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Preliminary studies on the chemical evaluation of the nutritive value of black caraway seeds (Nigella sativa L.)

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ABSTRACT

The seeds of *Nigella sativa* were evaluated for its chemical composition as well as its nutritional values. The proximate analysis showed 12.00% moisture, ash content 3.00%, ether soluble extract 33.30%, crude protein content 19.3%, total carbohydrate 7.2%, crude fibre content 5.33% and crude lipid 33.30%. The seed has a calorific value of 7203.44 kcal per 100g. The mineral elements determined were Calcium: 2.052 ppm, Magnesium: 0.313 ppm, Potassium: 498.50 ppm, Iron: 0.080 ppm, Sodium: 494.40 ppm. The amino acid composition showed some of the essential amino acids like Leucine 3.75±0.51, Isoleucine 2.09±0.96, Lysine 3.87±0.87, Methionine 1.57±0.26, and Arginine 3.05±0.03g/100 protein, Trytophan and Glycine were not detected. The phytochemical screening revealed the presence of alkaloids, tannins, flavonoids, saponins and anthraquinones. These results indicate the high nutritional potential of the Nigerian Nigella sativa especially as a source of fat and protein, and its application in flavouring various types of foods.

***Key words**: Nigella sativa L., proximate composition, phytochemical screening*

INTRODUCTION

A good knowledge of the chemical composition of foods especially seeds used as condiment and spices is quite essential in the dietary treatment of disease or in any quantitative study of human nutrition. The nutritional quality of nay food substance may therefore be evaluated by proximate composition, mineral, vitamin content, amino acid profile of the protein, fatty acid profile of lipids and levels of some anti nutritional substance, (1). There are different varieties of nut and seeds that grow along the west coast of Africa and commonly consumed by man like sesame, (*Sesamen indicu L*).

These sesame seeds belong to the family *Pedaliaceae*,, they are small and flattened and are widely used for flavouring of bread.

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The seed contains a high percentage of oil about 55% and has a very good stability due to the presence of natural anti-oxidant, it is medically used in the treatment of anaemia, blurred vision and relaxation of the bowel, (2).

In the Middle East and South Asia, Nigella sativa seeds have been used for thousands of years as a remedy for all sorts of allergies, inflammation and menstruation problems, boosting moral, depression, but especially against bronchitis, asthma and neurodermatitis as well as for carminative and stimulatory properties. The Prophet Mohammad (sallallaahu alayhi wa sallam) stated in his Hadith that "black seed oil cures every illness except death". No wonder then that a little bottle of the oil was even found in the tomb of the legendary Pharaoh Tutankhamen!, (3)

Cumin seeds (Nigella sativa) common name kammoun (in Arabic) cumin or green cumin (in English) Jirah, or Zeera (in urdu) is from the family Ranunculaceaes. These seeds have a strong aroma and characteristics are modified by frying or dry roasting. Its main composition consists of 2.5 to 4% essential oil, cumin alcohol, alpha and beta-pineme, 21%, dipentene, p-cymen and beta-phellandrene, (4).

Inspite of its nutritional and medicinal values, research work have not been carried out to document its nutritional and chemical composition in Nigeria. Therefore this work was carried out to evaluate chemically, the nutritive value of this commonly used seeds, *Nigella sativa*, so that it could be incorporated into foods for human consumption especially as an ingredient or condiment in local soups.

MATERIALS AND METHOD

Collection and Preparation of Seeds:-

Large quantities of the black caraway seeds were bought from local markets in Nigeria. The seeds were spread on a tray for effective air drying. The dried sample was ground into flour using a steel-bladed Moulinex coffee grinder. The analyses were carried out on the resulting flour. The seeds were identified and authenticated at the National Institute for Pharmaceutical research and Development (NIPRD), Abuja, and a voucher specimen deposited there.

Analysis of Sample

Chemical analyses were done as described by the Association Official Analytical Chemists (5). The moisture content was determined by drying a known weight of the flour to constant weight in a vacuum oven at 55°C. The ash was determined by incinerating the flour in a muffle furnance at 66°C till ash obtained. The crude protein was determined using microkjeldahl nitrogen estimation method and then multiplying the value for nitrogen by a factor of 6.25 to obtain the crude protein. The total carbohydrate was estimated by the difference. The crude lipid was estimated by exhaustive extraction of a known weight of dried sample with petroleum ether (bp 40-60°C) using a soxhlet apparatus (6).

The crude fibre was obtained from the loss in weight on ignition of dried residue remaining after digestion of fat free sample with 1.25% H_2SO_4 and 1.25% NaOH solutions under specified conditions. The calorific value was obtained by multiplying the mean values of the crude protein, lipid and carbohydrate by at-water factors of 4, 9 and 4 respectively, and taking the sum of the products expressed in kilocalories. The mineral element composition was determined using an Atomic Absorption Spectrophotometer. An automatic amino acid analyzer was employed in the estimation of the amino acid (Perkin Elmer model) (7). The method of Sofowora (8) was used for the estimation of saponins, tannins, alkaloids oxalate, flavonoids and anthraquinones.

RESULTS AND DISCUSSION

The result of the proximate chemical composition of black caraway seeds (*Nigella sativa*) as an average of five (5) determinations is given in Table 1, the elemental composition in Table 2, the amino acid composition in Table 3 and Fig.1, the qualitative analysis of some selected ant nutritional factors in Table 4. The moisture content of the seeds was quite high (12.00±0.03), due to short time of storage and is in agreement with a similar finding by (9). The ash content was found out to be 3.00%. The determination of ash content is of value in the analysis of food for vital reasons and is used as an index of the quality of feedings stuffs used for poultry, men, and cattle feeding (10). The seeds contain about one and half

($1^1/_2$) of crude lipid (33.30%) and this is in line with the fact that it is an oil seed. Lipid has at least three important functions in foods; culinary, physiological and nutritional. The dietary lipids provide the essential linoleic acid which has both a structural and functionally essential fat soluble vitamins.

Linoleic acid stabilizes the cell membranes and Prostaglandin has the effect of inhibiting inflammation. By that the immune reactions are stopped which cause the illnesses and which otherwise could be the start of many chronic illnesses like acne and hay-fever right up to cancer (11). In addition, the excessive T-cell function of the person suffering from allergies are stabilized through the substance in black seed oil and the abnormally rising immune reactions through suppressed anti-bodies. The excessive immune system is normalized and the large cell degranulation decreased.

The crude proteins and total carbohydrate contents (19.30±0.08% and 6.20±12% respectively) were high compared to those reported for some lesser known plant seeds (12). For example the crude protein content of coconut water chestnut and dried acorns range 3.5-8.10%. The crude fibre content in Table 1 was found to be 5.33±1.02% and this is quite high. Thus, the relatively high fibre content of the seeds has been implicated to be associated with reduced incidence of diverticulosis, cancer of the colon, cardiovascular disease and diabetes mellitus and so justifies the use of both black caraway seeds and oil in the treatment of colic, gingivitis, indigestion and irritable bowel syndrome (13). The more insoluble fibres such as cellulose and lignin commonly found in wheat bran are beneficial with respect to colonic whereas the more soluble fibres found in legumes and fruits e.g gums and pectins lower blood cholesterol, possibly by binding bile acids and dietary cholesterol (14). The soluble fibres also slow stomach emptying and delay and attenuate the postprandial rise in blood glucose with subsequent reduction in insulin secretion. This effect is beneficial to diabetics and dieters because it reduces the rebound fall in blood glucose that stimulates appetite, (15).

An attempt was made to test for the presence of some important classes of compound whose ant-microbial or ant-nutritional activities have been established. Therefore, alkaloids, tannins, saponins and flavonoids were detected (Table 4). Tannins are known to reduce the digestibility of nutrients especially proteins, carbohydrates or even lipids by binding in the substrate to be digested, inhibiting digestive enzymes. (16).

The profile of the amino acids composition of the seed is as shown in Table 3 and figure 1. All the essential amino acids, (Phenylalanine, isoleucine, leucine, lysine and cysteine) are present in the seeds and they compare very well above the FAO (17) standard for these essential amino acids, thus consumption of the seeds in soups, sauces will improve protein nutrition. The elemental consumption of *Nigella sativa* seeds (Table II) shows it is a rich source of potassium, sodium and phosphorus, the values are higher than those reported for some other seeds (18) e.g Cereals, *Bolanites Aegyptieca* Seeds and *Tamarindus indica.*

CONCLUSION

From the data obtained from the chemical evaluation of black caraway seeds, it can be deduced that these seeds in combination with other carbohydrate and protein-rich supplements, provides a balanced diet which contributes towards improving the human nutrition in addition to its medicinal value. However more research work should be conducted on the traditional use of this vital herbal seed and its oil as a medicinal component in plants.

Table I: **Proximate chemical composition of *Nigella sativa* seeds (dry weight base** ± standard deviation).

Component	Composition (%)
Moisture	12.00±0.03
Crude lipid	33.30±1.10
Crude protein	19.30±0.08
Crude fiber	5.33±1.02
Carbohydrate	6.20±0.12
Organic matter	33.3±0.03
Ash	3.00±0.01
Caloric value	7203.44kcal/100g

Values are means of 5 determinations ±Standard Deviation

Table II: **Elemental composition of *Nigella sativa***

Element	*Concentration (mg per 100g dry matter)*
Calcium	2.052±1.20
Potassium	498.50±1.10
Magnesium	0.313±0.05
Iron	0.488±0.080
Sodium	494.40±1.40
Phosphorus	50.30±1.70

Value is mean of three determinations ± Standard Deviation

Table III: **The amino acid composition of *Nigella sativa***

Amino acid	Concentration (g/100g protein) a	FAO Reference Protein b
Leucine	3.75%±0.51	4.20
Isoleucine	2.09±0.96	4.20
Lysine	3.87±0.87	4.20
Methionine	1.57±0.26	2.20
Phenylanine	2.51±0.13	4.40
Cysteine	0.88±0.40	2.20
Arginine	3.05±0.03	4.20

a – Value is mean of three determinations ± Standard Deviation
b – FAO (1970)

Table IV: **Qualitative result of some anti-nutritional factors in *Nigella sativa***

Test	Observation	Conclusion
(1) Alkaloids 1.0ml of extract dissolved 2ml of 0.1 HEL IN test-tube, 2mls of Meyers reagent was added	A cream colour was observed.	The presence of alkaloids was indicated.
(2). Saponins 2,0mls of extract was shaken for about 2 min in a test tube.	A foaming ability or frothing was obtained	Presence of saponin indicated.
(3) Tannins (a) 2ml of extract drops was added to few drops of ferric chloride solution.	A dark green colour was obtained	Presence of tannin indicated
(b) 2ml of extract was added to bromine water in a test tube.	A brick-red colour was obtained	Presence of tannin indicated.
(4) Bortrager's test anthraquinones 5g of plant extract was shaken with 10ml of 10% ammonia solution added to filtrate and the mixture was shaken again	A pinkish red colour observed in the ammoniacal lower phase	Presence of combined anthraquinones derivatives indicated.
(5) Flavonoids 2ml of extract was added to magnesium clips in a test tube. Then to this was added few mls of cone H_2SO_4 (Sulphuric acid)	A yellow colouration was obtained which turned milky in colour	Presence of flavonoids was indicated.

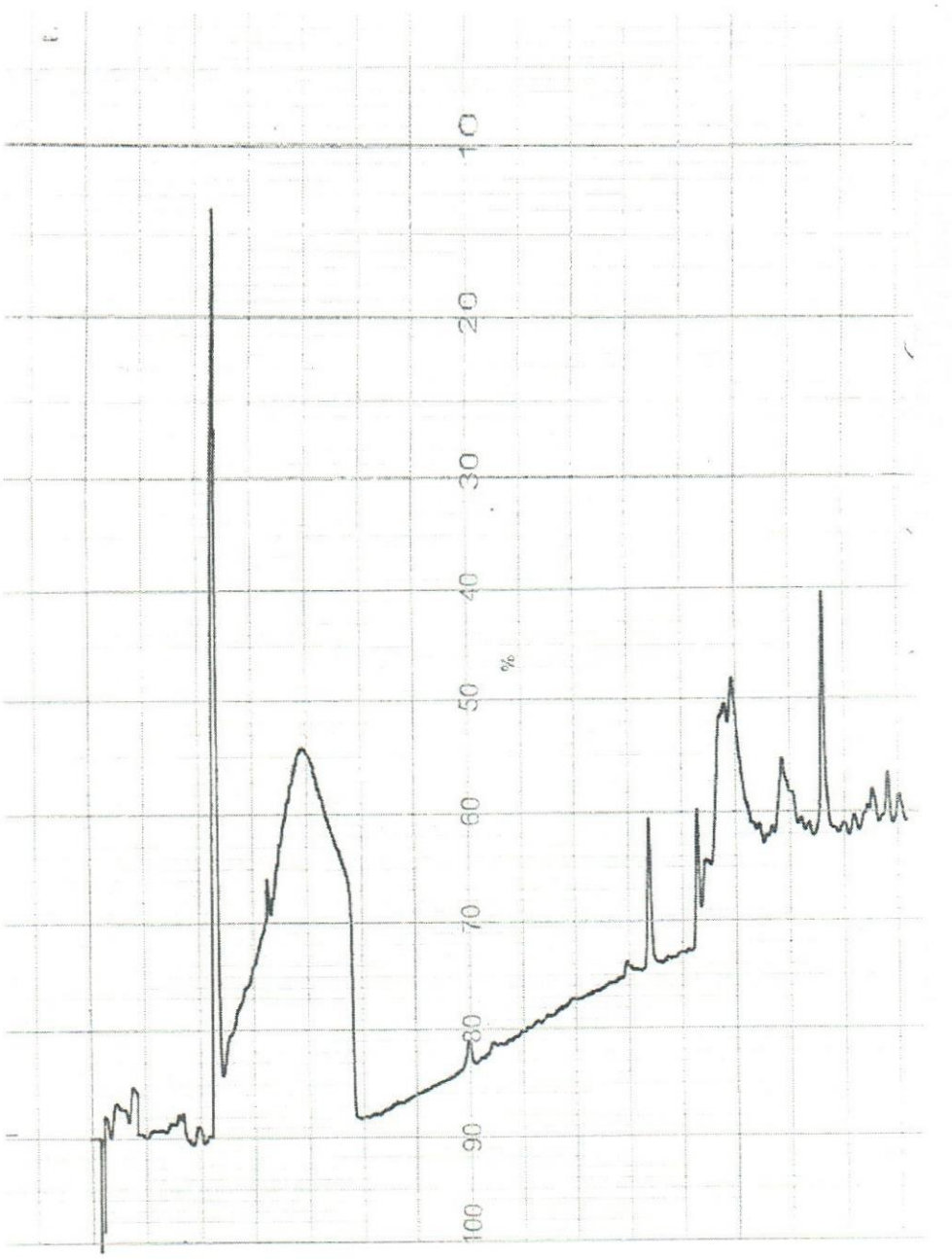

Fig. 1 : Chromatogram of amino acid profile

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