Table3: Effects of Bio-Chemically treated *Jatropha curcas* Kernel Cake on the Feed Intake, Milk Yield and Milk Composition**

| Parameter | A | B | C | D | ±SEM |
|---|---|---|---|---|---|
| Dry Matter Intake (g/d) | 2165.1[a] | 2194.5[b] | 2221.2[c] | 2767.3[d] | 6.02 |
| Milk Yield (g/d) | 140.53[b] | 130.10[a] | 133.14[a] | 136.63[a] | 2.86 |
| Fat (%) | 5.58 | 5.85 | 5.76 | 5.82 | 0.26 |
| SNF (%) | 9.11 | 10.46 | 10.76 | 10.99 | 1.04 |
| Total Solids (%) | 15.25[a] | 16.12[b] | 16.81[c] | 16.92[c] | 0.11 |
| Ash | 0.75 | 0.78 | 0.78 | 0.83 | 0.02 |
| Protein (%) | 4.07[a] | 4.69[b] | 4.70[b] | 4.72[b] | 0.03 |
| pH | 6.46 | 6.36 | 6.41 | 6.44 | 0.04 |
| Lactose | 4.17 | 4.22 | 4.23 | 4.21 | 0.01 |
| Calcium | 191.30 | 134.17 | 120.70 | 120.00 | 7.11 |
| Magnesium | 23.10 | 30.30 | 32.80 | 33.20 | 1.40 |
| Phosphorus | 85.10 | 87.60 | 88.70 | 88.60 | 0.41 |
| Sodium | 80.00 | 80.00 | 79.00 | 80.00 | 0.01 |
| Pottasium | 152.75 | 160.50 | 161.80 | 160.50 | 1.08 |
| FCM yield(g/d) | 139.97 | 138.22 | 139.97 | 147.07 | 4.30 |
| Energy ($MJKg^{-1}$) | 4.07 | 4.16 | 4.19 | 4.34 | 0.08 |

*abc means on the same row with different superscripts are significantly different ($p<0.05$)*values of mean of triplicate analysis FCM-Fat Corrected Milk

**DISCUSSION**

The milk yield obtained from this study was consistent with the small body size and conformation of the WAD goats (genetic make-up) and small body size of WAD goats has been linked with low milk production capacity, this is consistent with the reports of Ezekwe and Machebe, 2005 who reported that low milk capacity of WAD goats is due to their genetic makeup. This increase could be due to the frequency of milking (twice a day) that was done in this study and it was in line with the reports of that milk yield increased with milking frequency due to emptying of the udder per milking aids more milk secretion. The increase in the fat and protein content observed in the treatment group would be of importance to the cheese industry since protein and fat affects the premium placed on milk. The values obtained for the fat content obtained from this study were comparable to the values (6.03, 6.10%) obtained by Belewu *et al.,* 2007. The higher values obtained in this study could be due to the inclusion of fermented cake in the goat's diet. Belewu *et al* (2007) reported slightly higher milk protein content than value reported in this study The Total Solid and Solid Non Fat values obtained for WAD goat milk used in this study were higher than values reported by Ahamefule *et al.* (2012) for village reared WAD (13.55%, 9.91%) and intensively managed WAD (14.77%, 9.97%). The SNF recorded was however lower than the values of Ogunbosoye (2013). The higher total solids content in milk of goats fed biochemically treated *Jatropha curcas* cake suggests that microbial protein synthesized during pre-treatment of *Jatropha curcas* might have enhanced the content of the milk total solids, as fermented products enhances wellness The ash content of milk of goats fed the treatments were higher ($p>0.05$) than those on the control diet, this agreed with the works of (Jaqueline and Visser, 1996; Belewu *et al.*,2007) that pre-digested substrates possessed enhanced mineral content which could have been channelled into the milk of the goats. The mineral contents (Ca, Mg, K and P) showed increase in the milk of the treated group compared to the milk of the control group, except for sodium that was similar ($P>0.05$). The sodium value recorded for WAD goats in this study was slightly similar to the values (85-91mg) obtained by Ojoawo and Ojoawo (2014) confirms the fact that goat milk is a good source of sodium. The magnesium value obtained in this study was higher than the values reported by Jean and Randy (2002) and Ojoawo and Ojoawo (2014). This could be due to the inclusion of fermented *Jatropha curcas* cake in the diet of study animals. The potassium value obtained from this study was similar to the values reported by Ojoawo and Ojoawo (2014); Ojoawo and Akinsoyinu (2014). It can be inferred that goat milk is rich in potassium. This study affirms the proposition that milk of goats is an excellent source of minerals, and is suitable for consumption without attendant allergies. The high levels of these minerals in bio-chemically treated *Jatropha curcas* kernel cake could have been channelled into the milk.

## CONCLUSION

The inclusion of fermented *Jatropha curcas* kernel cake at 7% in the diet of WAD goats enhanced the milk composition of the WAD goats. The enhanced nutritional value added to the cake has been passed into the milk; especially the milk fat and protein content of the treatment which is of great importance to the dairy industry. This makes the cake a premium value adding feedstuff for the dairy industry.

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