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AN ASSESSMENT OF THE NUTRIENT COMPOSITION OF BENNISEEDS (*SESAMUM INDICUM*) GROWN IN DIFFERENTS LOCATIONS IN PLATEAU STATE, NIGERIA.

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ABSTRACT

Benniseed (*Sesamum indicum*) samples obtained from three local government areas (LGAs) of Plateau State were analysed for their amino acid profile, chemical and mineral compositions. Samples obtained from low land area (Langtang LGA) were found to contain higher percentages of carbohydrate, lignin, crude protein, digestible proteins, minerals and oil content compared to values from the high land areas (Mangu and Bokkos LGAs). No much variation was observed within the same variety (black oval shape and black elongated shaped samples). Amino acid profile showed that the Langtang LGA samples contained higher amount of the amino acids than samples from Mangu and Bokkos LGAs.

Key Words: Assessment, Nutrient, Composition, Benniseeds, Amino acids

INTRODUCTION

Benniseed (*Sesamum indicum, Pedaliaceae*) is an important oil bearing seed crop, which is mainly found in the tropics, particularly in Africa (Joshi, 1961). It is also grown in Asia and parts of Latin America for its edible seeds, which are the source of sesame oil.

Many varieties are now grown in different countries and differ in their season of planting, time of maturity and degree of branching. At present, sesame can be regarded as one of the most promising oil crop for warm temperate and tropical regions (Oche et al, 1966, Agboola, 1979).

Two main species, *Sesamum indicum* and *Sesamum radicum* are grown in Nigeria. A high proportion of benniseed in Nigeria is cultivated in parts of Benue, Plateau, Kogi, Niger, Kwara, and Kaduna states (Agboola, 1979). Sesame grows well in temperate areas during summer and in tropical lowlands under semi-arid conditions. It however, grows poorly under conditions of heavy rainfall or high humidity (Oche et al., 1966). Sesame seeds are used for the production of high quality, odorless oil that is used in the manufacture of margarine and as cooking oil. The oil contains phytosterol, tocopherol and sesamolin, which upon hydrolysis yields sesamol, which is responsible for the antioxidant behavior of benniseed oil (Joshi, 1961). It is also used in making soap, paints, and lubricants as well as in the manufacture of medicinal drugs and perfumes.

Cakes made from sesame seeds contain 40 - 42 % protein providing a good source of protein (Agboola 1979, Dashak and Fali 1993, Evans 1989, British Pharmacopia, 1980a). The seeds are processed and eaten in soups, bread, cakes and pastry. When young, the stalk and leaves are used in making vegetable soup or dried and pound before use in making 'draw' soup. The ash obtained by burning the dry plant is used for making local food preservative known as 'kangwa' (Hausa). The black variety is the most commonly grown in Plateau State and used for traditional obligations. It is also mixed and eaten with meat, beans and cereal grains to supplement the protein content of these cereals.

The chemical composition of benniseed has been reported to vary with variety and location where the crop is grown (Joshi, 1961). This paper therefore reports the variation in the nutrient composition of benniseed grown at three different locations in Plateau state.

MATERIALS

The benniseeds (*Semamum indicum*) samples were obtained direct from farmers from Bokkos, Mangu & Langtang Local Government Council Areas of Plateau State. Two types of black variety were collected from Bokkos Local Government Area and coded BOS - for the oval shaped samples and BES for the elongated shaped

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samples. The samples collected from Langtang were brown and yellow varieties, and were all oval shaped. The Mangu sample was the black variety and oval in shape. The high land areas (Mangu and Bokkos) generally have relatively colder weather, longer rainfal periods and moddy, reddish brown soil, while the low land area (Langtang) is characterised by hot weather, shorter periods of rainfall and sandy, porous soil.

All chemicals used for the analysis are of analytical grade and obtained from BDH (Poole, Dorset, U.K.)

METHODS

Moisture Content

The benniseed samples were milled using laboratory blender and 3.0g were weighed in preweighed petridishes and dried in an oven maintained at 110 °C for 24 hours. The samples were removed, cooled and weighed. The percentage loss in weight was expressed as moisture content.

Lignin

The lignin content was determined by the method of Campton and Maynard (1938).

Crude Oil

Moisture free benniseed flours (3.0g) were soxhlet extracted using 40°C - 60°C petroleum ether placed in weighed 250ml round bottom flasks for 8 hours. The petroleum ether was recovered by rotary evaporation at 26°C. The flasks containing the extracted oil were then weighed and the difference in weight expressed as percentage crude oil (AOAC, 1983).

Ash Content

Benniseed flours (1.5g) were placed in weighed porcelain crucibles and ashed in a furnace, maintained at 650 °C for 8 hours. The residues were weighed and expressed as percentage ash.

Crude Fibre

The crude fibre was determined by the method of Shambe et. al., (1973).

Carbohydrate Assay

Total carbohydrate was assayed by the L - cysteine sulphuric acid method (Peplow and Somers, 1969).

Crude Protein

This was determined by AOAC methods (AOAC, 1983).

Digestible Protein (Shambe et. al., 1973)

Digestible protein was determined by the method of Shambe et. al., 1973)

Saponification and Iodine Values

The saponification and iodine values were determined using the AOAC method (AOAC, 1983).

Amino Acids

The amino acid analysis of the benniseeds were determined using a Technicon TSM -1 amino acid analyser and the results expressed as grams of amino acid / 16g N (Moore et.al., 1958).

Mineral Contents

Milled benniseed samples were placed in porcelein crucibles and ashed in muffle furnance at 750 °C for 6 hours. The ashes were transferred to 150 ml beaker and treated successively with 10 ml each of water, concentrated perchloric acid, concentrated, hydrochloric acid and nitric acid. The mixtures were heated at 120 °C on a hot plate until the brown fumes were driven off and the sides of the beakers were rinsed with water and the solutions concentrated to about 5 ml. The beakers were cooled and 10 ml of conc. nitric acid and 50 ml water were added and boiled for 5 min. The solutions were filtered into 100ml standard flasks and made up to mark with distilled water. Standards of various metals were prepared from analytical grade reagents for calibration graphs. The absorbance readings for both standards and samples were carried out using an atomic absorption spectrophotometer (SP - 9 Pye Unicam).

Determination of Phosphorus

Milled benniseed samples were placed in porcelein crucibles and ashed in muffle furnance at 750 °C for 6 hours. The ashes were transferred to test tubes containing 3.0g of potassium pyrosulphate and mixed thoroughly and the mixture fused for 30 min. The test tubes were cooled and 5 ml of 4M nitric acid added and digested for 1 hour with shaking. The test tubes were removed, 20 ml of water added, shakened and allowed to stay over night. The solutions (2

TABLE 1: ANALYSIS OF THE BENNISEEDS

	SAMPLES				
Parameters determined	Mangu (Black OS)	Langtang (Brown OS)	Langtang (Yellow OS)	Bokkos (Black, OS)	Bokkos (Black, ES)
Moisture (%)	4.96 ± 0.02	4.13 ± 0.01	4.58 ± 0.26	3.52 ± 0.55	3.68 ± 0.63
Ash (%)	4.39 ± 0.10	5.29 ± 0.14	6.57 ± 0.04	5.98 ± 0.54	4.27 ± 0.14
Total Carbohydrate (%)	11.89 ± 0.10	17.03 ± 0.01	12.60 ± 0.01	8.42 ± 0.64	9.05 ± 0.52
Crude Fibre (%)	10.19 ± 0.38	7.63 ± 0.19	6.18 ± 0.10	20.63 ± 0.58	19.61 ± 0.03
Lignin (%)	20.63 ± 0.33	23.51 ± 0.08	8.46 ± 0.01	18.45 ± 0.65	15.67 ± 0.05
Crude Protein (%)	17.85 ± 0.12	26.26 ± 0.09	23.67 ± 0.44	17.51 ± 0.31	17.33 ± 0.18
Digestible Protein (%)	17.46 ± 0.12	25.45 ± 0.08	14.91 ± 0.10	16.98 ± 0.45	16.84 ± 0.38
Oil Content (%)	36.09 ± 0.17	41.27 ± 0.11	53.91 ± 0.12	37.70 ± 0.10	30.34 ± 0.39
Energy (kcal/100g)	441	540	627	341	376
Saponification Value (mg/KOH/g)	187.66 ± 0.28	191.02 ± 0.28	178.12 ± 0.14	189.34 ± 0.65	192.14 ± 0.81
Iodine Value (g / 100g fat)	105.90 ± 0.18	109.78 ± 0.04	101.97 ± 0.01	113.71 ± 0.23	105.58 ± 0.12
Acid Value (mgKOH/g)	2.44 ± 0.16	2.81 ± 0.08	2.42 ± 0.15	4.40 ± 0.41	4.20 ± 0.05

Key: OS = Oval Shape Samples; ES = Elongated Shape Samples

ml) were placed in 50 ml volumetric flask, 2 ml concentrated nitric acid and 10 ml of ammonium metavanadate/molybdate solution added. The solutions were then made up to mark with distilled water. Standard phosphate solutions were prepared from analytical grade potassium dihydrogen phosphate and treated with the ammonium metavanadate/molybdate solution for colour development. The absorbances of the standards and samples were read on SP6-450UV/VIS spectrophotometer. Percentage phosphorus were obtained from the calibration curve.

TLC of Hydrolysed Oils

The TLC of the standard fatty acid esters and hydrolysed benniseed oils were carried out on TLC plates coated with silica gel activated in an oven at 110 °C for 30 minutes. The plates were spotted with solutions of the hydrolysed benniseed oils or standard fatty acid esters in petroleum ether (40 - 60 °C) and separated in a mobile phase mixture of pet. ether/Et_2O/AcOH (80:20:1). The spots were rendered visible using iodine vapour.

RESULTS AND DISCUSSION

The proximate chemical analysis of the benniseeds is shown in table1. Tables 2 and 3 show the mineral composition and the amino acid profiles of the benniseed samples respectively.

The moisture content of the benniseeds is low and is comparable to that reported by (Dashak and Fali 1993), and similar to moisture content reported for other food crops, (Oyenuga, 1978, Shambe and Dashak, 1995). The crude protein, crude fibre and ash contents

TABLE 2: MINERAL CONTENT OF THE BENNISEEDS

Mineral	Concentration in mg/100g				
	Mangu Black OS	Langtang Brown OS	Langtang Yellow OS	Bokkos Black OS	Bokkos Black ES
Calcium	281.00	490.00	688.00	147.17	190.93
Copper	48.00	40.00	28.00	2.54	1.73
Iron	36.00	8.00	20.00	3.10	13.34
Magnesium	269.00	263.00	263.00	19.57	23.89
Phosphorus	765.00	935.00	750.00	512.00	327.58
Potassium	1530.0	2190.0	1650.00	302.60	190.93
Sodium	21.00	23.00	31.00	24.36	14.20
Zinc	140.00	163.00	148.00	3.46	1.96

Key: OS = Oval Shape Samples; ES = Elongated Shape Samples

are similar to those reported by (Joshi ,1961) for non-Nigerian benniseed. It can be observed that most of the protein is digestible (Table 1) and can therefore be eaten together with cereal foods that have low protein content. Sesame protein has angiotensin-converting enzyme inhibitor activity and therefore useful as antihypertensive agent (Takayoshi et al, 1995). The variation observed for the three black varieties of benniseed is probably due to the different locations in which the benniseeds are grown. The Langtang samples were obtained from the lowland area of Plateau state whereas the black OS and black ES benniseeds were obtained from the high land area of Plateau state (Mangu and Bokkos). The low land samples are rich in oil. The oil contents are similar to that reported by Joshi (1961), Oyenuga, (1978), Dashak and Fali, (1993). However, the yellow variety is the richest in oil content. A similar observation had been reported by Dashak and Fali (1993). Sesame oil is used to enrich pyrethroid and organophosphorus pesticides (Ruiquan, 1995).

The benniseed oil samples have high saponification and iodine values. The high iodine value indicates that the oils contain high quantity of unsaturated fatty acids. 48.7 % oil content has been rerported for sesame seeds and consist mostly of unsaturated fatty acids. This value is higher than that of most other oil seeds except for groundnut oil (Panford and deMan, 1990). Saponification and iodine values of 193 and 110 respectively have been reported (Panford and deMan, 1990). These reported values are similar to the values reported in Table 1. Sesame oils are not easily converted to peroxides i.e. they are stable to oxidation (Schwartz and Rady, 1990). This may be due to the presence of antioxidant agent (sesamol) present in benniseeds.

Minerals such as calcium, phosphorus, magnesium, sodium and potassium play important roles in the body and are therefore important nutritionally. Deficiencies of these minerals usually lead to defined syndromes. The important functions performed by these minerals include maintenance of electrolyte (sodium and potassium) balance (Guthric, 1989), development of body skeleton, formation of strong bones and teeth (calcium and phosphorus), as well as the use of calcium as a blood clotting factor (Mudambi and Rajagopal, 1983). The mineral profile shown in Table 2 indicates that the benniseeds are rich in potassium, phosphorus, magnesium and calcium compared to cereal grains. The variation in values of mineral even between the black varieties could be attributed to location and agronomic factors. Similar variation in mineral composition of foods have also been reported by Zhai et. al., (1990). The values are similar to those reported for barley by Shambe and Dashak (1995) and Muralidharudu and Singh (1990). The high phosphorus and calcium could be utilized in foods, particularly for young children for the development of bones and teeth. In particular, black OS and black ES have low mineral content compared to the other benniseed samples. The variation in mineral composition could be due to fertilizer application, soil composition and rain fall, (Muralidharudu and Singh, 1990).

The amino acid profile of the benniseeds (Table 3) shows that the benniseed samples contain appreciable quantities of essential amino

TABLE 3: AMINO ACID PROFILE OF THE BENNISEEDS

	Concentration in g / 16N					
AMINO ACID	Mangu Black OS	Langtang Brown OS	Langtang Yellow OS	Bokkos Black OS	Bokkos Black ES	FAO/WHO (1965 and 1973)
LYS	1.86	3.05	4.38	1.83	2.97	5.00
HIS	2.24	2.60	5.01	1.24	2.59	-
ARG	5.98	10.68	22.01	2.35	2.78	-
ASP	7.87	6.04	12.74	4.95	6.97	-
THR	3.01	4.05	4.68	2.05	3.02	4.00
SER	3.65	4.28	7.20	2.20	3.43	-
GLU	12.68	22.01	33.06	8.54	11.32	-
PRO	2.96	4.03	9.03	3.64	3.63	-
GLY	3.80	5.06	8.08	2.89	3.55	-
ALA	4.00	4.12	7.04	3.66	3.53	-
CYS	3.52	4.09	4.82	3.36	2.18	2.00
VAL	3.68	5.01	6.30	2.17	2.82	5.00
MET	1.76	3.45	4.07	1.13	1.42	3.00
ILEU	3.25	3.52	5.05	2.04	3.94	4.00
LEU	6.02	7.05	11.03	3.90	5.97	7.00
TYR	0.86	2.00	4.62	2.17	2.10	2.81
PHE	5.62	3.85	3.88	2.85	3.82	2.80

Key: OS = Black Oval Shape Samples; ES = Black Elongated Shape Samples

acids. They contain lysine, methionine, threonine and tryptophan, which are usually limiting in most cereals and legumes (Armstrong and Bennett, 1979). The Mangu samples (black) contain more Phen. than FAO/WHO values. Lys. values is lower in all the samples compared to the FAO/WHO values. The Bokkos samples (BOS and BES) have lower values of most of the amino acids except Cys and Phen. Even though the amino acid profile is similar to those reported by Dashak and Fali (1993), they are lower than that reported by Njike et. al. (1974) for some Nigerian feed meals.

TLC of the hydrolysed oils from the benniseed samples showed that they all contained mainly stearic, linoleic and oleic acids. Traces of other acids were observed but are yet to be identified.

CONCLUSION

In conclusion, the amino acid profile, chemical composition as well as mineral composition of benniseed vary with the location, plant and variety. For the purpose of oil production, the yellow variety from Langtang is preferable.

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