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EVALUATION OF THE NUTRIENT AND ANTINUTRIENT COMPOSITIONS OF SESAME (*Sesamum Indicum L*) MILK

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Abstract: Sesame (*Sesamum Indicum*) was purchased in Ubani Market Abia State Nigeria from five randomly selected vendors and pooled to obtain the samples for the milk production. Standard method was used to prepare the milk. The proximate and vitamin content of the samples were determined using standard AOAC methods. Mineral elements were determined using wet-acid digestion method for multiple nutrients determination. All tests were carried out in duplicates and the data generated were analysed using standard methods. Sesame milk contains crude protein (3.47%), fat (2.27%), ash (0.80%), crude fiber (0.09%), and CHO (3.54%). Sesame milk is a good source of mineral but poor source of vitamin. Sesame milk contains Ca (194.00mg/100g), Mg (39.37mg/100g), K (35.72mg/100g), Na (63.63mg/100g) and Fe (1.79mg/100g); β-carotene (5.89μg/100g), B_1(0.05mg/100g), B_2 (0.03mg/100g), B_3 (0.17mg/100g) and vitamins C and E (0.65 and 0.78mg/100g respectively). The entire antinutrient determined were below 1%.The study shows that sesame milk is a good source of protein, fat, and minerals (Ca, K).

Keywords: Sesamum Indicum, Milk, Antinutrients, Minerals, Vitamins, Protein, Fat, Health-Benefit.

INTRODUCTION

The continuous increase in population and inadequate supply of protein has inadvertently increased the occurrence of malnutrition in developing countries (Siddhuraju *et al.*, 1996). In order to meet the protein demands in developing countries, where animal protein is grossly inadequate and relatively expensive, research effort is now geared towards finding alternative sources of protein from legume and seeds (Belewu and Belewu, 2007) ; milk from plant sources are now key ingredient in the diet of most Africans (including Nigeria) due to their high nutritional values, economic potentials and as well as an ally in the fight against hidden hunger (Belewu and Belewu, 2007). For individuals that are lactose intolerant plant milk has become an important alternative. Soybeans, peanuts and cowpea have been accorded high attention in the investigations as milk substitutes; however, hardly any attention was accorded beniseed. Beniseed also known as sesame (*Sesamum indicum L.*) is a rich source of protein, calcium and phosphorus (Salunkhe *et al.,* 1992). Beniseed is regarded in the orient as a health food for increasing energy and prevention of aging (Hajimahmoodi *et al.*, 2008). This seed is found in tropical, subtropical and southern temperate areas of the world, particularly in India, China, South America and Africa (Ray, 2007). It is made up of both wild and the cultivated species. Most wild species are native to sub-Sahara Africa. Beniseed also come in variety of colours depending on the plant variety; these include shades of brown, red, black, yellow and most commonly a pale grayish ivory. The darker seeds are said to be more flavourful (Peggy, 2014). Apart from the fact that beniseed is nutritious, it also have high antioxidant properties (Hu *et al.,* 2004).

In Nigeria, particularly in the major production areas beniseed is basically use in traditional recipes and as snacks (Agiang *et al.*, 2010; Abu *et al.,* 2012). This study therefore seeks to diversify the use of beniseed by producing milk from it.

MATERIAL AND METHODS

Sample Collection/ Cleaning

Dehulled white variety of beniseed (*Sesame indicum*) was randomly bought from at least five different stores in Ubani Market Umuahia, Abia State. The sample was pooled to obtain the representative sample for the milk production. The beniseed was winnowed and sieved to remove sand and stones. The sample was then washed, rinsed and drained with potable water before using for the milk production.

Figure 1: washing and draining of water from the sample

Production of Milk from Sesame

Two hundred and twenty gram (220g) sesame was soaked in a bowl with 3 litres of potable water overnight and water was discarded the next day. The sample was rinsed with Potable water a second time before been milled into a smooth paste with a quantity of 450ml of water using a kitchen blender. A clean Muslin cloth was used to sieve out the milk. About 150ml of potable water was added to the residue in order to extract the remaining milk. About 650ml of potable water was added to the extract and allowed to boil for 20 minutes. Sugar syrup made up of 300ml of potable water and 20 cubes of sugar was added to the boiling milk and allowed to further boil for another five minutes. The samples for chemical analysis were poured into clean sample bottles and immediately taken for analysis.

Figure 2: sieving of milk using a muslin cloth

Chemical Analysis

The proximate composition of the sample was carried out using the standard methods of 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 energy was calculated using the Atwater Conversion factors in KJ and Kcal (17KJ/4Kcal, 17KJ/4Kcal, and 37KJ/9Kcal, for protein, carbohydrate and lipid respectively.

Minerals elements were determined using wet acid digestion method for multiple nutrient determinations as described by AOAC (2006). Potassium and sodium were determined by flame photometer method. Calcium and magnesium were determined by EDTA Versarale Complexiometric titration method. Phosphorus was determined by the Vanadomolydata yellow method using the spectrophotometer. The trace metals (zinc, iron) were determined using the atomic absorption spectrophotometer 969 instrument. The appropriate cathode lamp was fixed for each element. B-carotene, Thiamin, Niacin, Riboflavin, vitamin E and Folic acid were determined spectrophotometrically using the methods of AOAC (2006). Ascorbic acid was determined using titration method as described by AOAC (2006).

Gravimetric method (Harborne, 1973) was used to determine alkaloids and flavonoids. Tannin content of the samples was determined spectrophomethrically 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 420nm. Phytate was determined by titration with ferric chloride solution using the method described by Makkar and Becker (1996).

Statistical Analysis

All determinations were done in duplicates. The data generated were entered into the computer and analyzed using Statistical Package for Social Sciences (SPSS version 16.0) Means and standard deviation obtained from the chemical analysis were calculated. Level of significance was accepted at $p<0.05$.

RESULTS AND DISCUSSION

The proximate composition of beniseed (*Sesame indicum*) milk is shown on Table1. The moisture content of the milk was 89.84%. These fell within values reported for most plant milk. Moisture in food is a function of its shelf-life stability; this implies that beniseed milk may have a short shelf-life. The protein content of beniseed (3.47%) was similar to values reported for *Treculia africana* seed milk (3.15-3.85%), soymilk (3.50%), and tigernut milk 3.35% (Nnam, 2003; Riaz, 2006; Onweluzor and Nwakalor, 2009). Though protein is known to be low in most plants and their products, study has however shown that regular consumption of plant product particularly those of legume and seed adds substantial amounts of other nutrients to diet (ADA, 2003; Leitzmann, 2005). Beniseed milk ash value (0.80%) was comparable to the ash content (0.89%) of *Treculia africana* seed milk (Onweluzo and Nwakalor, 2009) but lower than 1.5% for soymilk (Ukwuru, 2008). Ash content is an indication of mineral content of a food (Gernah *et al.*, 2012). This implies that beniseed milk would contribute substantial mineral to diet of those that consumes it. Crude fiber value of 0.09% was found beniseed milk (0.09%). Crude fiber is found only in plant milk; dietary fibre is essential for effective gastro-intestinal functions and in the treatment and prevention of many diseases including colon cancer, coronary heart diseases, obesity, diabetes, and gastrointestinal disorders (Anderson *et al.*, 1994; Ogbonna *et al.*, 2012). The crude fat content of beniseed milk 2.27% was lower than 8.42% (Awonorin and Udeozor, 2014) reported for tigernut milk but close to the value (3.25%) reported for whole milk (Nutrient content of milk varieties, 2015); beniseed fat however has some advantages over animal fat because it does not contain cholesterol and it is rich in monounsaturated, polyunsaturated fatty acid and in natural antioxidant (Ogawa *et al.*, 1995; Hu *et al.*, 2004). It contains phytosterols which not only decreases blood cholesterol levels but reduces the risk of developing certain types of cancer (Kamal-eldin *et al.*, 2011).

The carbohydrate and energy values of beniseed milk were found to be 3.54% and 48.47kcal respectively. The low carbohydrate and energy values found in beniseed milk may be due dilution effect of water added during the extraction process. The low energy, high moisture, low fat and low protein however make beniseed milk suitable for patients with some physiological conditions.

The mineral composition of beniseed milk is shown on Table 2. The calcium and potassium values of beniseed milk (194mg/100g vs 35.72mg/100g respectively) were higher than values reported for tigernut milk (8.34mg/100g and 2.48mg/100g) and those of bambara groundnut (18.20, 3.24mg/100g respectively) (Udeze *et al.*, 2014) but iron content of beniseed milk (1.79mg/100g) fell within values reported for tigernut milk and bambara groundnut milk (2.08mg/100g and 2.25mg/100g respectively)(Onweluzo and Nwakalor, 2009). Calcium and potassium are important element in the body; they play essential role in health of bone as well as regulating of blood pressure (Elamin and Tuvemo, 1990). Iron also plays important role in many parts of the body, including immune function, cognitive development, temperature regulation, energy metabolism, and work performance (Wood and Ronnenberg, 2006. The β-carotene value of milk 5.89µg/100g was higher than the ones reported for some plant milk (Awonorin and Udeozor, 2014). β-carotene is known to help in growth and development, maintenance of the immune system and good vision (Tamumhardjo, 2011). The vitamin C and the vitamin B-complex of beniseed were generally low but consumption of the milk as part of a diets can make appreciable increase to total intake. All the antinutrients evaluated were also low (below 1%). The low antinutrients found in the product can be as a result of the effect of processing.

CONCLUSION

The study shows that sesame milk is a good source of plant protein, fat, and minerals. All the antinutrients determined were below 1%. This implies that sesame milk can be used as alternative to other common plant milk.

RESULTS

Table 1: Proximate composition of beniseed (*Sesame indicum*) milk

Nutrients	Milk
Moisture (%)	89.84± 0.00
Dry matter (%)	10.16± 0.00
Ash (%)	0.80 ± 0.03
Crude fibre (%)	0.09 ± 0.00
Fat (%)	2.27 ± 0.01
Crude protein (%)	3.47 ± 0.02
Carbohydrate (%)	3.54 ± 0.03
Energy(kcal/kj)	48.47/203.16

Table 2: Mineral composition of beniseed (*Sesame indicum*) milk (mg/100g)

	Milk
Sodium	63.63±0.25
Calcium	194.66± 0.20
Magnesium	39.37± 0.11
Potassium	35.72± 0.17
Iron	1.79± 0.01

Table 3: vitamin composition of beniseed (*Sesame indicum*) milk

constituents	Milk
β-carotene (µg/100g)	5.89 ± 0.05
Vitamin C(mg/100g)	0.65± 0.00
Vitamin B_1(mg/100g)	0.05± 0.00
Vitamin B_2(mg/100g)	0.03± 0.00
Vitamin B_3(mg/100g)	0.17± 0.01
Vitamin E(mg/100g)	0.78± 0.00

Table 4: Anti Nutrient Composition of beniseed (*Sesame indicum*) milk (mg/100g)

Constituents	Milk
Phytate	0.08 ± 0.00
Hydrogrn cyanide	0.01 ± 0.00
Oxalate	0.05 ± 0.00
Tannin	0.12 ± 0.01

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