NSAP 47th Annual Conference (JOS 2022) CONFERENCE PROCEEDINGS
THEME: SECURING ANIMAL AGRICULTURE AMIDST GLOBAL CHALLENGES

COMPARISON OF CHEMICAL COMPOSITION OF BACTERIAL (*PSUEDOMONAS AERUGINOSA*) TREATED AND UNTREATED *JATROPHA CURCAS* KERNEL CAKE

Ganiyu, A.O. and Belewu, M. A.
Department of Animal Production, University of Ilorin, Ilorin,Nigeria.
gakeem217@gmail.com

ABSTRACT

The study was conducted to compare the proximate composition of treated and untreated *Jatropha Curcas* Kernel Cake (JKC).Standard procedures (AOAC) were employed to analyse the samples of dried kernel of *Jatropha curcas* purchased from open market. Results showed that after fermentation, the *Psuedomonas aeruginosa* treated JKC contained 24.54% of crude proteins compare to 28.40% for untreated sample and the fermentation process has appreciably reduced the fat and crude fibre contents from 16.81% and 27.05% to 19.52% and 14.97% respectively. This preliminary study has shown that the methods of detoxification employed in this study have potentials to improve the nutritive value of JKC.

Key Words: Compare, Jatropha, Psuedomonas, Proximate, Kernel.

INTRODUCTION

Owing to the depletion of farm outputs caused by climatic changes, pests, diseases, cost of agro-chemicals and developed countries shunting grain into energy, the search for alternative feed resources for livestock has becomes imperative because of the high cost of conventional stuffs. One of the alternative feed components that are feasible, locally available and accessible is *Jatropha curcas* kernel cake. *Jatropha curcas*, commonly known as physic nut are oil plants belonging to the Euphorbiaceae family. The genus (*Jatropha*) includes more than 175 species, among which *Jatropha curcas* L. and *Jatropha platyphylla* Müll. Arg. has drawn particular attention as potential biofuel and animal feed sources. *Jatropha curcas* has both toxic and non-toxic genotypes while *Jatropha platyphylla* is a non-toxic species (Makkar *et al*., 2012). *Jatrophas curcas* are drought-resistant perennial and multipurpose shrubs or trees similar to the cassava plant (Elbehri *et al*., 2013). It is a deciduous tree, shedding its leaves during the dry season. It can grow to a height of 3-5 m, and remains productive for 30 to 50 years. Jatropha has a deep taproot and four shallow lateral roots. The taproot anchors the plant in the soil, stabilizing the soil against landslides, and the lateral roots prevent soil erosion. The trunk is covered with a smooth grey bark that exudes watery and sticky latex when cut. The leaves are smooth, 4-6 lobed, 10-15 cm long and wide, and are usually pale green in colour (Raheman, 2012). Inflorescences develop at the apex of the branches and bear approximately 10 or more ovoid fruits (pods) (Makkar *et al*., 2012). Flowers and fruits develop during the rainy season or year-round in permanently humid regions. The pods contain many elliptic seeds and become yellow when they mature. Dry jatropha fruits contain about 38% husks and 62% seeds. The seeds look like castor seeds in shape, and are black in colour (Raheman, 2012). They consist of 30-40% testa (shells) and 60-70% kernels. The kernels contain 44-62% oil (King *et al*., 2009). Most *Jatropha* species, including *Jatropha curcas*, contain numerous toxic components and the plant and its by-products, when not detoxified, are deleterious to humans and livestock. One species, *Jatropha platyphylla* is non-toxic and is eaten by indigenous people in the Sinaloa State of Mexico, who call it "sangregrado". This species has thick succulent branches and its leaves borne on long petioles, are glabrous and larger (25 -35 cm) than those of *Jatropha curcas*. Its

seeds are almost circular and contain 50-60% edible oil (Makkar *et al*., 2011). Although the cake meal of *J. curcas* is rich in protein, it is toxic to rats, mice, ruminants and humans due to the presence of antinutrional factors such as phorbol esters, curcin, trypsin inhibitors, lectin etc, (Makkar and Becker, 1997; Aregheore *et al*., 2003; Makkar *et al*., 2008; Abou-Arab and Abu-Salem, 2010).

Because of its richness in protein, several works has been carried out on the *J. curcas* seed so that it can be used as a source of protein in animal feed. For example Oladele and Oshodi (2008) attempted the detoxification of the seeds using local fermentation process while Martı´nez – Herrera *et al*. (2006) also used chemical such NaHCO3, ethanol as well as irradiation as a method of detoxification. However, Aregheore *et al* (2003) reported that Heat and chemical (ethanol) treatments was able to reduced the antinutrient factors in *J. curcas* seed to a tolerable minimum, while solid state fermentation employed by Belewu & Sam (2010) was able to detoxified and inactivate almost 100 % of the antinutrient contents of *Aspergillus niger* treated sample of *Jatropha* kernel cake to a tolerable level. The residual protein-rich seed cake, remaining after extraction of the oil, could form a protein rich ingredient in feeds for poultry, pigs, cattle and even fish if it could be detoxified. In view of these, the present research was designed to evaluate and compared the nutrient composition of biological (*Psuedomonas aeruginosa)* treated and untreated Jatropha kernel meal.

MATERIALS AND METHOD

Experiment Location

The experiment was carried out at Department of Animal Production Laboratory, University of Ilorin, Ilorin, Kwara State, Nigeria.

Preparation of the substrate

The substrate (milled dehulled J. curcas kernel) was purchased from reputable source and was soaked in solvent (Petroleum ether) for 24 hours after which it was squeezed in a sieving cloth and air dried for three days to get rid of the oil. The defatted cake was autoclaved at 121°C for 15 minutes.

Bacteria used

The bacteria used (*Pseudomonas aeruginosa*) was collected from Department of Microbiology, University of Ilorin Laboratory and maintained on nutrient agar containing in petri dishes for growth of the organism.

Inoculation and Incubation of the Jatropha kernel cake

The defatted Jatropha kernel cake was inoculated with the spores of the bacteria (*Pseudomonas aeroginosa*). The inoculated substrate was covered with black polythene bags and incubated at room temperature to allow the organism to grow over the substrate for first four days turned and allowed to continue its growth for another five days. After which the growth was terminated by oven dried and kept for analysis.

Chemical Analysis

Prepared *Jatropha carcass* kernel cake was analysed in the laboratory for dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract using the method of AOAC (2000).

RESULTS AND DISCUSSION

Proximate Composition of Bacteria (Psuedomonas aeruginosa) Treated and Untreated Jatropha curcas Kernel Cake on Dry matter basis

The proximate composition of the bacteria treated *J. curcas* kernel cake is presented in Table 1. The results indicate that the bacteria treatment increases the dry matter content of *Jatropha*

curcas kernel cake; this was in agreement of earlier report of Belewu *et al* (2010). On the other hand, higher crude protein value of 28.40% was observed in untreated jatropha which is against earlier studies (Belewu & Sam, 2010 and Ameen *et. al*., 2011) while lower values was observed for crude fibre and ether extract, (19.52% and 14.81% respectively) in treated sample which was in line with earlier studies (Ameen *et. al*., 2011, belewu *et. al*., 2010 and Sanusi *et. al*., 2013). The nitrogen free extract and ash value was higher for treated sample (29.39% and 6.75% respectively) compare to 14.89% and 5.25% for nitrogen free extract and ash respectively for untreated sample which are in accordance with report of Sanusi *et. al*.,(2013). The lower crude protein observed for treated sample could be attributed to the source and chemical composition before treatment.

Table 1: Proximate composition of Bacteria (*Psuedomonas aeruginosa*) treated and Untreated *Jatropha curcas* kernel cake on dry matter basis

Parameters	Untreated JKC	Treated JKC
Dry matter (%)	92.40	94.00
Crude protein (%)	28.40	24.54
Crude fibre (%)	27.05	19.52
Ether extract (%)	16.81	14.97
Ash (%)	5.25	6.75
NFE (%)	14.89	28.22

JKC : Jatropha Kernel Cake

CONCLUSION

Based on this study it could be concluded that fermentation of jatropha kernel with bacteria (*Psuedomonas aeruginosa*) could be a promising means of improving feeding value of *Jatropha curcas* Kernel Cake.

REFERENCES

Abou-Arab A. A. and Abu-Salem F. M. (2010) Nutritional quality of *Jatropha curcas* seeds and effect of some physical and chemical treatments on their anti-nutritional factors, Afr. J. Food Sci. 4(3) 93 – 103.

AOAC, (2000). Official method of analysis, 14th edition association of the official analytical chemists' standard method Arlingo, Nigeria and U.S.A.

Amen, O. M., Belewu, M. A., Onifade, O. O., and Adetutu, S. O. (2011). Chemical Composition of Biologically treated *Jatropha curcas* Kernel Cake. *In. Journal of science and nature*; 2(4):757 -759

Aregheore, E. M., Becker K. and Makkar, H.P.S. (2003) Detoxification of a toxic variety of *Jatropha curcas* using heat and chemical treatments, and preliminary nutritional evaluation with rats, S. Pac. *J. Nat. Sci*., 21, 50-56.

Belewu M.A. and Sam R. (2010) Solid state fermentation of *Jatropha curcas* kernel cake: Proximate composition and antinutritional components, Journal of Yeast and Fungal Research, 1(3), 44 – 46.

Elbehri, A.; Segerstedt, A.; Liu, P. (2013). A global assessment of sustainability Biofuels and sustainability challenge : issues, trends and policies for biofuels and related feedstocks. FAO, Rome, Italy.

King A. J., He W., Cuevas, J. A., Freudenberger M., Ramiaramanana D., Graham I. A., (2009). Potential of *Jatropha curcas* as a source of renewable oil and animal feed. *J. Exp. Bot.*, 60 (10): 2897-2905

Makkar, H. P. S.; Kumar, V.; Oyeleye, O. O.; Akinleye, A. O.; Angulo-Escalante, M. A.; Becker, K. (2011). *Jatropha platyphylla*, a new non-toxic Jatropha species: Physical properties and chemical constituents including toxic and antinutritional factors of seeds. Food Chem., 125 (1):63-71

Makkar, H. P. S.; Kumar, V.; Becker, K. (2012). Use of detoxified jatropha kernel meal and protein isolate in diets of farm animals: chapter 21. In: Makkar, H.P.S, Biofuel coproducts as livestock feed - opportunities and challenges, FAO.

Martı´nez-Herrera, J., Siddhuraju, P., Francis, G., Da´vila-Ortı´z, G., and Becker, K. (2006) Chemical composition, toxic/antimetabolic constituents, and effects of different treatments on their levels, in four provenances of *Jatropha curcas* L. from Mexico, Food Chemistry 96 (2006) 80 –89.

Oladele, E. O.P. and Oshodi, A.A. (2008) Effect of fermentation on some chemical and nutritive properties of Berlandier Nettle spurge (*Jatropha cathartica*) and physic nut (*Jatropha curcas*) seeds. Pak. J. Nutr. 7: 292-296.

Raheman, H., (2012). Jatropha: chapter 14. In: Chittaranjan, K; Joshi, C. P. ; Shonnard, D. R.(Eds). Handbook of bioenergy crop plants. CRC Press, Taylord & Francis Group

Sanusi, G. O., Belewu, M. A., and Oduguwa, B. O. (2013). Changes in chemical composition of *Jatropha curcas* kernel cake after Solid-state fermentation using some selected fungi. Journa of Biology, Agriculture and Health Science; 2(2):62-66.