Journal of the Saudi Society of Agricultural Sciences (2016) xxx, xxx–xxx

King Saud University

Journal of the Saudi Society of Agricultural Sciences

www.ksu.edu.sa
www.sciencedirect.com

FULL LENGTH ARTICLE

Effects of processing on the nutrient composition of rubber seed meal

M.D. Udo [a,*], U. Ekpo [b], F.O. Ahamefule [b]

[a] Akwa Ibom State University, Ikot Akpaden, Akwa Ibom State, Nigeria
[b] Michael Opara University of Agriculture, Umudike, Nigeria

Received 29 March 2016; revised 10 June 2016; accepted 12 June 2016

KEYWORDS

Nutritive value;
Rubber seed meal;
Processing methods;
Livestock;
Poultry

Abstract The nutritive value of raw and processed rubber seed meal (*Hevea brasiliensis*) was investigated by considering the following parameters – proximate composition, gross energy, mineral composition and anti-nutritional factors. The raw and processed seeds were dried, milled and chemically analysed. Crude protein contents of the raw and processed rubber seeds ranged between 21.08% and 24.60%, while the crude fibre values ranged between 4.47% and 5.88%. The gross energy content for the raw had significantly ($P < 0.05$) higher values than the processed. Mineral content (macro and micro) of seeds boiled was significantly ($P < 0.05$) higher than other processing methods. Also, seeds boiled had significantly ($P < 0.05$) lower values in all anti-nutritional factors, with hydrogen cyanide and trypsin inhibitor completely destroyed by both boiling and toasting. With high value of crude protein (24.60%), appreciable energy content (2.32 MJ/kg), highest value of macro and micro minerals and significantly lower values in all the anti-nutritional factors for the seeds boiled, boiling is therefore recommended for usage in livestock and poultry ration.

1. Introduction

Livestock and poultry farmers, especially those in Nigeria and neighbouring countries are faced with the problems of continual inadequacy of feedstuffs. This has been blamed on the rising needs of man for the same livestock/poultry feedstuffs for his food and industrial raw materials use (Duruma et al., 2006). This has led to escalating cost of conventional feedstuffs (maize, soya bean, groundnut, etc.) resulting in feed cost being 70–80% of the total cost of production (Akinmutimi, 2007). The result of high demand and rising costs is scarcity; thus, farmers are unable to meet the feed requirements of livestock/poultry. Consequently, they are forced to close their farms or run at a very low level of stock (Duruma et al., 2006). The overall effect of the above is shortage of animal protein production and hence shortage of animal protein intake due to scarcity and high cost of animal products (Akinmutimi, 2007).

There is therefore the need to source for an alternative feedstuff that is cheap, available and less competed for by man and industry (Akinmutimi, 2004a). One of the envisaged alternative

* Corresponding author.
E-mail address: solomosmon2002@yahoo.com (M.D. Udo).
Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.jssas.2016.06.001
1658-077X © 2016 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University.

Table 1 Proximate composition of rubber (*Hevea brasiliensis*) seed.

Proximate composition	Raw	Boiled	Toasted	SEM
DM	96.91[a]	85.40[c]	93.63[b]	0.572
CP	23.31[b]	24.60[a]	21.08[c]	0.064
EE	38.47[a]	23.13[c]	32.57[b]	0.016
CF	5.88[a]	4.47[b]	4.95[b]	0.015
Ash	3.77[c]	4.68[a]	4.57[a]	0.015
NFE	38.58[ab]	37.40[b]	38.73[a]	0.030
GE* (MJ/kg)	2.88[a]	2.32[c]	2.58[b]	0.004

a, b, and c means on the same row with different superscripts differ significantly ($P < 0.05$).
* Calculated.

feedstuff is rubber seed (*Hevea brasiliensis*) (Delabarre and Serier, 2000; Iyayi et al., 2008; Sovanno, 2002).

The rubber tree is cultivated in Nigeria on an estimated 185,000 ha with seed collection of about 10,175 tonnes/year (Njwe et al., 1988). The rubber seed is rich in oil which contributes up to 41.2% of total weight (Njwe et al., 1988). Traditionally, rubber seeds were used primarily as planting materials. The present trend towards propagating or selected clones by grafting, however, has led to surplus of rubber seeds (Agunbiade et al., 1995). These surpluses rather than being a waste could be utilized as feeding stuff for livestock and poultry.

This article reports on the influence of processing methods namely, boiling and toasting on the nutritive value of rubber seed meal. However, there is paucity of information on the processing of rubber seed.

2. Experimental procedure

2.1. Materials

Rubber seeds (*H. brasiliensis*) were procured from Palmol rubber plantation in Cross River State of Nigeria. The seeds were dark brown with black strips of various sizes and dimensions. Raw rubber seeds (one kilogramm) were dehulled and the nuts subsequently milled to obtain raw rubber seeds meal. Triplicate samples were later taken for laboratory analysis.

2.2. Processing methods

2.2.1. Boiling

One kilogramm of raw rubber seeds was introduced into cooking pot whose water has attained boiling temperature (100 °C). The content was allowed to boil for 30 min before the seeds were descanted. The boiled seeds were sun dried for seven days. The product was then dehulled and the nut milled as boiled rubber seed meal. Triplicate samples were also taken for laboratory analysis.

2.2.2. Toasting

One kilogramm of raw rubber seed was toasted in a garri frying pot for 30 min. The product was dehulled after cooling and the nut milled and used as toasted rubber seed meal. Triplicate samples were taken for laboratory analysis.

2.3. Analytical procedure

The raw, boiled and toasted rubber seed meals were analysed for proximate composition using AOAC (2000) procedure. The gross energy of the samples was determined using the methods provided by McDonald et al. (2011). The mineral content of the milled raw, boiled and toasted rubber seed meal was determined by the dry ash extracted method (Onwuka, 2005). Phosphorus was determined by the Vanadomolybdate (yellow) spectrometry as described by James et al. (2008). Calcium and magnesium content of samples was determined by the Versanale EDTA complexometric titration (Pearson, 1976). Potassium and sodium in samples were determined by flame photometry (Junsomboon and Jakmunee, 2011).

Determination of hydrogen cyanide, trypsin, tannin, saponin, phytic acid and oxalate was carried out using the method of Onwuka (2005), Arntfield et al. (1985), Pearson (1976), Wheeler and Ferrel (1971) and AOAC (2000).

2.4. Statistical analysis

Data collected were subjected to analysis of variance procedure as described by Steel and Torrie (1980). Significant means were separated using Duncan's Multiple Range Test (Duncan, 1955).

3. Results and discussion

3.1. Proximate composition of rubber seed

The proximate composition of raw, boiled and toasted rubber seed (RS) (*H. brasiliensis*) is shown in Table 1. All the parameters observed in this study were significantly ($P < 0.05$) different between the raw and the processed seed.

The raw seed has a crude protein (CP) content of 23.31%, while boiled and toasted values were 24.60% and 21.08% respectively. These values fell within the values recorded by earlier workers (Stosic and Kaykay, 1981 = 28%; Babatunde and Pond, 1988 = 28.3%; Hao and Liem, 2003 = 30%; Eka et al., 2010 = 17.4%). Though the crude protein reported in this study is lower than the one reported for mucuna seed (30.60%), groundnut (34.88%) and soya bean (38–43.06%), it is higher than the crude protein of lesser

Table 2 Mineral composition of raw, boiled and toasted Rubber (*Hevea brasiliensis*) seed (Mg/kg).

Mineral	Raw	Boiled	Toasted	SEM
Sodium (Na)	63.70[b]	70.70[a]	62.50[c]	0.119
Potassium (K)	1864[b]	12755[a]	11760[c]	1.555
Calcium (Ca)	1740[b]	1906[a]	1687[c]	1.555
Phosphorus (P)	2187[b]	2277[a]	2093[c]	1.500
Magnesium (Mg)	2066[b]	2217[a]	2024[c]	1.190
Iron (Fe)	67.70[b]	69.70[a]	65.80[b]	0.100
Copper (Cu)	17.70[a]	17.80[a]	16.80[b]	0.119
Zinc (Zn)	27.00[b]	28.80[a]	25.50[b]	0.155
Manganese (Mn)	32.70[b]	35.40[a]	30.30[c]	0.141

a, b, and c means on the same row with different superscripts differ significantly ($P > 0.05$).

Please cite this article in press as: Udo, M.D. et al., Effects of processing on the nutrient composition of rubber seed meal. Journal of the Saudi Society of Agricultural Sciences (2016), http://dx.doi.org/10.1016/j.jssas.2016.06.001