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Research Paper

Nutrients and anti-nutrients contents of white beniseed caltivar (*Sesamum indicum* L.) in Nigeria

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The objective of the study was to determine the chemical composition of sesame (*Sesamum indicum* L.). Dehulled white variety of beniseed (*Sesame indicum*) was randomly bought from at least five different stores in Ubani Ibeku Umuahia Main Market Abia State Nigeria. The proximate composition shows that dehulled sesame flour contains 19.71% crude protein, 6.18%, ash 3.54% crude fiber, and 37.61% crude fat. The carbohydrate and energy values of sesame were 21.64 g/100g and 1412 KJ, respectively. The potassium and sodium contents (mg/100g) of the sesame were 418.0, 235.74, while the values for magnesium, calcium and iron were 184.12, 428.78, and 5.27 respectively. The vitamin contents of sesame seed were 0.68 mg/100g, Thiamin, 0.33 mg/100g Riboflavin, and 0.57 mg/100g, Niacin. The β-carotene, vitamins C and E were 5.89 mcg/100g, 3.94 mg/100g, and 2.77 mg/100g respectively. Phytate, hydrogen cyanide, tannin and oxalate were found to be 0.84%, 0.54%, 0.93% and 1.29% respectively. The results of the study showed that beniseed is a good source of protein and fat. Also, the result shows that the protein concentrate and the raw seed will be useful in some food formulation. Macro and micronutrients were comparable to those of other indigenous legume and seed; also the phytate, hydrogen cyanide and tannin composition of beniseed were within permissible level.

Key words: *Sesame indicum*, beniseed, anti-nutrient, cultivar, chemical composition.

INTRODUCTION

Plant oilseeds and pulses constitute a readily available source of dietary protein for use but their use within compound aqua feed is restricted by the presence of one or more endogenous anti-nutrients (NRC, 1993). Sesame ((*Sesamum indicum* L.) otherwise known as sesamum or beniseed, member of the family *pedaliaceae,* is one of the most ancient oilseeds crop known to mankind. *Sesamum indicum* L. commonly known as beniseed is a tropical annual crop and one of the oldest oilseeds cultivated in the world (Gharbia Abau *et al*., 2000). It is a highly priced oil crop of some countries of the world. Sesame plays important role in human nutrition. Its seeds are used in Asia and Africa because of its high content of edible oil and protein (Johnson *et al*., 1979; Makinde and Akinoso, 2013). Sesame seed (*Sesamum indicum* L. synonymous with *S. orientale* L.,) is ranked second in Africa and seventh in the world in terms of beniseed production (NAERLS, 2010). Nigeria is one of the major producers of sesame seed in the Africa and it is also the main commercial crop in Nigeria, Sudan and Asia (NAERLS, 2010). Its colour varies from cream – white to charcoal-black but it is mainly the white cultivar that is grown around Benue (Oturkpo), Nassarawa (Doma), Jigawa (Malam-madori) and Taraba States while the

black cultivar grows in the Northern Nigerian region; Kano (Dawanau), and Jigawa (near Hadejia) States and in some parts of Katsina State (Makinde and Akinoso, 2013). As a crop, capable of growing in areas where growth requirement are quite limited, sesame has a key role in sustaining food provision in disadvantaged areas of the tropical Africa.

Total annual consumption is about 65% for oil extraction and 35% for food. The segment includes about 42% roasted, 12% grounded, 36% washed and processed and 10% roasted and salted (RMRDC, 2004). In Africa, the most popular method of preparing this seed is cooking or roasting.

Fermenting sesame seeds (ogirisaro) are popular in Sierra Leone but not very common in the other Africa countries. Beniseed is rich in protein; the protein, though deficient in lysine, is rich in sulphur amino acids such as methionine (3.2%) and cystine which is often the limiting amino acid in legume-based diets (Ojiako *et al*., 2010). Beniseed oil is very stable and it contains a natural antioxidant which not only has some health benefits but also prevents aging (NAERLS, 2010; Weiss, 2000).

The antioxidant activity of sesame seed oil and the various healthful properties are attributed to the presence of lignans such as sesamin (Weiss, 2000; Hu *et al*., 2004).

Sesame particularly the white cultivar is consumed in Nigeria either as soup thickener or as snack (Makinde and Akinoso, 2013).

This study is therefore designed to evaluate the nutrients and anti-nutrients factors of white variety of beniseed.

MATERIALS AND METHOD

Collection/preparation of sesame seed flour

The dehulled white variety of beniseed (*Sesame indicum*) seeds was purchased from at least five different stores in Ubani Ibeku Umuahia Main Market Abia State. The beniseed from different were mixed together, winnowed and sieved to remove sand and stones. The sample was milled into flour using attrition milling machine (Thomas Wiley Model ED-5) to 5mm sieve size. The milled sample was stored in air-tight containers and taken to the laboratory for chemical analysis.

Determination of proximate

The proximate composition of the samples was determined by AOAC, (2006). Moisture content of the samples was carried out by oven drying at 105°C to constant weights. Crude protein was determined using micro-keldahl method. Crude fat was determined by soxhlet extraction method using petroleum either. Ash was determined by furnace incineration method. Crude fiber was determined by digesting the sample in a reagent mixture (Trichloroacetic acid, acetic acid, nitric acid and distilled water), boiling, refluxing, drying and ashing.

Carbohydrate was obtained by difference, while gross energy (KJ and Kcal per 100g) was calculated based on the formula by Eknayake *et al*. (1999). Gross energy (Kcal per 100 g dry matter) = (crude protein x 16.7) + (crude lipid x 37.7) + (crude carbohydrate x 16.7) for protein, carbohydrate and lipid respectively.

Determination of minerals

The minerals were determined using wet acid digestion method for multiple nutrient determinations as described by AOAC, (2006). Potassium and sodium were determined by flame photometer (Jenway Digiter, Model PFP7, USA). Calcium and magnesium were determined by EDTA versarale complexiometric titration method. The iron mineral was by Atomic Absorption Spectrophotometer (Model 3030 Perkin Elmer, Norwalk USA).

Determination of vitamins

Vitamin A, Thiamin, Niacin, Riboflavin, vitamin E and Folic acid were determined by using spectrophotometric method. Ascorbic acid by dye solution of 2, 6-dichloroindophenol (DCIP) titration method was determined according to the Association of Official Analytical Chemist Methods (2006).

Determination of anti-nutrients

Gravimetric method (Harborne, 1973) was used to determine alkaloids and flavonoids. Tannin content of the samples was determined spectrophometrically as described by Kirk and Sawyer (1991). Saponin was determined by comparing the absorbance of the extract of the samples with the standard at 380nm (Makkar and Becker, 1996). Oxalate was determined spectrometrically at 420 nm. Phytate was determined by titration with ferric chloride solution using the method described by Makkar and Becker (1996).

Statistical analysis

The results obtained from the various analysis were subjected to Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS version 16.0). (SPSS Inc., Chicago Il,USA).

RESULT AND DISCUSSION

Proximate composition of *Sesamum indicum*

The proximate composition of dehulled white sesame seed is presented in (Table 1). The moisture content of the seed flour was 8.68%. This value was similar to the one (7.65%) reported by Afam- Anene and Onuoha, (2006) but higher than 4.18% reported by Borchani *et al.* (2010). The low moisture content of the seed flour is an indication of long shelf-life (Adepoju and Adeniji, 2008), moisture content of less than 10% has been reported to be responsible for state of non –deterioration in seed over a long period (Makkar *et al*., 1998). The crude protein and ash were 19.71% and 6.18% respectively. This values were similar to the results reported by Afam-Anene and Onuoha (2006); Stadlmayr *et al.* (2012). The crude fiber and the crude fat were 3.54% and 37.61% respectively, these values were lower than the values reported by Stadlmayr, *et al.* (2012) and Makinde and Akinoso, (2013). The relatively high protein and high fat contents beniseed makes it an important source of protein and fat that can be used to complement other sources of protein and fat. The calculated carbohydrate by difference and energy values of sesame were 21.64g/100g and 1412 KJ respectively. The whole white seeds consist of 21.9% protein, 46.1%fat, 17.0%carbohydrate, 6.16%ash and 4.70% fiber (Makinde and Akinnoso, 2013).

Table 1. Energy and proximate composition of dehulled white beniseed (*Sesame Indicum*).

Nutrients	*Sesame* flour (%)
Moisture	8.68±0.06
Dry matter	91.3±0.06
Ash	6.18±0.02
Crude fiber	3.54±0.08
Fat	37.61±0.01
Protein	19.71±0.13
Carbohydrate (%)*	21.64±0.00
Energy (kcal/KJ/100g)	503/1412

Values of means ± standard deviation of double determinations.*calculated by difference.

Mineral composition of *Sesamum indicum*

The mineral composition of dehulled sesame seed are shown on (Table 2). Calcium was the predominant mineral followed by potassium, sodium and magnesium. Potassium and sodium contents (mg/100g) were 418.01, 235.74 respectively. The potassium value was comparable to the one (466.03 mg/100g) reported by Borchani *et al.* (2010). The magnesium and calcium values were 184.12 and 428.78 respectively. The magnesium value (184.12 mg/100g) was comparable with that of groundnut (191mg/100g) (Stadlmayr *et al*., 2012), while the calcium value (428.78 mg/100g) was 9 folds higher than the calcium content of groundnut and 4-fold higher than that of melon (Stadlmayr *et al*., 2012). Calcium is an important element in the body. It plays essential role in health of bone as well as regulating of blood pressure (Elamin and Tuvemo, 1990). The iron value (5.27 mg/100g) was lower than value (11.6 mg/100g) reported for beniseed by Stadlmayr *et al.* (2012). The iron (5.27 mg/100g) value found in this study was higher than that of groundnut (2.3-3.71 mg/100g). Dietary iron is known for its role in psychomotor development, maintenance of physical activity and resistance to infection (Black, 2003). This implies that beniseed is beneficial to individuals that consume it.

Table 2. Mineral composition of dehulled white beniseed (*Sesame Indicum*).

Nutrient	*Sesame* flour (mg/100g)
Sodium	235.74±0.12
Calcium	428.78±0.11
Magnesium	184.12±0.25
Potassium	418.01±0.82
Iron	5.27±0.01

Values of means ± standard deviation of double determinations.

Vitamin composition of *Sesamum indicum*

Vitamin content of beniseed cultivar of Sesame seeds was shown on (Table 3). Vitamins B_1 (Thiamin), B_2 (Riboflavin) and B_3 (Niacin) values (mg/100g) were (0.68, 0.33, 0.57) respectively, this values fell within the range reported for most common legumes and seeds (Stadlmayr *et al.,* 2012). Water soluble vitamins particularly vitamins B_1, B_2 are known for their roles in releasing energy from protein, fat and carbohydrate *in-vivo* (Wardlaw and Hampl, 2007). The β-carotene, vitamins C and E (5.89 µg/100g, 3.94 mg/100g, and 2.77 mg/100g, respectively). These values were higher than the values reported for beniseed by Stadimayr *et al.* (2012). The presence of β-carotene, vitamins C and E in beniseed is an indication of its health benefits; as these vitamins acts as antioxidants (Bello *et al*., 2008).

Anti-nutrient composition of *Sesamum indicum*

The anti-nutrient composition of dehulled sesame seed are shown on (Table 4). The phytate, hydrogen cyanide and tannin values (%) were (0.84%, 0.54%, 0.93%) respectively. The oxalate (1.29%) was however slightly higher than 1%. Study has that the safe level of most ant-nutrient is 1% (Anigo *et al*., 2010); this shows that anti-

Table 3. Vitamin composition of dehulled white beniseed (*Sesame Indicum*).

Nutrient	*Sesame* flour
β-carotene (mcg/100g)	5.89±0.06
Vitamin B_1 (mg/100g)	0.68±0.00
Vitamin B_2 (mg/100g)	0.33±0.02
Vitamin B_3 (mg/100g)	0.57±0.04
Vitamin C (mg/100g)	3.94±0.02
Vitamin E (mg/100g)	2.77±0.04

Values of means ± standard deviation of double determinations.

Table 4. Anti- nutrient composition of dehulled white beniseed (*Sesame Indicum*).

Anti nutrient	*Sesame* flour(%)
Phytate	0.84± 0.01
HCN	0.54 ±0.00
Oxalate	1.29 ±0.01
Tannin	0.93 ±0.00

Values of means ± standard deviation of double determinations.

nutrient composition of beniseed are within permissible level.

Conclusion

The study showed that beniseed is a good source plant protein and fat. Its macro and micronutrients were comparable to those of most legume and seed and most of its anti-nutrient (phytate, hydrogen cyanide and tannin) compositions were within safe level.

AUTHORS' DECLARATION

We declare that this study is an original research by our research team and we agree to publish it in the journal.

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