Nigerian Journal of Biochemistry and Molecular Biology
Volume 10, 1995 (Printed in Nigeria)

0189-4757/95 $3.00 + 0.00

NJBMB 9501/1001

Chemical composition of some oil seed grown in northern Nigeria

D. A. Almustafa, L. S. Bilbis, J. M. Rades and M. K. Abubakar,

Department of Biochemistry, Usmanu Danfodiyo University, Sokoto, Nigeria.

ABSTRACT: There is quite a substantial variation in the chemical composition of oil seeds due to varietal and environmental factors. To determine the exact composition of popular oil seeds in Northern Nigeria, fresh samples were obtained and analysed using standard methods. The seeds analysed are Groundnut and Sheanut; Cotton, Melon, Sesame, Neem and Mango seeds. The seed cakes have an average dry matter of 94.5% and a crude protein content ranging from 18 - 57% except for Mango seed which has 6.6%. All the seeds contain adequate quantities of the minerals phosphorus, sodium, calcium and magnesium to make them capable of meeting the needs of animals fed on them. The quantities of oil (ether extract) in the seeds range from 7.8% (Melon seed) to 49.4% (Sesame seed) which means they can be commercially exploited, especially as they are of good quality (in the natural triglyceride forms) as indicated by the low acid, free fatty acid and peroxide values. The saponification values of all the oils indicate they are suitable for commercial soap making. The relatively high iodine values of the oils also suggest they could be cholesterol lowering and hence beneficial in deterring atherosclerotic lesions.

INTRODUCTION

The rapidly increasing population coupled with a diminishing food supply are some of the major challenges facing developing countries like Nigeria. This, therefore, calls for the need to exploit all available food and feeding stuff with a view to alleviating some of the nutritional problems of the populace. The most serious problem in this regard is to provide food of high quality and quantity to satisfy the nutritional needs of the people. This requires, firstly, a chemical analysis of the feeding stuff which provides some insight into the presence or the absence of the nutritionally essential components.

Although the literature is replete with nutrient composition tables of most oil seeds produced in West Africa, the chemical composition is determined by a variety of genetic and environmental factors like climate, soil, fertiliser use etc (1). The paucity of information in respect of the dietary composition of oil seeds produced in the semi-arid environments of Sokoto, in Northern Nigeria, calls for an urgent need to evaluate the nutrient composition of these locally produced and consumed oil seeds. The aim of this work, therefore, is to assess the dietary composition of some important oil seeds produced in this region with a view to ascertaining the sufficiency or deficiency of some nutritionally essential components.

MATERIALS AND METHODS

Groundnuts (*Araches hypozoa*), cotton seed (*Gossipivion hirsitium*), Melon seed (*Gocumis melo*), Sesame seed (*Sesamum indicum*), Neem seed (*Azandirachta indica*), Mango seed (*Mangifera indica*) and sheanut (*Butyrospermions paradoxium*) were obtained from five geographically different zones in Sokoto State. The samples were purchased from open markets in these zones and did not show any visible sign of physical damage or fungal infestation. 50g of each was weighed, ground, and kept at $4^{o}C$. 2g of each sample was taken and analysed for dry matter, ether extract (Lipids) and crude protein as described by AOAC (2) and Oyeleke (3). Phosphorus was determined colorimetrically using molybdate-vanadate reagent as described earlier (4). The saponification number, iodine, peroxide and acid values and percentage free fatty acids were determined titrimetrically as described by Plumer (5).

RESULTS

The proximate composition of the oil seeds is shown in Tables 1 and 2. In general, the seeds exhibited a relatively low moisture content as judged by the values of the dry matter. Consequently the dry matter is high in all cases. However, about 50% of all the dry seed weight comprises the ether extract (lipids) except for mango seed which contained only about 13% lipid. The acid vaues in all the seeds is generally low ranging from 0.74 to 2.36. All the seeds had a considerably high iodine value reflecting their rich content of unsaturated fatty acids (5). The relatively low peroxide values of the seeds in the range of 1.81 to 5.80, indicates the stability of the lipid content of the seeds to oxidative degradation which may be attributed to various antioxidants contained in the seeds.

The seed cakes are in general, very high in crude protein, with values above 50% for groundnut, sheanut and cotton seed cakes. Melon seed cake had a crude protein content of 28% with neem having 8.6%. Mango had the least protein content (6.6%). The results also indicate that the seed cakes are rich in phosphorus with figures of above 500mg/100g except for melon seed (122mg) and Mango (15mg). The sodium content of the seeds spaned from 4.3mg/100g (Mango seed) to 6.0mg/100g (Sesame seed) with calcium ranging from 80mg/100g (Mango seed) to 957mg/100g (Sesame seed). Figures for magnesium increased from the lowest value of 21mg/100g (Mango seed) to a highest value of 228mg/100g in cotton seed cake.

DISCUSSION

The results of this work point to the fact that all the seeds are very good potential sources of lipids which may be extracted for various commercial purposes. Already, groundnut, cotton seed and sheanut are extensively used in northern Nigeria to produce cooking oils. Melon, sesame and neem seeds are commercially viable sources of lipids but have not yet attracted much attention (ike groundnuts) in Nigeria. In the case of mango seed, however, although the percentage fat is relatively low, much economic gain may be anticipated from extracting the oil and subsequent utilization of the cake for human or animal feeding (after suitable processing) instead of throwing away the seeds and allowing them to waste. The saponification values of the oils confer on all of them the potential for use in soap making. In the case of neem seed and sheanut oils which are locally known to have medicinal applications, they may be used for the manufacture of medicated soaps. Though soaps have no direct nutritional value, their sale will generate revenue to assist relevant aspects of the economy to improve nutritional status.

The high content of unsaturated fatty acids in these oils as reflected by their iodine values (6) gives them a considerable importance in the prevention of coronary heart disease (7, 8). The degree of saturation of dietary fats and oils have recently been implicated in the parthology of heart disease and it is now generally believed that plant oils (rich in unsaturated fatty acids) have the ability to lower the levels of serum cholesterol thereby reducing the risk of heart disease (8). On average, the percentage free fatty acids in the oils and consequently acid values are both low. This means the oils are largely in their natural triglyceride forms and therefore of good quality. The resistance to peroxidation indicated by low peroxide values (Average 2.89) further indicates that the ether extracts are likely to keep well without much risk of spoilage by peroxide interactions with double bonds of the unsaturated fatty acids. The reason for much of the resistance to peroxidation could be due to the presence of α-tocopherols which are known to be present in most oils.

The seed cakes are all very good sources of crude protein except for mango seed which has just 6.6%. Even this low amount may still be useful in animal feeds where non-protein nitrogen can be supplied for protein synthesis in the rumen, thereby supplementing even apparently low protein diets. Groundnut cake is extensively eaten in northern Nigeria and it partially replaces meat protein in the diets of the lower socio-economic classes. Melon seed is also extensively used as "egusi" while sesame seeds are eaten fried and salted or in confectionary especially in the north. Cotton seed cake is an already popular animal feed, but it must be thoroughly processed to eliminate gossypol which is toxic (9). Sheanut and neem seeds are abundant in northern Nigeria - the former in the wild while the latter is found both in the wild and in the town. The seed cakes of both of them are unpalatable and require further processing to make them suitable even for animal consumption. It may be more advisable, therefore, to try them as raw materials for fertilizer manufacture as they are rich in nitrogen and minerals. The mineral (Na, Ca, P and Mg) content of the cakes are excellent and should easily support normal griowth even if they are being used as sole feeds (7).

In conclusion, it is suggested that more efforts should be made to exploit the potentials of all these oil seeds and particularly those that are virtually left to go to waste as is the case with neem and mango seeds. In the present economic hardship, the exploitation of natural resources is an area that cannot be neglected. Components of oil seeds have been used as food for humans and animals. Therefore more efforts should be made to process both lipids and seed cakes of all these oil seeds to increase their consumption by humans as well as

Table 1: Lipid contents and characteristics of some oil seeds produced in Northern Nigeria.

	Oil Seeds						
Property	Groundnut	Sheanut	Cotton Seed	Melon Seed	Sesame Seed	Neem Seed	Mango Seed
Ether extract	47.3 ± 7.5	43.4 ± 2.0	30.9 ± 0.1	7.8 ± 0.0	49.4 ± 0.0	43.6 ± 0.5	13.0 ± 3.1
Saponification value	198.3 ± 1.4	187.2 ± 6.2	199.9 ± 10.0	209.9 ± 9.50	206.4 ± 8.7	217.1 ± 5.0	213.4 ± 7.4
Free fatty acids (%)	0.48 ± 0.03	1.06 ± 0.15	1.26 ± 0.03	1.19 ± 0.04	0.94 ± 0.15	0.37 ± 0.01	[illegible]
Iodine value	89.5 ± 1.5	57.5 ± 5.0	106.5 ± 5.5	109.5 ± 5.5	97.5 ± 6.1	64.5 ± 4.7	49.5 ± 3.5
Peroxide value	2.93 ± 0.05	1.97 ± 0.0	1.94 ± 0.1	5.80 ± 0.9	2.21 ± 0.40	2.52 ± 0.5	1.81 ± 0.10
Acid value	0.95 ± 0.0	2.11 ± 0.07	2.51 ± 0.07	2.36 ± 0.70	1.84 ± 0.49	0.74 ± 0.10	[illegible]

Table 2: Protein and mineral content/100g of seed cakes of some oil seeds produced in Northern Nigeria.

	Oil Seeds						
Property	Groundnut	Sheanut	Cotton Seed	Melon Seed	Sesame Seed	Neem Seed	Mango Seed
Dry weight (%)*	95.1 ± 2.1	96.1 ± 2.1	95.2 ± 1.0	97.1 ± 0.5	97.5 ± 0.6	94.3 ± 2.6	93.5 ± 3.3
Crude Protein (%)	59.1 ± 2.7	52.5 ± 5.3	56.9 ± 6.1	28.2 ± 3.0	50.3 ± 1.3	18.6 ± 2.1	6.6 ± 0.3
Phosphorus (mg)	507 ± 5.1	626 ± 6.3	730 ± 4.1	122 ± 7.8	799 ± 23.5	557 ± 5.9	15 ± 2.0
Sodium (mg)	4.5 ± 0.20	5.0 ± 0.18	5.2 ± 0.3	6.4 ± 0.7	6.0 ± 0.51	5.5 ± 0.42	4.3 ± 0.17
Calcium (mg)	95 ± 5.0	248 ± 3.3	209 ± 7.3	114 ± 4.1	115 ± 27.5	342 ± 5.8	80 ± 2.7
Magnesium (mg)	228 ± 2.9	222 ± 3.1	228 ± 4.9	225 ± 5.4	225 ± 1.9	219 ± 3.7	219 ± 4.2

*% Dry weight based on whole seed.

animals. The provision of more high quality animal feed will go a long way to enhance the production of more animal products which are in very small supplies in our diets.

REFERENCES

1. Paul, A.A. and Southgate, D.A.T. (1978). MacCance and Widdowson's. The Composition of Foods; p. 3. Her Majesty's Stationary Office, London.
2. A.O.A.C. (1975). Official Methods of Analysis, 12th ed. Association of Official Analytical Chemists, Washington D.C.
3. Oyeleke, O.A. (1984). Outlines of Food Analysis, A.B.U., Zaria, Nigeria.
4. Allen, S.E.; Grimshaw, H.M.; Parlinson, J.A. and Quarry, C. (1974). Chemical Analysis of Ecological Materials. Blackwell Scientific Publication, London.
5. Plumer, D.T. (1978). Introduction to Practical Biochemistry, MacGraw-Hill Book Company, U.K., Maidenhead, England.
6. Cristie, W. W. (1982). Lipid Analysis, 2nd ed. Pergamon Press, batles, J. (1975). The Obtaining and Processing Food. Varlang Paul Parory, Berlin and Humburg.
7. Guthrie, H. A. (1989). Introductory Nutrition, 7th ed. Time Mirror/Mosby College Publishing; St. Louis, Toronto and Boston.
8. Foster, H. D. (1992). Health, Disease and the Environment, p. 61 - 111. Belhamen Press, London/CRC Press, Baco Raton, Ann Arbor, and Tokyo.
9. Davidson, S.; Passmore, R.; Brock, J.C. and Trustwell, A. S. (1979). Human Nutrition and Dietectics, 7th ed. Churchill Livingstone, Edinburgh.