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LIPID COMPOSITION OF SOME NIGERIAN FOODSTUFFS, ONION *(Allium cepa)*, COCOYAM *(Colocasia esculenta)*, AND PLANTAIN *(Musa sapientum)*

CHUKWU E. ONYENEKE* and OCHUKO EJEDEGBA+
***Department of Biochemistry, University of Nigeria, Nsukka**
+Chemistry Division, NIFOR, Benin City, Nigeria.
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ABSTRACT

The lipid composition of three tropical food items - onions *(Allium cepa)*, cocoyam *(Colocasia esculenta* var. *Antiquorum* schott) and plantain *(Musa sapientum)* were investigated. The isolate showed that onion, cocoyam and plantain contain respectively 0.96%, 0.56%, 0.32% lipid (dry weight). Fractionation showed that onion contains 50.8% phospholipids, 28.9% glycolipids and 20.3% neutral lipids; cocoyam: 20.8%a phospholipids, 40.7% glycolipids and 38.5% neutral lipids; and plantain: 27.2% phospholipids, 38.6% glycolipids and 34.2% neutral lipids. The fatty acid profile of each food item indicated that the predominant fatty acids were mainly C-18 (unsaturated) and C-16 (saturated) species.

INTRODUCTION

Onion *(Allium cepa)*, cocoyam *(Colocasia esculenta)* and plantain *(Musa sapientum)* are tropical food items which are widely and extensively consumed in Nigeria. They are consumed because of either the spicy qualities, or their carbohydrate content which is the major food reserve of these species.

There are various methods of preparation which depend on the culture and the nutritional habits of the locality (Onwueme, 1978).

These foodstuffs have been roported to be high in carbohydrates (Oyenuga, 1968), and also in the case of onion, serve mostly as a spicing agent although, some medicinal properties have also been reported (Bordia and Verma, 1980). The corm and cormels are the major economic part of cocoyam. Occasionally, the leaves and petioles are also used for food (Onwueme, 1978).

The carbohydrate, protein, fibre,

*Present Address: Department of Biochemistry, University of Benin, Benin City, Nigeria and to whom all correspondence should be addressed.

ash and mineral contents of onion, cocoyam and plantain have been reported (Coursey, 1968; Oyenuga, 1968; Bordia and Verma, 1989). Detailed analyses of the total lipids in plants have been concentrated on commercially important oil-rich seeds, with little or no information on storage organs. Other plant species and these organs have been ignored and therefore deserve some attention to complement the existing information on the major components of these food items.

MATERIALS AND METHODS

Healthy onion *(Allium cepa)*, cocoyam *(Colocasia esculenta* var. *Antiquorum* schott) and plantain *(Musa sapientum)* were procured from the Faculty Demonstration Farm, Faculty of Agriculture, University of Nigeria, Nsukka.

The total lipid content of the foodstuffs were extracted and purified according to Folch *et al* (1957) procedure. The silicic acid column procedure of Lepage (1968) was used to separate the lipid extracts into neutral, glycolipid and phospholipid classes. Estimations of the various classes were by the following methods: neutral lipids, Nagy and Nordby (1970); glycolipids, by the combined methods of Lepage (1964) and Clark (1968); and phospholipids, Rouser *et al* (1970). The fatty acid components of the total lipid extract for each foodstuff were determined by converting an aliquot into methyl esters by transmethylation and the fatty acid methyl esters (FAME) were separated and quantified with Pys series 104 gas chromatograph (Opute and Osagie, 1978).

RESULT AND DISCUSSION

The data on lipid composition of some plant storage organs, bulbs, corms and non-economic but nutritional important tropical crops are meagre. Apart from the work on cassava and yam tubers, contennials and potatoes, the literature has been relatively scanty (Hudson and Ogunsua, 1974; Lepage, 1968; Galliad, 1968; Opute and Osagie, 1978; Walter *et al*, 1971; Osagie, 1988). Although these food substances are relatively high in food value, analysis of the lipid components show that they contain very low lipid levels.

The lipid contents of *Allium cepa, Colocasia esculenta* and *Musa sapientum* were found from this study to be 0.95%, 0.56% and 0.32% (dry weight) respectively (Table 1). These findings could be compared to the works of Galliard (1968) and Lepage (1968) who recorded about 0.5% lipid (dry weight) for white potatoes.

Hudson and Ogunsua (1974) have also shown that cassava tubers contain 2.5% lipid dry weight. The lipid composition of some tuber species (Dioscorea) have been investigated by Opute and Osagie (1978) where they found less than

1% -1.5% lipid (dry wt). Previous studies have shown that these storage organs normally accumulate polyssecharides rather than lipids, or any other storage products as their major source of energy reserve. Thus, the lipid content of these tissues is generally low and is of the order 0.2 - 2.7% of the tissues dry weight.

Table 2 shows the results obtained from the individual lipid classes after separation into phospholipids, glycolipids and neutral lipids. On analysis, onion contains 50.8% phospholipid, 28.9% glycolipid and 20.3% neutral lipid; cocoyam: 20.8% phospholipid, 40.7% glycolipid, and 38.5% neutral lipid; plantain: 27.2% phospholipid, 38.6% glycolipid and 34.2% neutral lipid. The various fractions isolated/ identified by TLC were quantified as described in the methodology and are also as shown in Table 2. Results of the separation show that onion is richer in phospholipids than cocoyam and plantain. On the other hand, cocoyam contains predominantly glycolipids when compared to the other foodstuffs.

The fatty acid spectrum of the total lipids is shown in Table 3 The results indicate that each of the food items exhibits a high degree of unsaturation and this was due to the preponderance of the C_{18} unsaturated fatty acids-linoleic ($C_{18:2}$) and oleic ($C_{18:1}$), and to a lesser extent linolenic ($C_{18:2}$) acid. These fractions accounted for 77.6% onion, 68.5% cocoyam, and 65.1% plantain total fatty acids. The saturated fraction is contributed mainly by the $C_{16:0}$ fatty acids and these results suggest that the predominant fatty acids in these food items are the C_{16} members. Cocoyam and plantain lipids show in respect to their fatty acid profile, greater degree of saturation. These species tend to concentrate $C_{16:0}$ and $C_{18:1}$ components at the expense of the polyunsaturated acids (linoleic and linolenic) of onion. Since the diet in these food items are virtually carbohydrate-based, the amount of esential fatty acids supplied from them may be critical.

The contribution of plant lipids has been recognised for decades (Holman, 1918; Odoemena and Onyeneke, 1988). Plant

lipids are mainly present as triacylglycerols in seeds or in the fleshy part of fruits where they act as food stores, and provide very important commercial sources of fats and oils. In other plant tissues such as the leaves, roots or tubers, acyl lipids are mainly present as glycolipids and phospholipids (Osagie, 1988). Although the amounts of lipids in these foodstuffs are too low to make major nutritional contribution to them, the lipids content contributes towards palatability, enhances organ cellular integrity and resistance to bruishing and may play a vital role in reducing enzymatic darkening in organ flesh.

Their greater importance lies in their susceptibility to enzymic degradation and non-enzymic auto-oxidation, which may lead to rancidity in dehydrated products.

These food items are regarded as good sources of carbohydrates, some mineral nutrients, and some vitamins (Onwueme, 1978; Oyenuga, 1968, Coursey, 1968). They are however poor sources of proteins and lipids. A diet consisting of these food items should therefore be supplemented with other foods rich in the nutrients deficient for adequate nutrition.

Table 1: Total Lipid components of the Three Foodstuffs

Foodstuff	Percentage lipid composition
Allium cepa	0.95
Colocasia esculenta	0.56
Musa sapientum	0.32

Table 2: Lipid Composition of various Foodstuffs

Lipid	Percentage weight of total lipid		
	Allium cepa	*Colocasia esculenta*	*Musa sapientum*
PHOSHPOLIPIDS	50.8	20.8	27.2
Phosphatidyl ethanolamine	16.6	6.8	8.5
Phosphatidyl inositol	11.3	3.6	12.2
Phosphatidyl Choline	8.5	5.3	3.4
Phosphatidyl Serine	4.9	1.7	1.5
Lysophosphatidyl Choline	3.8	1.4	1.3
Phosphatidyl glyceride[a]	3.6	1.2	0.3
Unidentified	2.1	0.8	-
GLYCOLIPIDS	28.9	40.7	38.6
Monogalactosyl diglyceride	12.5	19.1	14.9
Digalactosyl diglyceride	7.2	7.3	8.5
Steryl glucoside	3.7	2.3	6.7
Cerebroside	2.9	5.2	1.8
Unidentified	1.4	4.6	4.6
Unidentified	1.4	2.2	2.1
NEUTRAL LIPIDS	20.3	38.5	34.2
Triglycerides	12.2	28.5	21.7
Diglycerides	1.7	2.2	6.3
Steryl esters	4.8	1.8	4.5
Free sterols	1.3	4.6	1.7
Unidentified	0.3	1.4	-

a: Tentatively identified by their chromatographic behaviour on TLC.

Table 3: Fatty Acid components of the Three Foodstuffs

Item	Fatty acids (%)										
	C12:0	C14:0	C16:0	C16:1	C18:0	C18:1	C18:2	C18:3	C20:3	TOTAL	RATIO
Allium cepa	a	a	16.8	a	4.4	12.4e	57.4e	7.8	a	98.8 b c	21.2 77.6d
Colocasia esculenta	a	a	27.2	-	4.0	40.6e	22.4	5.5	-	99.7 b c	31.2 68.5
Musa sapientum	1.6	a	30.5e	-	2.6	40.8e	20.2	4.1	-	99.8 b c	34.7 65.1d

a. Trace amount: less than 0.5% b: Saturated fatty acids

c. Unsaturated fatty acids d: Comparison made between b and c ($P < 0.05$)

e. Major differences within the same column

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