PRINT ISSN 1119-8362
Electronic ISSN 2659-1499

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 28 (4) 1165-1169 April 2024

Proximate Composition and Phytochemical Content of Solvent Extracted Roasted Castor Seed Meal from Oriire Local Government area of Oyo State, Nigeria

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ABSTRACT: The proximate composition and phytochemical content of solvent extracted roasted castor seed meal from Oriire Local Government area of Oyo State, Nigeria was determined using appropriate standard methods. The meal were found to contain 14.28% moisture, 24.48% crude protein, 3.46% crude fibre, 23.29% ether extract,5.71% ash,85.72% dry matter, nitrogen free extract and gross energy values were 56.91% and 5724kcal/kg respectively. The results of anti-nutritional factor present in the roasted solvent extracted castor seed meal revealed that it contained 0.13% ricin, 0.83% phytate and 0.38% oxalate. Based on the results of this study, roasted solvent extracted castor seed meal can be potential source of protein in the diet of monogastric animals

DOI: https://dx.doi.org/10.4314/jasem.v28i4.16

Cite this Article as: OGUNBODE, A. A; RAJI, A. W (2024). Proximate Composition and Phytochemical Content of Solvent Extracted Roasted Castor Seed Meal from Oriire Local Government area of Oyo State, Nigeria. *J. Appl. Sci. Environ. Manage.* 28 (4) 1165-1169

Dates: Received: 22 January 2024; Revised: 29 February 2024; Accepted: 23 March 2024 Published: 29April 2024

Keywords: Anti-nutritional, castor, proximate composition, phytochemical content

The major problems of farm animal production, especially monogastric animals which are fast-growing and prolific, include high cost and scarcity of feed, low productivity, a weak livestock extension system and disease outbreaks. The high cost of feed isdue to the competition between man, industry and farm animals for conventional sources of cereals like maize, the predominant supplier of energy in animal feed and plant proteins such as soybean, a supreme source of protein.These sources are in short supply, thereby making livestock farmers unable to purchase the quantity of feed needed for efficient livestock production. As such, the production of animal source food is affected(Apata and Atteh, 2016). Also, in Nigeria, the increasing demand for animal protein coupled with the dwindling availability of conventional feed raw materials, call for changes in the current feed resources utilization. Many farmers produce feeds to serve the farms, but the raw materials available to them are either expensive or difficult to get. It is imperative, therefore to exploit the use of locally available feed resources which are not directlyutilizable by man. Harnessing such a variety of feed sources for the development ofsuitable alternatives is very important in livestock production to mitigate the perennial problem of the rising cost of feeding and safeguard stalling the feed industry. It is therefore necessary to search for substitute/alternatives and test the substitutes both in the laboratory for biochemical constituents and in the field for efficiency of their utilization by the animals. This is in line with the national livestock transformation plan as a sustainable approach for the production of animal protein (Apata,2022). Over the

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past few decades, there has been increased exploitation of certain unconventional feeding materials as alternative protein sources to replace the costly protein materials for livestock. Also scarcity of high-quality conventional feed materials resulting in high competition between man and farm animal (Balogun*et al.*, 2005a). Of the vast vegetation across the globe, castor seeds (*Ricinuscommunis*) is considered as one of those alternative feedstuffs and it has been underutilized all along (Balogun*et al.,* 2005b)). The plant belongs to Europhorbiaceae, a spurge family, easy to cultivate, early matured and grow all the year round (Akande*et al.,* 2011). Its species is distributed in the tropical and subtropical regions across the globe (Weiss, 2000) with Brazil, China, India and Mozambique serving as the main producers in the world (FAO, 2013) but India ranks its highest producer (FAO, 2014). It grows well on fertile soil and tolerates not less than daytime temperatures of 200c throughout the growing period (Gana*et al.,* 2013).Since there is an urgent need to investigate the nutritional properties of the non-conventional feedstuff to know their suitability before recommendation for animal and feed formulation (Francis *et al.,* 2001), hence, the objective of this study was to investigate the proximate composition and phytochemical content of solvent extracted roasted castor seed meal from Oriire Local Government area of Oyo State, Nigeria.

MATERIALS AND METHODS

*Source and preparation of roasted solvent extracted castor seed meal:*Ripened and matured castor seed was purchased from castor grown farmer in Oriire Local Government area of Oyo State. The seeds were remove of dirts, roasted using open pan placed on burning firewood for 17 minutes at 100-110^{0}c and the oil was extracted using solvent extractor.

*Laboratory analysis:*Triplicate homogenous representative samples of solvent extracted roasted castor seed meal which was kept in properly labeled containers were analyzed at the nutrition and biochemistry laboratory of Department of Animal Science, University of Ibadan, Nigeria

*Determination of proximate composition:*Samples of the roasted solvent extracted castor seed meal were analyzed according to the methods of (AOAC, 2005). The parameters determine were moisture, crude protein, crude fibre, ether extract, ash and gross energy. The nitrogen free extract (NFE) was determined by difference.NFE% = 100-(%CP+%CF+%EE+%ash).

*Moisture content:*2.00g of the sample were put into the crucible, dried in an oven at 105^0 overnight. The dried sample were cooled in a desiccator for 30 minutes and weighed. The percentage loss in weight was expressed as percentage moisture content (A.O.A.C, 1999).

*Ash content:*2.00g of each of the grounded samples were placed in each crucible and ashed in a muffle furnace (Lenton Furnace, England) at 600^0 for 3 hours. The hot crucible were cooled in a desiccator and weighted. The percentage residual weighed was expressed as ash content(A.O.A.C, 2005).

*Crude lipid content:*2.00g of each sample were used for determining crude lipid by extracting lipid from it for 5 hours with petroleum ether in a soxhlet extractor.

*Crude fibre content:*2.00g of each sample were used for estimating crude fibre by acid and alkaline digestion method with 20% H_2SO_4 and NaOH solution.

*Carbohydrate determination:*Available carbohydrate (%) = 100 – (Protein (%) +Moisture (%) +Ash (%) + Fibre (%) + Fat (%)).

*Quantification of toxins:*The quantification of toxins in processed castor seed meal were determined for ricin using (13),oxalate by (Fasset, 1996) and phytate by (Maga, 1983)

*Oxalate determination:*The total oxalate was determined according to the procedure of (Fasset, 1996). The extraction was done by weighing 1g of each sample and soaked with 100ml of distilled water. It was allowed to stand for 3 hours and each was filtered through a double layer of filter paper, 10, 20, 30, 40 and 50 ppm standard solution of oxalic acid was prepared and read on the spectrophotometer at 420 nm for the absorbance. The absorbance of filtrate from each sample were also read on the Spectronic 20.

*Phytate determination:*Phytate was determined using the method of (Maga,1983). 2 grams of each sample were weighed. 100ml of 2% concentrated hydrochloric acid was used to soak each sample into conical flask for 3 hours and filtered through a double layer of hardened filter paper. 50ml of each filtrate was placed in 250 mi beaker and 107 ml of distilled water was added in each case to give proper acidity. 10 mi of 0.3% ammonium thiocyanate solution was added into each solution as indicator. This was titrated with standard iron (111) chloride solution which contained 0.00495g iron per ml. The end point was slightly brownish-yellow which persisted for 5 minutes

RESULTS AND DISCUSSION

The results of the proximate composition of roasted solvent extracted castor seed meal were as presented in Table1. The moisture content obtained fall within range (5-12%) as reported by (Annongu and Joseph, 2008) and (Akande*et al*, 2012). The moisture content of any feed is an index of its water activity(Frazier and Wwtoff, 1978) and is use as a measure of the stability and susceptibility to microbial contamination. The relatively low moisture content of the seed promise a long shelf-life before cultivation. The low moisture content also implies that dehydrationwill decrease the relative concentration of the other food nutrient and improve the long shelf-life of the seed (Edem*et al*, 2008). The crude protein of (24-48%) for the seeds were within range(21-48%) reported by (Ani and Okorie, 2009) and this made castor seed a good source of plant protein. This report agreed with the findings of (Akande*et al.*, 2012). The crude protein content was enhanced by processing methods. The increased crude protein content of the seed could be attributed to the removal of oil which caused an increase in the concentrations of other nutrients in the seed. The crude fibre value of (3.46%) in the roasted-solvent extracted castor seed were below therange of (12.5-24.5%) reported by (Akande*et al*, 2012). The crude fibre is the sum total of all those organic compounds of the plant cell membranes and supporting structures which in chemical analysis of plants foodstuff remained after removal of the crude protein, fat and nitrogen free extract. The physiological role of crude fibre in the body is to maintain an internal distention for proper peristaltic movement of the intestinal tract (Oduor*et al.*,2008). It increased stool bulk and decreased the time that waste materials spent in the gastrointestinal tract. The crude fibre was related to level of decortications and it is important to remove the abrasive seed coat to mitigate the effect of high fibre in nutrient absorption and of course deoiled the seed to prevent the purgative influence which tended to interrupt with nutrient absorption. The crude fat obtained for roasted-solvent extracted castor seed (23.29%) were higher than the range of values (1.9-20%) reported by (Akande*et al.*, 2012). The crude fat was associated with method of oil extraction. High crude fat value in the seed signified high lipid content. The higher oil content of castor seed made it one of the most appropriate renewable alternative sources ofbiodiesel in terms of availability and cost. Fats and oils were the most abundant lipids found in nature. They are heterogenous group of organic compounds which are important constituents of plant and animal tissues. The ash content which is an indicator for mineral elements was (5.71%) in processed castor seed and were below the range of (8.1-19.2%) reported by (Anandan*et al.*, 2005). The low-ash content of the seed implied that the seeds were not good source ofmineral nutrition and that there is need for supplementary diets rich in mineral content to avoid metal deficiency syndrome like ricket and calcification of bones as a result of calcium deficiency, when included in diet of livestock. The low ash content value of the sample also indicates that low quantity of inorganic minerals were present in the seed. The dry matter content of the seed was high (85.72%) and this showed that the seeds were richer in organic matter.The gross energy obtained in this study was higher than those obtained by (Nsa and Ukachukwu, 2007) but fall within the range with those obtained by (Annongu and Joseph, 2008).

Table 1: Proximate composition of roasted-solvent extracted castor seed

Composition	Values
Dry matter (%)	85.72
Crude Protein (%)	24.48
Crude Fibre (%)	3.46
Ether Extract (%)	23.29
Moisture Content (%)	14.28
Ash (%)	5.71
Nitrogen Free Extract (%)	56.91
Gross Energy (kcal/kg)	5724

Values are means of triplicate determination

Table 2 present the result on anti-nutritional factor in roasted-solvent extracted castor seed meal. Roasting and solvent extractor treatment employed in the study reduced the level of anti-nutrients in castor seed. The roasted-solvent extracted castor seed revealed ricin (0.13), phytate (0.83%), oxalate (0.38%). The level of oxalate recorded (0.38%) was below the values (9.16%) reported for Gmelinaarbores seed (Nsa*et al.*, 2011) opined that oxalate decreased calcium absorption aiding the formation of kidney stones and the formation of oxalate crystal take place in digestive tract. (Natesh and Ska, 2018) advocated that oxalate can result in burning in the eyes, ears, mouth, throat, abdominal pain, muscle weakness, nausea and diarrhea.The level of ricin recorded (0.13%) was below the values (1-5%) as reported by (Bradberry*et al.*, 2003). Ingestion of castor seed rich in ricin manifests symptoms like burning sensation in the mouth and throat, abdominal pains, purging, bloody diarrhea, dehydration, hypotension and decrease in urine excretion. The level of phytate in roasted-solvent extracted castor seed meal (0.83%) was less than (1.56%) reported for mucuna seed. Phytate reduces nutrient absorption and bio-availability through the formation of indigestible complexes with minerals and proteins (Ramteke*et al.*, 2019). (Iqbal *et al.*, 1994) reported that these complexes cannot be digested or absorbed in the intestinal tract of monogastric animals due to the absence of phytate enzyme. The value of anti-nutrients recorded were all below the threshold of lethal levels and therefore safe for animal consumption.

Table 2: Anti nutritional factors in roasted – solvent extracted castor seed meal

Anti-nutrients (%)	**Values (mg/100g)**
Ricin	0.13
Phytate	0.83
Oxalate	0.38

Conclusion: Solvent extracted roasted castor seed meal is edible and nutritive. Some detailed information on the proximate and anti-nutritional factors which enhances our knowledge and appreciation for the use of the seed was reported. The seed were characterized with high protein and carbohydrate content and very low in anti-nutritional composition. Thus, solvent extracted roasted castor seed could be of high nutritional value and better for consumption.

REFERENCES

Akande, TO; Odunsi, AA; Ojediran, TK (2012). Physical and nutrientcharacterization of raw and processed castor *(Ricinuscommunis)* seeds inNigeria. *World J. Agric. Sci.* 8 (1): 89-95

Akande, TO; Odunsi, AA; Adedeji, OS (2011). Toxicity and nutritive assessment of castor (*Ricinuscommunis*) oil and processed cake in rat diet. *AsianJ. Animal. Sci.* 5: 330-339. Doi: 10.39.23/ajas.2011.330.339

Anandan, S; Kumar, GKA; Ghosh, J; Ramachandra, KS (2005). Effect ofdifferent physical and chemical treatments on detoxification of ricin incastor cake. *Animal Feed Sci. Technol.* 120: 159-168

Ani, AO; Okorie, AU (2009). Response of broiler finisher finisher to dietscontaining graded levels of processed castor oils bean *(RicinuscommunisL*) meal. *J. Animal Physiol.Nutrit.* 93: 157-164

Annongu, AA; Joseph, JK (2008). Proximate analysis of castor seeds andcake. *J. Appl. Sci. Environ. Manage*. 12(1): 39-41

AOAC, 1999. Official methods of analysis (996.01) fat (total, saturated,unsaturated and nonsaturated) in cereal products (17th ed. USA: A.O.A.C)international

AOAC, 2005. Association of Official Analytical Chemists. Official Method ofAnalysis. 19th ed. Washington DC. Pp. 69-88

Apata, DF (2022). Feed is good, toxicants the bane. Inaugural 7th lecture series 7, Faculty of Agriculture, Kwara State University, Malete, Nigeria.

Apata, DF; Atteh, OM (2016). Growth performance and intestinal morphology of broiler chicken fed diets containing almond fruit meal fermented with *Aspergillusniger*. *Wayamba J. Animal Sci*. 8, 1436-1444

Balogun, JK; Abdulahi, SA; Auta, J; Ogunlade, OP (2005a). Feed conversion, protein efficiency, digestibility and growth performance of *Oreochromisniloticus* fed *Delonixregia* seed meal. Proceedings of the National Conference of Fisheries Society, 29 Nov-03 Dec.2004 held at Ilorin, Nigeria 823-829

Balogun, JK; Auta, J; Abdulahi, SA; Agboola, EO (2005b). Potentials of castor seed meal (*Ricinuscommunis*) as feed ingredient for *Oreochromisniloticus*. In: proceedings of 19th Annual conference of Fisheries Society of Nigeria (FISON), 29 Nov- 03 Dec 2004, Ilorin, Nigeria Pp 838-843

Bradberry, SM; Dickers, KJ; Rice, P; Griffiths, GD; Vale, JA (2003).Ricin poisoning. *Toxicol Rev.*, 22, 65-70

Edem, CA; Dosunmu, MI; Ebong, AC; Jones, M (2008). Determination ofproximate composition of ascorbic acid and heavy metal contents of starfruit (*Averrhoacarambola*). *Glob. J. Pure Appl. Sci.* 14 (2): 193-195

FAO (2013). Food and Agriculture Organization of the United Nations. Rome. http://issue.com/faosyb/docs/fao-statistical-yearbook-2

FAO (2014).Castor seed production. Statistical database of the Food and Agriculture Organization of the United Nations. http://faostat.fao.org/

Fasset, DW (1996). Oxalate In: Toxicants occurring naturally in foods. NationalAcademy of Science Research Council, Washington D.C, U.S.A

Francis, G; Makkar, HPS; Becker, K (2001). Anti-nutritional factors presentin plant derived alternate fish feed ingredients and their effects in fish.*Aquacult.* 199 (3-4): 197-227

Frazier, WS; Wwtoff, DC (1978). Food microbiology 3rd edition McGraw Hill, New York Pp. 346-348

Gana, AK; Yusuf, AF; Apuyor, B (2013). Castor oil plant and its potential in transformation and industrialization of under developing nations in the world. *Adv. J. Agric. Res.* 1 (005): 072-079

Iqbal, TH; Lewis, KO; Cooper, BT (1994). Phytate activity in the human and rat small intestine. *Gut*, 35: 1233-1236

Maga, JA (1983). Phytate: Its chemistry, occurrence, food interaction, nutritionalsignificance and methods of analysis. *J. Agric. FoodChem.* 30: 1-9

Natesh, NH; Ska, LA (2018). An overview of nutritional and anti-nutritional factors in green leafy vegetables. *Hortic. Int. J.* 1 (2); 58-65

Nsa, EE; Ukachukwu, SN (2007). Effect of boiling and soaking duration onthe proximate composition, ricin and mineral contents of undecortifiedcastor Oil seeds (*Ricinuscommunis*). *Int. J. Plant Anim. Environ. Sci*. 1. (3): 23-28

Nsa, EE; Ukachukwu, SN; Isika, MA; Ozung, PO (2011). Effect of boilingand soaking durations on the proximate composition, ricin and mineralcontents of undecorticated castor oil seeds (*Ricinuscommunis*).*Inter. J. Plant, Animal. Environ. Sci.* 244-252

Oduor, PM; Struszczyk, MH; Peter, MG (2008). Characterization ofchitosan from blowfly larvae and some crustacean species from KenyanMarine waters prepared under different conditions. *Discov.Innov.* 20 (2): 129-142

Ramteke, R; Doneria, R; Gendley, MK (2019). Anti-nutritional factors in feed and fodder used for livestock and poultry feeding. Acta Scientific Nutritional Health, 3, 39-40

Weiss, EA (2000). Oilseeds crops. 2nd Edition Blackwell science, Oxford. Pp ix + 364.https://doi.org/10.1002/1097-0010 (20008) 80:10