Global Journal of Science Frontier Research: C
Biological Science
Volume 19 Issue 1 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Combined Methods of Detoxification of Antinutrients that Prevent Jatropha Caucas to Take its Place in Aninmal Feed

By Lawal, W. S, Banjoko, K.I, Hameed, S.A, Akande, T.A & Olayiwola, S. A

Abstract- A study was conducted to evaluate the chemical composition and antinutrient qualities of Jatropha seeds detoxified by physical, chemical, biological, and combined method, making four (4) treatment all together.100kg of jatropha seeds was detoxified each by physical (grind, soak and sundry) chemical (soak in methylated sprit, hexan and methanol) biological (Aspergillus niger and Bacillus lichiformis) and combined method (all the previous methods is repeated in this method).Quantitative analysis of antinutrients from each of the methods was carried out and the result revealed, a drastical reduction of about (70%) of phobol ester and other antinutrients in combined method of detoxification was noticed.

Keywords: jatropha curcas, aspergillus niger, baccillus lichiformis, fermentation, antinutrients.

GJSFR-C Classification: FOR Code: 069999

Strictly as per the compliance and regulations of :

Combined Methods of Detoxification of Antinutrients that Prevent Jatropha Caucas to Take its Place in Aninmal Feed

Lawal, W. S [α], Banjoko, K.I [σ], Hameed, S.A [ρ], Akande, T.A [ω] & Olayiwola, S. A [¥]

Abstract- A study was conducted to evaluate the chemical composition and antinutrient qualities of Jatropha seeds detoxified by physical, chemical, biological, and combined method, making four (4) treatment all together.100kg of jatropha seeds was detoxified each by physical (grind, soak and sundry) chemical (soak in methylated sprit, hexan and methanol) biological (Aspergillus niger and Bacillus lichiformis) and combined method (all the previous methods is repeated in this method).Quantitative analysis of antinutrients from each of the methods was carried out and the result revealed, a drastical reduction of about (70%) of phobol ester and other antinutrients in combined method of detoxification was noticed.

Keywords: jatropha curcas, aspergillus niger, baccillus lichiformis, fermentation, antinutrients.

I. Introduction

As the population of human being in the world keeps increasing say average of seven billions presently, there may be increase in demand and competition for conventional food/feedstuffs both by man and monogastric livestock. This is especially true in underdeveloped and developing countries like Nigeria where food production did not tally with the high growth rate in population. There is also an increase in the prices of these conventional feedstuffs as a result of this competition between feed industries and man. This has caused developing countries like Nigeria to embark on researches focused on novel feedstuffs, which are not staple for human consumption to alleviate the problems of shortage and competition for the available traditional feedstuffs. It is for these reasons that *Jatropha curcas* seeds are considered as alternative feedstuff in this experiment.

Jatropha curcas is regarded as a wonder plant because of its numerous attributes; the seeds contain up to 60% oil with a fatty acid pattern similar to that of edible oil, the percentage of essential amino acids and mineral content can be compared to those of other seeds (Makkar and Becker, 1999).

The use of *Jatropha* in animal nutrition is however faced with several problems of anti-nutritional factors such as lectins, saponins, tannins, phytic acid, trypsin inhibitors, hydrocyanides and phorbolesters (Makkar and Becker, 1999). Due to these phytotoxins, the seeds, cake or its oil cannot be used for human or animal consumption unless it is detoxified (Belewu et, al. 2010).

Nevertheless, in order to search for alternative feeds, this experiment attempted to investigate the detoxification by combined method, feeding trial and sensory evaluation of meat from *Jatropha* seeds to improve its nutritional value so that it could be used in monogastric nutrition.

On a daily basis, the recommended animal protein consumption of average Nigeria is inadequate NRC (1998) since an average Nigerian cannot take this value of animal protein because of the cost of poultry meat and products.

The source of protein for the poultry birds are the feed ingredients like Soyabean, Palmkernelcake, Groundnut cake etc. Effort is therefore needed to get alternative protein feed ingredients that is available and cheap like *Jatropha* so that the cost of producing poultry birds and products will be reduce, since about 80% cost of producing birds goes for feeding alone Heller J. (1996).and also the expansion of poultry business has been hindered by production of good and quality feed. Grunert, K. G. (2006).

However, soybean, which is a commonly use source of protein in poultry feed is also use together with maize, and they have been staple food of mankind since ancient times. In human diets, soybean has been used as a protein source for over 5,000 years (Peisker, 2001).

Soybean competes with human food and hence there is a need to identify other protein-rich plant resources that could be used in animal diets. The whole world is becoming increasingly aware of the possible looming of food scarcity, and hence the possibility of raising animals on unconventional, easily sourced and cheap feedstuffs in the tropics and subtropics deserves more quicker attention (Belewu *et. al.*, 2009). Worldwide, the growing scarcity of conventional animal feed has therefore motivated nutritionists to find alternative sources of protein for livestock

Jatropha a small shrub plant which grows wildly in the tropics and sub-tropics but it is used as fencing in Nigeria. The plant could adapt to marginal areas with poor soils and low rainfall (480 mm per annum and

Author α σ ρ ω: Kwara State Polytechnic, Ilorin, Nigeria.
Author ¥: College of Education, Ilorin, Nigeria.
e-mail: awsl2004@gmail.com

28.5°C) where growth is not in competition with annual food crops.

a) Objectives

The objectives of this study are:

- Detoxify jatropha seed with physical, chemical, biological and combined method of detoxification.
- Analyses of the antinutrients from each method of detoxification
- Present and recommend a better method of detioxification

b) Justification

- Availability and presence of jatropha trees and seeds both in residential and bushes
- Seeds, leaves, stems and roots are gotten free of charge

c) Material and Methods

i. *Sources of Seeds*

The seeds was purchased from university of Ilorin Jatropha plantation, in Ilorin. Nigeria.

ii. *Toasting and Milling*

The seeds were decorticated, and the kernels were toasted and milled using the mechanical grinder

iii. *Preparation for Detoxification*

The seeds was sorted out for dirts and bad onces after which it was grinded to increase the surface area of the seeds for proper and effective detoxification.

iv. *Physical Method*

The seeds was soaked for two (2) days after which the liquid was drain off with cloth of mesh 20mm and was later sundry.

v. *Chemical Method*

The seeds in this method was first soaked in methylated sprit 1.4 for two (2) days and soxhlet equipment was used to remove the oil and was sundry for the odour of methylated sprit to go off and then was re-soaked again in hexane 1;4 for another two (2) days and soxhlet extractor was used to remove the oil and is again sundry for the odour to go off and was finally rinsed with methanol 1;4 and the oil was extracted with soxhlet equipment and was sundry.

vi. *Biological Metghod*

Granulated Jatropha seed was made moist into paste and Aspergillus niger a microorganism was added and was allowed to stand for 7 days and turning is done every 6 hours of the 7 days. The effect of Aspergillus Niger was to break the oil down into smaller size that can easily be removed since the oil contain the toxic phobol esther, it is sundry for 5 days so that effect of Aspergillus Niger can go off or reduced to bearest minimum after which Bacillus licheliformis is added to the granulated jatropha seed for another 7 days and turning is effected for every 6 hours, after which the oily liquid is removed by sieve. it is then sundry so that it is turned into powdery form samples was collected on a daily bases from this method to monitor rate of phobolester detoxification by the microorganisms.

vii. *Combined Method*

In this type of detoxification method both physical, chemical and biological method are combined by carrying out one after the other. Physical method is carried out first, it is then washed and sieved and after chemical method follows it is again washed and sieved and the odour of the chemical is allowed to go off then the process of biological method starts immediately after the use of each micro organism it is washed and sieved and sundry. It reduces the phobol esther level better compared to other methods.

viii. *Laboratory Analysis*

Samples collected from each of the methods were taking to the laboratory to test the level of phobol ester and antinutrients so that comparism can be made within the methods for conclusion to be drawn. Samples were collected on daily basis from biological and combined methods of detoxification.

ix. *Sources of Inoculum*

The fungi used (*Aspergillus niger and Bacillus lichiformis)* were obtained from Biology department of Science Laboratory Technology of Institute of Applied Sciences, Kwara State Polytechnic, Ilorin Nigeria in McCartney bottles.

II. Result and Discusions

a) Result

Table 1: Effects of Detoxification Methods on Antinutrients Content of Jatropha Caucass

Trmt	PhE	Phenol	Tanin	Phytate	Saponin	Tryp inhb	Lectin	Protein	Dm	Cf	EE	Ash	NFE
Untreated	3.00[a]	3.60[a]	0.04[a]	9.40[a]	2.60[a]	21.30[a]	102[a]	56[a]	85[a]	4.7[a]	7.6[a]	8.1[a]	12.8[a]
Phy mthd	2.60[b]	1.20[c]	0.04[a]	1.29[c]	2.00[c]	16.22[b]	102[a]	56[a]	89[a]	4.5[a]	7.6a	8.0[a]	12.1[a]
Chem mthd	2.60[b]	1.90[b]	0.02[c]	1.03[d]	2.29[b]	15.40[d]	86[b]	42.33[b]	89[a]	4.2[a]	7.0[b]	7.2[b]	10.5[c]
Bio mthd	2.09[c]	1.19[d]	0.03[b]	2.05[b]	2.00[c]	14.44[c]	76[c]	30.95[c]	90[a]	4.0[a]	6.4[c]	6.8[c]	11.1[b]
Comb mthd	1.48[d]	0.80[e]	0.008[d]	0.92[e]	1.09[d]	9.30[e]	51.00[e]	31[c]	90[a]	3.8[b]	5.5[d]	6.1[d]	9.2[d]
SEM	0.18	0.43	0.06	1.08	0.17	1.28	6.25	3.32	3.30	0.11	1.20	2.41	1.1

a, b, c and d means within the same column with different superscripts are significantly different P<0.05).

The antinutritinal factor of untreated and that of physical, chemical, biological and combined methods of detoxified Jatropha kernel cake is presented in Table 3.1.

There was a significant difference in phobol ester within the methods (P<0.05), the untreated jatropha has the highest value of phobol ester, followed by physical, chemical, biological methods. The physical method only reduces the phobol ester by 0. 4g, the combined reduces the phobol ester by 1.48g and is highly significant when compared to untreated jatropha and other three methods.

Phenol has the same trend like that of phobol ester (PhE) with significant difference in all the methods of detoxification, the physical method was able to remove 3.4g of phenol and is significant (P<0.05). The chemical method could remove 1. 75g, the biological method removed 2.41g while the combined method was highly significant (P< 0.05) with 0.08g of phenol left in the sample.

There was no significant difference between the physical and the untreated sample of jatropha caucas they contain 0.04g of tanin(P>0.05). Chemical method has about 0.02g while the biological method has 0.03g but the combined method which is highly significant has 0.08g (P<0.05).

There was a significant difference in combined method of saponin(P<0.05) containing 1.09g left, but there was no significant difference in physical and biological method of detoxification (P> 0.05) as the both contained 2.00g of saponin while the chemical method has 2.29g left in the sample of jatropha caucas.

Trypsin inhibitor followed same trend with the combined method having a better method and so is highly significant (P< 0.05) followed by biological, chemical and finally the physical method in that manner.

A different trend occurred in lectin as no significant difference occurred in both the untreated and physical method of detoxification they both contain 102g of lectin, chemical ,method contain 86g and biological method contain76g left in the sample. Combined method has about 51g of lectin and is highly significant when compared to other methods of detoxification (P< 0.05).

Protein which is one of our targeted nutrients has a significant difference in all the methods (P<0.05), it remain very high (56%) in the untreated and physical methods, closely followed by the chemical method (42.33%) and biological methods (30.95%) and the combined method has (31%) left after all the procedure.

Though there was a significant difference (P<0.05) in dry matter content of the methods of detoxification but there are little differences among all the methods with biological method and combined method been the highest

The combined method has a significant difference (P<0.05) in crude fibre when compared with other methods. There was no significant difference (P<0.05) in all other methods of detoxification.

The untreated and physical methods has the highest value of ether extract followed by chemical and

biological methods but the combined method method has the best lowest value of ether extract but generally there was a signinificant difference ($P<0.05$) in all the methods

The Ash content shows a significant difference in all the methods of detoxification with the combined method being the best followed the biological method of detoxification.

NFE content is highest in untreated jatropha followed by physical, chemical and biological method of detoxification. The combined method show the lowest best value though there was a significant difference in all method of detoxification.

III. Discussion

The values obtained for the untreated jatorpha is high, this is because the jatropha has not gone through any type of treatment, it is untouched and undiluted.

The values of phobol ester reduced by physical method is not significant when compared to untreated jatropha, this may be because the physical method did not really has much effect on phobol ester, but other antinutrient like phenol, phytate, saponine etc. The soaking and sundry of the physical method may have no effect on the crude protein and the value remain same for physical method and untreated jatropha, the same reason may holds for dry matter, crude fibre, ether extract, Ash and Nfe.

The chemical method is not different from physical method, the effect of chemical on phobol ester is not significant, may be reason why very little phobol ester is detoxified when compared to both untreated and physical method, but the effect of chemical on protein may be why the protein is reduced and the reduction is significant. The same reason may holds for crude fibre, ether extract, Ash and Nfe.

The significant difference noticed in phobol ester content of biological method may be as a result of the action of enzyme secreted by the microorganism that really involved in detoxification process, the phobol ester is embedded in the oily content of the seed, so as the enzymes is breaking the oil, the phobol ester is treated simultaneously. These microbes also feed on the protein content of jatropha caucas for their survival and performance for the period of 7days and this may be why the crude protein of jatropha in biological method to reduce in value when compared to the crude protein of other methods.

The jatropha caucas has gone through physical, chemical and biological to have the combined method and certain amount of the antinutrients is removed at each level of detoxification method, this may be why the phobol ester is significantly reduced when compared to other method of detoxification, other antinutrients is also reduced for this same reason. The protein content of biological and combined method is not significant, this may be because the microbes involved in the system both acted in same manner, but the combined method has its detoxification process commenced in the physical method before the effect of the microbes in the biological method and this may be reason why all the antinutrients is better reduced significantly when compared to other methods.

References Références Referencias

1. Belewu M. A, Adekola F.A., Adebayo G.B., Ameen O. M., Muhammad N. O., Olaniyan A. M. Adekola O. F. and Musa A. K. (2009). Physico-Chemical characteristic of oil and biodiesel From Nigerian and Indian, *Jatropha curcas* seeds, *International Journal of Biological and Chemical Science* 4(2), 524-529.
2. Grunert, K. G. (2006) Future trends and consumer lifestyles with regard to meat consumption. Meat Science, v. 74(1): 149-160.
3. HellerJ. (1996). Physic Nut: *Jatrophacurcas* L. Promoting the Conservation and Use of Underutilized and Neglected Crops. I. Institute of Plant Genetics and Crop Plant Research, Gatersleben/ International Plant Genetic Resources Institute, Rome. International.
4. Makkar, H.P. S., Aderibigbe, A. O. and Becker, K. (1999). Comparative evaluation of non-toxic and toxic Jatrophacurcas for chemical composition, digestibility, protein degradability and toxic factors. Food Chemistry, 62(2), 207-215.
5. NRC (1998) Peadiatric nutrition in West Africa, Paper presented to alliviate Kwashoko.