Comparative evaluation of proximate composition of bacterial (*Psuedomonas aeruginosa*) treated and untreated *Jatropha curcas l.* kernel cake

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Abstract

*The study was conducted to compare the proximate composition of bacterial (**Psuedomonas aeruginosa)** treated and untreated Jatropha curcas kernel cake (JKC). Jatropha curcas L. is one of the toxic species of Jatropha similar in shape to plants in Euphorbiaceous families in plant kingdom. It kernel after oil extraction have been shown to be a promising animal feed cake with appreciable crude protein content, therefore method of detoxifying the kernel cake should be intensify in other to improve it feeding value. Dried Jatropha curcas kernel cake was obtain from University of Ilorin Jatropha plantation unit. It was treated by soaking in petroleum ether (24 hours), air dried (three days) and then autoclave for 15 minutes at 121^{O}C before fermented with the spores of bacteria (Pseudomonas aeruginosa) for nine days. Standard procedures (AOAC) were employed to analyse the treated and untreated Jatropha curcas kernel cake samples. The results showed that the treated sample significantly ($p<0.05$) had higher content of dry matter, ash and nitrogen free extract while the untreated had lower values. On the other hand the untreated sample significantly ($p<0.05$) had higher values of crude protein, crude fibre and ether extract while the treated sample had lower. It can be concluded that inoculation of Jatropha curcas kernel cake with bacteria (Pseudomonas aeruginosa) will improve dry matter, ash and nitrogen free extract contents.*

Keywords: Comparative, Evaluation, *Jatroph acurcas*, *Psuedomonas aeruginosa*, Proximate composition

Évaluation comparative de la composition immédiate des bactéries (*Psuedomonas aeruginosa*) traitées et non traitées tourteau aux noyaux de *Jatropha curcas l.*

Résumé

L'étude a été menée pour comparer la composition immédiate des bactéries (Psuedomonas aeruginosa) traité et non traité de tourteau de noyau de Jatropha curcas (TNJ). Jatropha curcas L. est l'une des espèces toxiques de Jatropha de forme similaire aux plantes des familles Euphorbiacées du règne végétal. Il a été démontré que le noyau après extraction de l'huile est un tourteau prometteur pour l'alimentation animale avec une teneur appréciable en protéines brutes. Par conséquent, la méthode de détoxification du tourteau de noyau doit être intensifiée dans d'autres pour améliorer sa valeur alimentaire. Le gâteau de noyau de Jatropha curcas séché a été obtenu auprès de l'unité de plantation de Jatropha de l'Université d'Ilorin. Il a été traité par trempage dans de l'éther de pétrole (24 heures), séché à l'air (trois jours) puis autoclavé pendant

15 minutes à 121°C avant de fermenter avec les spores de bactéries (Pseudomonas aeruginosa) pendant neuf jours. Des procédures standard (AOAC) ont été utilisées pour analyser les échantillons de tourteaux de noyau de Jatropha curcas traités et non traités. Les résultats ont montré que l'échantillon traité de manière significative ($p < 0,05$) avait une teneur plus élevée en matière sèche, en cendres et en extrait sans azote tandis que l'échantillon non traité avait des valeurs plus faibles. D'autre part, l'échantillon non traité avait significativement ($p < 0,05$) des valeurs plus élevées de protéines brutes, de fibres brutes et d'extrait d'éther tandis que l'échantillon traité en avait des plus faibles. On peut conclure que l'inoculation du tourteau de Jatropha curcas avec des bactéries (Pseudomonas aeruginosa) améliorera les teneurs en matière sèche, en cendres et en extraits libres d'azote.

Mots-clés : Comparatif, Evaluation, Jatroph acurcas, Psuedomonas aeruginosa, Composition proche

Introduction

Jatropha curcas, also known as physic nut. It an oil seed plant belonging to the family *Euphorbiaceous*. 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). *Jatropha curcas* is a drought-resistant perennial and multipurpose plant similar in shape with cassava plant (Elbehri *et al*., 2013). It is a deciduous tree, shedding its leaves during the dry season. It usually grows to a height of about 3-5 m, and can remain productive for 30 to 50 years. It has a deep taproot and four shallow lateral roots. 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. 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 livestock. The other 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).

Owing to the depletion of farm outputs caused by climatic changes, pests, diseases, and cost of agro-chemicals there is continuous increase in the cost of conventional stuffs. Therefore, the search for

alternative feed ingredients for livestock that is cheap and locally available becomes imperative. One of such alternative feed ingredients is *Jatropha curcas* kernel cake. *Jatropha curcas* is a drought resistant shrub or tree that grows wild or in semi-cultivated environments (Kumar and Sharma, 2008). Depending on soil quality and rainfall, the oil from *Jatropha curcas* nuts and seeds may be obtained after 2–5 years after cultivation. *Jatropha Curcas* nuts or seeds are produced in quantities ranging from 0.5 to 12 tonnes per year per hectare. It remains after oil has been extracted from the seeds. Although the cake is rich in protein, but have been observed to be toxic to rats, mice, ruminants and humans due to the presence of antinutrional factors such as phorbolesters, curcin, trypsin inhibitors, lectinetc, (Makkar and Becker, 1997; Aregheore *et al*., 2003; Makkar *et al*., 2008; Abou-Arab and Abu-Salem, 2010). Due to this fact 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 as substitute for conventional feedstuffs. For example, Belewu (2008) showed reduction in some antinutritional factors such as phytate, saponin, and tannin when treated with *Rhizopus oligosporus*. Belewu *et al.*(2010) also deduced that *Aspergillus niger* was effective in lowering the level of antinutrients in the kernel cake to level that do not elicit toxic response in the West African Dwarf goats while *Trichoderma longibrachiatum* was not effective in detoxifying the antinutrients as the toxic responses was noticed (persistent diarrhoea, dehydration and sudden deaths). More so, Oladele and Oshodi (2008) detoxified the seeds using local fermentation process while Martı´nez – Herrera *et al*. (2006) also used chemical such as $NaHCO_3$, 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 reduce the antinutrient factors in *J. Curcas* seed to a tolerable minimum, while solid state fermentation employed by Belewu and 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. In view of these, the present study was designed to compare the proximate composition of bacterial (*Psuedomonas aeruginosa)* treated and untreated *Jatropha curcas* kernel cake.

Materials and methods

Experimental location

The experiment was carried out at Department of Animal Production Laboratory, University of Ilorin, Ilorin, Kwara State, Nigeria. The University is located along Longitude 8^{O} 28' 55.20"North and Latitude 4^{O} 40' 7.76"East.

Preparation of the substrate

The substrate (milled dehulled *J. curcas* kernel cake) was obtained from University of Ilorin Jatropha plantation unit and was soaked in solvent (Petroleum ether) for 24 hours. Thereafter it was squeezed with 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 were *Pseudomonas aeruginosa*. It was collected from the Department of Microbiology Laboratory, University of Ilorin and was maintained on

nutrient agar containing in petri dishes for growth of the organism.

Inoculation and incubation of the Jatropha kernel cake

The defatted *Jatropha curcas* kernel cake was inoculated with the spores of the bacterium (*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 in an airtight container prior to analysis.

Chemical analysis

The prepared *Jatropha curcas* kernel cake was analysed in the laboratory for proximate analysis typified by dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract using the method of AOAC (2000) while the gross energy was estimated using NRC linear formula below.

$Gross\ Energy\ (G.E)$ =5.7XCP+9.4XFAT +4.1(NFE+CF)

Statistical analysis

Data obtained from chemical analysis were subjected to T-test analysis of two variable samples to estimate the level of significance among the means.

Results and discussion

Proximate composition of treated and untreated Jatropha curcas kernel cake

The proximate composition of the bacteria treated and untreated *J. Curcas* kernel cake is presented in Table 1. The treated ***Jatropha curcas*** **kernel** cake had higher dry matter (94.00%), ash content (6.75%) and nitrogen free extract (34.22%)to while the untreated cakehad lower (92.40%5.25% and 22.52% respectively). On the other hand the untreated ***Jatropha curcas*** **kernel** cake had higher crude protein, crude fibre and ether extract (28.40%, 27.05% and 16.81% respectively) of untreated cake were significantly ($p<0.05$) higher while the treated had lower (24.54%, 19.52% and 14.97% respectively). The gross energy of untreated kernel cake (523.14Kcal/100kg) was significantly ($p<0.05$) higher while the treated (500.94Kcal/100kg) had lower. The increased in dry matter content as a result of treating ***Jatropha curcas*** **kernel** cake with ***Psuedomonas aeruginosa*** agreed with the report of Belewu *et al.* (2010) (90.56% to 92.92%). The decreased in crude protein in the treated sample disagreed with 37.82% to 65.75% for untreated and treated respectively (Belewu and Sam, 2010) and from 44.4% to 52.9% for untreated and treated respectively (Ameen *et. al*. 2011) while the lower values observed for crude fibre and ether extract were in line with earlier studies from 9.02% to 4.70% for untreated and treated respectively (Ameen *et. al*., 2011), from 34.23% to 29.53% for untreated and treated respectively (Belewu *et al*. 2010) and from 6.50% to2.55% for untreated and treated respectively (Sanusi *et al*. 2013).The lower crude protein observed for treated sample could be attributed to the source and the organism use in this study against previous studies (Belewu *et al*., 2010) who use *Aspergillus niger* meanwhile, lower value observed for crude fibre shows that the bacteria had appreciably degraded the fibre content. The ash value was higher for treated sample compared to untreated sample which

was in accordance with 8.10% and13.00% for untreated and treated (Sanusi *et. al*. 2013).

Table 1: Proximate composition of treated and untreated *Jatropha curcas* kernel cake

Parameters	JKC		P-value	Sign. Level
	Untreated	Treated		
Dry matter (%)	92.40	94.00	0.057	NS
Crude protein (%)	28.40	24.54	<0.0001	Sign.
Crude fibre (%)	27.05	19.52	<0.0001	Sign.
Ether extract (%)	16.81	14.97	<0.0001	Sign.
Ash (%)	5.25	6.75	0.19	NS
NFE (%)	22.52	34.23	<0.0001	Sign.
GE (Kcal/100kg)	523.14	500.94	<0.0001	Sign.

JKC-*Jatropha curcas* kernel cake, NFE-Nitrogen free extract, GE-Gross Energy, Signf-Significantly different, NS- Not significantly different

Conclusion

Based on this study it can be concluded that fermentation of *Jatropha curcas* kernel cake with bacteria (*Psuedomonas aeruginosa*) helps in improving ash and nitrogen free extract content as well as reducing crude fibre content, but negatively affected crude protein and ether extract contents.

On this note, in other to ascertain the feeding potential of *Psuedomonas aeruginosa* treated *Jatropha curcas* further study on it feeding trial was recommended to evaluate it feeding value and it implication in animal physiological status.

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