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Full Length Research Paper

Proximate and mineral composition of whole and dehulled Nigerian sesame seed

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Sesame plant seed which grows extensively in Benue State of Nigeria is an important and popular source of edible oil. It ranks ninth among the top thirteen oilseed crops which make up 90% of the world production of edible oil. The relative abundance of its seed coupled with the little knowledge on its nutritional significance prompted the need for this study. Whole and dehulled Sesame seeds were studied for their proximate and mineral composition using standard methods of analyses of AOAC. The results of analyses revealed that 100g portion of seed sample contained 5.2 and 6.4 g moisture, 11.6 and 17.1g crude protein, 48 and 44g crude lipid, 4.6 and 2.6g crude fibre, 6.2 and 3.6g ash, 29.0 and 21.7g carbohydrate for whole and dehulled seed samples respectively. Both whole and dehulled seed samples were low in macrominerals but can be good source of both iron and zinc. The seed can be a good source of dietary protein, fibre, iron and zinc, apart from being a good source of edible oil.

Key Words: Sesame seed, Proximate composition, Minerals, Whole seed, Dehulled seed.

INTRODUCTION

Sesame (*Sesemum indicum linn*) is probably the most ancient oilseed known and used by mankind. It is also known as benniseed, gingelly, simsim and till (Ashri, 1988). It is often stated that it has its origin in Africa, and spread early through West Asia, India, China and Japan. Due to its relatively low productivity, sesame ranks ninth among the top thirteen oilseed crops which make up 90% of the world production of edible oil (Kamal *et al.*, 1995).

Sesamum indicum is an annual plant, which, depending on variety varies in height from 0.5 to 2m. It has a large taproot, and a diverse surface mat of feeder roots, which makes it resistant to drought. The seeds are very small and have no endosperm; one thousand seeds weigh 2-4 g. The seed colour can be white, grey, brown, chocolate or black. The oil extracted from the seeds could be used for cooking, massage and health treatment of the body. In addition to its popular use as oil for salads or cooking, sesame oil is used in producing margarine, soap making, pharmaceuticals, paints, and lubricants. In the cosmetic field, sesame oil is used as a base in developing perfumes, and its seed cake is very high in protein (Price and Smith, 1999). A portion of this nutritious seed cake is used as animal feed, while the remainder is ground into sesame flour and added to health foods (http://www.vegparadise.com/highestperch41.html).

Godin and Spensley, (1971) reported the sesame seeds to contain 45-55% oil, 19-25% protein and about 5% water. The seeds were also reported to contain 25 percent protein, which are rich in methionine and tryptophan, and one ounce of decorticated or hulled seeds contains 6 grams of protein, 3.7 grams of fibre, and 14 grams of total fat (Godin and Spensley, (1971)).

The fat in sesame seeds comprises of 38% monounsaturated and 44% polyunsaturated fatty acids (http://www.vegparadise.com/highestperch41.html; McIntyre, (2002)). The oil is of high quality, odourless and

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not likely to become rancid due to the presence of the antioxidants sesame and sesamol, and lignans which are also anticarcinogenic phytosterols which block cholesterol production and prevent high blood pressure as well as increase vitamin E supplies in animals (Price and Smith, (199l); Patnaik, (1993)). It also protects the liver from oxidative damage (Nakai *et al*., 2003). The main unsaturated fatty acids in sesame oil have been identified to be oleic acid, 40%, and linoleic acid, 40%; and the content of the saturated acids in the oil is about 14% (McIntyre, (2002)).

Ensminger and Ensminger (1994) reported the fat, protein, ash, crude fibre, and calcium content of both whole and dehulled Sudanese white and Indiana black sesame seeds, showing the seeds to be rich in these nutrients; while Obiajunwa *et al.,* (2005) reported the mineral value and certified range of sesame seed, indicating the seed to be rich in calcium, potassium, iron and phosphorus.

As nutritionally important as sesame seed is in some parts of the world, little is known and documented about the nutritional value of Nigerian sesame seeds in the literature, especially its proximate and mineral composition. Investigation revealed that sesame seed is grown extensively in Benue State of Nigeria; and at the Federal Institute of Industrial Research, Osodi (FIIRO), attention has been chiefly focused on the extraction of the seed oil. It is therefore the aim of this study to provide nutrition information on the proximate and mineral composition of Nigerian brown variety of sesame seed.

MATERIALS AND METHODS

Sample collection and preparation

Sample of dry, brown sesame seeds was identified by market women and purchased from Mile 12 market in Ketu, Lagos Metropolis of Lagos State, Nigeria. The sample was packaged in a polythene bag and taken to the analytical laboratory of Federal Institute of Industrial Research, Osodi (FIIRO), Lagos for re-identification, authentication and analysis.

The sesame seeds were sorted and cleaned from debris and all extraneous materials by winnowing and hand picking. Two composite samples (whole, (undehulled) and dehulled) were prepared from clean seeds. Dehulling of the seeds was done by accurately weighing 200grammes of the seeds and soaking it in 500ml of distilled water for 30minutes, and thereafter rubbed in between the palms of the hands to remove the hull. The dehulled seed and the hull were then separated and dried in the oven (Mammert model) at $45^{O}C$ for 24hours. The two samples (whole and dehulled seeds) were then subjected to the following analyses:

Chemical Analyses

The two samples were analysed in triplicate for moisture, crude protein, crude lipid, crude fibre and ash using standard methods of Association of Official Analytical Chemists (AOAC, 1995). The carbohydrate content was obtained by difference (i.e. subtracting the values obtained for moisture, crude protein, crude lipid, crude fibre and ash from 100). Potassium and sodium were determined using modified method of Bonire *et al.*, (1990) by digesting the ash of the seed with perchloric acid and nitric acid, followed by taking the readings on Jenway digital flame photometer/spectronic20. Phosphorus was determined by vanado-molybdate colorimetric method. Calcium, iron, zinc and manganese were determined spectophotometrically using Buck 200 atomic absorption spectrometer (Buck scientific, Norwalk) (Essien *et al.*, 1992), and then compared their absorption with absorption of standards of these minerals. Statistical analysis was performed on the results using paired t-test, and level of significance was set at $p < 0.05$.

RESULTS

The proximate composition of Sesame seed is as shown in Table 1. The moisture content of the samples was very low, an indication that the seed will be high in dry matter content. The whole seed was slightly higher in crude protein than dehulled seed showing that the hull also contained and contributed to the crude protein content of the seed. Dehulled sample was higher in lipid content compared with whole seed sample, though the difference was not significant ($p > 0.05$). The whole seed was significantly higher in crude fibre compared with dehulled sample. There was a high significant difference ($p<0.05$) in the ash values of whole and dehulled seed samples, the whole being twice the value of dehulled sample.

The result of mineral analysis of Sesame seed is as shown in Table 2. The seed was low in sodium content moderate in potassium and high in calcium, iron, phosphorus and zinc. Figures 1, 2 and 3 show sesame plant, fruit and seed respectively.

DISCUSSION

The moisture content obtained for the whole and dehulled samples were in perfect agreement with the one in the literature (Godin and Spensley, 1971). The very low moisture content of the seed was suggestive of its long shelf life and keeping quality; and this might be an advantage since most spoilage microorganisms do not thrive well on food items that are low in moisture content (Tressler *et al*, 1980). The lower moisture value of the dehulled sample might have been a result of dehulling, indicating that more moisture resides in the hull.

The values obtained for crude protein of the two samples in this studied were slightly lower than the range stated in the literature (Godin and Spensley, 1971, Ensminger and Ensminga, 1994). This observed variation might have resulted from varietal and geographic

Table 1: Proximate Composition of Sesame Seed (g/100g)

Parameter	Whole seed	Dehulled seed
Moisture	6.4 ± 0.04	5.2 ± 0.35
Crude Protein	17.1 ± 0.25	11.6 ± 0.15
Crude Lipid	44.0 ± 0.40	48.0 ± 0.55
Crude Fibre	4.6 ± 0.03	2.6 ± 0.02
Ash	6.5 ± 0.05	3.6 ± 0.02
Carbohydrates	21.4 ± 0.12	29.0 ± 0.25

Table 2: Mineral Composition of Sesame seed (mg / 100g)

Parameter	Whole seed	Dehulled sample
Potassium	106.7 ± 0.50	124.0 ± 0.55
Sodium	36.1 ± 0.05	32.1 ± 0.04
Calcium	281.1 ± 0.68	268.1 ± 0.50
Iron	3.83 ± 0.75	3.88 ± 0.80
Phosphorus	157.0 ± 0.30	131.7 ± 0.25
Manganese	1.03 ± 0.20	1.04 ± 0.15
Zinc	4.46 ± 0.05	3.08 ± 0.02

Figure 1: sesame plant

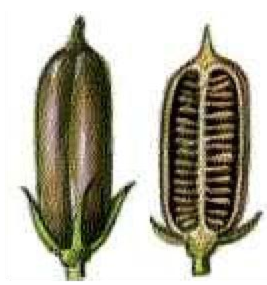

Figure 2: sesame fruit

Figure 3: sesame seed

differences. Both whole and dehulled samples were moderately high in crude protein compared with other plant fruits, seeds and nuts (Nahar *et al*., 1990, Hernandez-Perez *et al.*, 1994). Since vegetables and fruits are the major contributing sources of protein in the developing countries, the level of crude protein in sesame seed can qualify it as a good source of plant protein, if bio-available and easily digestible by the body.

The lipid content of whole and dehulled seed samples were within the range stated in the literature (Godin and Spensley, 1971). The values obtained for both whole and dehulled samples of brown sesame seed in this study were lower than the values recorded for both whole and dehulled samples of Sudanese white and Indian black sesame seeds (Ensminger and Ensminger, 1994). This observed variation in lipid content might be closely associated with varietal and geographic differences.

The dehulled sample was higher in lipid content compared with whole seed. This observation was in agreement with that of Ensminger and Ensminger, (1994). The observed difference in lipid content of whole and dehulled seeds in this study was believed to have resulted from the presence of the hull which hindered the seed oil from being completely extracted from the whole seed. The value obtained in this study for lipid content of Sesame seed confirmed the fact that the seed is very rich in crude lipid.

The whole seed sample was significantly higher in crude fibre compared with dehulled sample. This observation pointed to the fact that greater percentage of the crude fibre was present in the hull. This result was in line with the findings of Adepoju *et al.*, (2003) on *Moringa oleifera* seed and husk.

The significance of crude fibre cannot be overemphasized in human nutrition. High fibre content have been reported to be beneficial in preventing constipation and diverticulosis, bind to and remove toxic materials from the body, has high water holding capacity thereby making stooling easy and bulky (Mc Dougall *et al.*, 1996, Jansen, 2004). It has also been reported that dietary fibre improves glucose tolerance, is beneficial in treating maturity onset of diabetes, and have health promoting potential (Anderson, 1979; Larrauri *et al.*, 1996).

The ash content of the samples was relatively high and highly comparable with the ones for Sudanese white and Indian black sesame seeds (Ensminger and Ensminger, 1994). The difference in the ash values of whole and dehulled seed samples was an indication that the hull contained about half the total minerals present in the seed, hence should not be discarded so as to retain the minerals. The seed was rich in carbohydrate, though not as high in value as those with lower lipid content such as *Andersonia digitata*.

The result of mineral analysis of Sesame seed is as shown in Table 2. Except iron and zinc content, the values obtained for potassium, calcium and phosphorus in this study were lower than the literature value (Obiajunwa *et al.*, 2005); while the values of iron and zinc were significantly higher. The observed difference in values is believed to be due to varietal differences.

The low sodium content of the seed can be an advantage of its usefulness as an additive or condiment in food preparation. It is high in calcium and phosphorus, and can serve as good source of these minerals. Due to its relatively high value of iron, brown sesame seed can be a good source of non-heame iron to its consumers if confirmed to be bio-available. Its zinc level also can qualify it as a good source of this important mineral for growth and maintenance of good health.

CONCLUSION

Whole and dehulled brown sesame seeds were high in lipid, protein, carbohydrate, and mineral content, and can serve as a good source of these nutrients. Because of its nutritional value, it can be used as food supplement to complement and improve the nutrient content of other food items, which may be low in protein and essential minerals. It can also serve as a food supplement or additive in formulating complementary diets for infants. However, the bio-availability of the protein, iron and zinc, as well as antinutritional factors level of the seed need to be investigated to establish its suitability or otherwise as food supplement.

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