



Effect of Different Processing Methods on the Nutritional Composition of full fat Soya Bean seed meal

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Short communication

Abstract

Laboratory analysis was conducted at the Chemistry Laboratory of Federal University Lokoja, Kogi State, Nigeria, to determine the effect of processing methods on the nutritional composition of soya bean seed meal. The Soya beans were collected and subjected to three (3) processing methods which were raw (control), boiling (T₂) and toasting (T₃) in a completely randomized design (CRD). The beans were subjected to different processing methods for 30 minutes. Data collected were analysed using analysis of variance with the aid of SPSS. Results from the proximate composition of soya bean seed were statistically significant (P < 0.05). The value for moisture content, Ash, Lipid, Crude fibre, Crude protein, and Carbohydrate (CHO) ranged from 4.15-8.15%, 3.13-3.62%, 20.72-24.13%, 4.98-6.14%, 30.64-36.15% and 30.27-40.26%, respectively. The values for calcium, phosphorus, potassium, sodium, and iron ranged from 0.181-0.321%, 0.612-0.715%, 0.107-0.215%, 0.003-0.004% and 0.013-0.017%, respectively. Crude fibre fractions were statistically significant (P < 0.05) except for ADL (P > 0.05). The values for NDF, ADF, ADL, Hemicellulose and Cellulose ranged from 10.62-12.13%, 5.33-6.07%, 0.99-1.02%, 5.12-6.07% and 4.56-5.65%, respectively. It was concluded that T₂ (boiled) had the highest value for moisture content compared to T₁ and T₃. Lipid, crude fibre and carbohydrate were best in T₃ (toasted). T₂ (boiling) showed best effect on NDF, ADF and hemicelluloses while T₃ (toasted) was best for cellulose. Based on the findings of this research, toasting as a processing method for soya bean seed meal is recommended.

Keywords: Processing Methods, Soya Bean Meal, Nutritional Composition

Introduction

Food insufficiency and malnutrition have been the major problem of the developing countries, including Nigeria. Any approach to help fight this problem will go a long way in pushing the wheel of development in our country. Plant protein products are gaining increased interest as ingredients in food systems throughout many parts of the world; the success of utilizing plant proteins as additives depends greatly upon the favourable characteristics that they impart to food (Adebowale *et al.*, 2005). Plants proteins are now regarded as versatile functional ingredients or as biologically active components more than as essential nutrients in the developed countries (Marcello and Gius, 1997). High-quality

protein and oils are of paramount importance to human beings. One primary source of high-quality protein and oils is the soya bean (Grieshop and Fahey, 2001). According to Bayero *et al.* (2019), the quality of soya beans is usually determined by seed protein, oils, fatty acid, and mineral content as such its quality is key to improving human and animal nutrition.

Soybean (*Glycine max* (L.) Merr.), a member of Leguminosae family is believed to have originated in North-eastern China and distributed in Asia, USA, Brazil, Argentina and other parts of the world. This crop is aptly called a “Miracle crop” of the 20th century due to its multiple uses. Soybean with an average protein content of

40% and oil content of 20% has the highest protein of all crops for food and feed (Sharma *et al.*, 2013; Hossain and Komatsu, 2014), including those of cowpea and common bean (Nwadike *et al.*, 2018), and second only to groundnut in terms of oil content among food legumes. Though several literature abound on the nutritional composition of soya bean meal, there is a dearth of information on the effect of processing method on the nutritional composition of soya bean meal. The need to provide relevant information on the effect of different processing methods on the nutritional composition of soya bean meal while also proffering the best treatment method for soya bean meal necessitated this research. Therefore, the aim of this study was to determine the effect of processing method on the nutritional composition of soy bean seed meal.

Materials and Methods

Experimental Location

The research was conducted at the Chemistry Laboratory of Federal University Lokoja, Kogi State, Nigeria. Lokoja, the capital of Kogi state, was carved out of former Kwara and Benue States in 1991. The town and its suburbs also constitute the Kogi LGA. It lies on latitude 7°49'N and longitude 6°44'E at an altitude of 45-125m above sea level, on the western bank of the Niger River, close to its confluence with the Benue River (Google.com, 2022).

Results and Discussion

Results

Table1. Effect of Processing Methods on the Proximate Composition of Soya bean seed Meal

Parameter (%)	Treatment			SEM	LOS
	T ₁ (Raw)	T ₂ (Boiled)	T ₃ (Toasted)		
Moisture Content	5.83 ^b	8.15 ^a	4.15 ^c	0.58	* *
Ash	3.62 ^a	3.13 ^c	3.19 ^b	0.01	* *
Lipid	24.13 ^a	20.72 ^c	22.13 ^b	0.49	*
Crude Fibre	6.14 ^a	5.00 ^b	4.98 ^b	0.19	*
Crude Protein	36.15 ^a	32.62 ^b	30.64 ^b	0.81	*
Carbohydrate (CHO)	30.27 ^c	35.31 ^b	40.26 ^a	1.44	*

^{abc} Means on the same row bearing different superscripts are significantly ($P < 0.05$) different, SEM = Standard Error of Mean, LOS= Level of significance *= significant ($P < 0.05$)

Experimental Materials

Soyabean seeds were bought from Natak Market, Lokoja, Kogi State, Nigeria. The seeds were handpicked to remove extraneous materials. The raw beans represented T₁, (control), while those processed as boiled and toasted for 30 minutes were T₂ and T₃, respectively. The beans was milled after drying.

Chemical Analysis

The collected samples were taken to the Chemistry Laboratory of Federal University Lokoja, Kogi State, Nigeria for proximate, mineral and crude fibre fractions determination. Moisture content, crude fibre, crude protein and lipid were determined in triplicates using the standard procedure of AOAC (2004). Percentage carbohydrate was determined by the difference method as reported by Onyeike *et al.* (1995). Minerals including calcium, phosphorus, potassium, sodium and iron were determined by atomic absorption spectrometry, flame photometry and spectrophotometry as reported by AOAC (2003). The fibre fractions were evaluated using the trichloroacetic method reported by AOAC (2004).

Data Analysis

Data collected were subjected to Analysis of Variance and significant means were separated at 5% ($P < 0.05$) level of significance using Least Significance Difference (LSD) with the aid of SPSS Version 26.0.

Table 1 shows the effect of processing methods on the proximate composition of soya bean seed meal. All parameters measured were statistically significant ($P < 0.05$). The value for moisture content, Ash, Lipid, Crude fibre, Crude protein, and Carbohydrate (CHO) ranged from 4.15-8.15%, 3.13-3.62%, 20.72-24.13%, 4.98-6.14%, 30.64-36.15% and 30.27-40.26%, respectively.

Table2. Effect of Processing Methods on the Mineral Composition of Soya bean seed Meal

Parameter (%)	Treatment			SEM	LOS
	(T ₁)Raw	(T ₂)Boiled	(T ₃)Toasted		
Calcium	0.321 ^a	0.211 ^b	0.181 ^c	0.021	*
Phosphorus	0.715 ^a	0.617 ^b	0.612 ^b	0.051	*
Potassium	0.215 ^a	0.111 ^b	0.107 ^b	0.054	*
Sodium	0.004	0.003	0.003	0.000	NS
Iron	0.017	0.013	0.013	0.013	NS

^{abc} Mean on the same row bearing different superscripts are significantly ($P < 0.05$) different, SEM = Standard Error of Mean, LOS= Level of significance *= Significant ($P < 0.05$), NS = Not significant ($P > 0.05$).

The effect of processing method on the mineral composition of soya bean seed meal is presented in Table 2 above. Potassium and sodium were not statistically significant ($P > 0.05$). The values for calcium, phosphorus, potassium, sodium, and iron ranged from 0.181-0.321%, 0.612-0.715%, 0.107-0.215%, 0.003-0.004% and 0.013-0.017%, respectively.

Table3. Effect of Processing Methods on the Crude fibre Fraction of Soya bean seed Meal

Parameter (%)	Treatment			SEM	LOS
	(T ₁)Raw	(T ₂)Boiled	(T ₃)Toasted		
NDF	12.13 ^c	10.62 ^a	11.81 ^b	0.23	*
ADF	6.07 ^c	5.33 ^a	5.89 ^b	0.11	*
ADL	1.02	1.00	0.99	0.01	NS
Hemicellulose	6.07 ^c	5.12 ^a	5.72 ^b	0.14	*
Cellulose	5.65 ^b	5.65 ^b	4.56 ^a	0.18	*

^{abc} Mean on the same row bearing different superscripts are significantly ($P < 0.05$) different, SEM = Standard Error of Mean, LOS= Level of significance *= Significant ($P < 0.05$), NS = Not significant ($P > 0.05$).

Table 3 shows the effect of processing methods on crude fibre fraction of soya bean seed meal. All parameters measured were statistically ($P < 0.05$) significant except for ADL ($P > 0.001$). The values for NDF, ADF, ADL, Hemi-cellulose and Cellulose ranged from 10.62-12.13%, 5.33-6.07%, 0.99-1.02%, 5.12-6.07% and 4.56-5.65%, respectively.

Discussion

Table 1 shows the effects of processing methods on the proximate composition of soya bean seed meal. The value observed for moisture content ranged from 4.15% -

8.15%. The observed results were statistically ($P < 0.05$) significant. T₂ had the best value for moisture content followed by T₁. However, no clear pattern of variation was observed across the treatment means. The high value observed for T₂ (boiled) could be as a result of imbibition of water into the seed. The value observed (4.15% - 8.15%) in this study is slightly lower than the range of 7.23-10.92% reported by Pele *et al.* (2016). Ash content ranged from 3.13-3.62% which was statistically ($P < 0.05$) significant with T₁ (raw) having the best value for ash content, followed by T₃ (Toasted) while T₂ (boiled) the worst value

for ash content. The observed result may suggest the absorption of water by seeds in T₃ result in lowered mineral content. The value of 3.13%- 3.62% observed is lower than 3.83%-6.75% reported by Pele *et al.* (2016). Crude fibre showed a significant ($P < 0.05$) difference across the treatment means. The value for crude fibre ranged from 4.98% - 6.14%. The values observed falls within the ranged reported by Pele *et al.* (2016). T₂ and T₃ were statistically similar, however, T₁ showed the worst value for crude fibre. The progressive decrease in the value for crude fibre content observed across the treatment means could be as a result of the effect of heat breaking up the cellulose and hemi-cellulose fractions of the soybean seed meal. Crude protein follows similar trend as crude fibre, the value observed is within the range (36.94 - 40.10%) reported by Eshun (2012). Carbohydrate (CHO) was statistically ($P < 0.05$) significant across the treatment means. T₃ had the best value for carbohydrate followed by T₂, while T₁ had the worst value.

The effect of processing method on the mineral composition of soya bean seed meal is presented in Table 2. Sodium and iron were not statistically ($P > 0.05$) significant. The values for calcium ranged from 0.181% - 0.321%. A progressive significant ($P < 0.05$) decrease was observed for calcium across the treatment means with T₁ (raw) having the best value for calcium, followed by T₂ (boiled) while T₃ (toasted) had the worst. The range observed was higher than those reported by Siulapwa and Mwambungu (2014) but lower than 0.33 – 0.43 reported by (Maidala *et al.*, 2013). Phosphorus was significantly ($P < 0.05$) influenced by the treatments. A progressive numerical decrease was observed across the treatment means. The values in T₂ and T₃ were statistically ($P > 0.05$) similar. However, the values observed fell within the range of 0.59 – 0.96% reported by Siulapwa and Mwambungu (2014) but higher than 0.12 – 0.18% reported by Maidala *et al.* (2013)

Table 3 shows the effects of processing methods on the crude fibre fraction of soya bean seed meal. Acid detergent lignin (ADL) was not statistically ($P > 0.05$) significant. Neutral detergent fibre (NDF) ranged from 10.62 – 12.13% and was statistically ($P < 0.05$) significant. T₁ had the highest value for NDF followed by T₃. However, no clear pattern of variation was observed for NDF. Acid detergent fibre (ADF) followed similar trend as NDF. Hemicellulose was statistically ($P < 0.05$) influenced by the treatment methods. T₁ had the highest value for hemicelluloses, followed by T₃, while the least value was observed in T₂. Cellulose range from 4.56 – 5.65% and was statistically ($P < 0.05$) significant. The observed values were higher than those reported by Maidala *et al.* (2013).

Conclusion

The study was conducted to determine the effect of processing methods on the nutritional compositions of soya bean seed meal. The result showed that the different processing methods had significant influence on the proximate, mineral and crude fibre fractions of soya bean seed meal. T₂ (boiled) had the highest value for moisture content compared to T₁ and T₃. Lipid, crude fibre and carbohydrate were best in T₃ (toasted). T₂ (boiling) showed best effect on NDF, ADF and hemicelluloses while T₃ (toasted) was best for cellulose.

Recommendation

Toasting as a processing method is recommended since it resulted in considerable reduction in crude fibre fractions, and lowered moisture content thereby reducing rancidity in feed. Further research on other processing methods of soya bean seed meal is also recommended.

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