

## Studies on the fatty acid composition of ungerminated and germinated seeds of *Capsicum annuum* L. and *Aframomum melequeta* K. Schumm

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### ABSTRACT

The fatty acid contents of ungerminated and germinated seeds of *Capsicum annuum* and *Aframomum melequeta* were studied. The fatty acid component of ungerminated *Capsicum annuum* seeds were cholesteryl heptadecanoate (C17.0), 1, 3-dipalmistin 2-stearin (C16.0, C18.0), trilinolein acid (C18.1), tristearin (C18.0) and triLinoleic acid (C18.1), triolein (C18.1) and trilinolenic acid (C18.3) while those of germinated *Capsicum annuum* were cholesteryl myristate (C14.0), cholesteryl palmitate (C14.0), trimyristin (C14.0), cholesteryl palmitate (C16.0), cholesteryl heptadecanoate (C17.0), 1, 3-dipalmitin 2-stearin (C16.0, C18.0), tristearin (C18.0), cholesteryl stearate (C18.0), trilinoleic (C18.2). The fatty acid components of ungerminated seeds of *Aframomum melequeta* were trimyristin (C14.0), cholesteryl palmistate (C16.0), 1, 2-dipalmitin (C16.0), cholesteryl heptadecanoate (C17.0), 1,3-dipalmitin 2-stearin (C16.0, C18.0), trilinoleic (C18.2), trioleic (C18.1) and tristearin (C18.3) while those of germinated seeds of *Aframomum melequeta* are cholesteryl heptadecanoate (C17.0), tripalmitin (C16.0), 1, 2-dipalmitin (C16.0), 1,3-dipalmitin 2-stearin (C16.0, C18.0), tristearin (C18.0), trioleic (C18.1), trilinoleic (C18.2), trilinoleic (C18.3), and n-hexa-triacontane (C36). The use of these fatty acids as edible oil and for industrial purposes are suggested.

**Keywords:** Fatty acid, Germinated, Ungerminated seeds, *Capsicum annuum* and *Aframomum melequeta*

### INTRODUCTION

*Capsicum annuum* is commonly called sweet pepper in English and “Ntuen Okpo” in Ibibio. *Capsicum annuum* belongs to the family solanaceae. It is a small bushy annual of 30cm-1.5m tall. It is sometimes, herb or sub-shrub [1]. The fruit of *Capsicum annuum* can be classified as berry or capsule. The unripe fruit is characteristically green in colour but when ripe, is either red, yellow or Orange [2]. *Capsicum annuum* is an important ingredient in most Nigerian cooked dishes. It is used fresh as food condiment [3]. The fruits of *Capsicum annuum* are counter irritant, anti-flatulent and laxative. The fruits of *Capsicum annuum* contain very little carbohydrate, hence highly recommended for diabetic and obese persons [3]. Infusion/volatile oil of the fruit is used to cure ringworm and rheumatism [4]. The red colour of *Capsicum* is important to spice industries where it is used to impart colour to food products [5; 6].

*Aframomum melequeta* is a member of the family Zingiberaceae, a major family of tropical and subtropical fruits [7;1]. *Aframomum melequeta* has its common name as alligator pepper and Ibibios call it “Ntuen Ibok” because of its popular use in ethnomedicine. *A. melequeta* is a perennial monocotyledonous herbaceous plant that produces spicy edible fruits. It is somewhat palm-like in appearance forming dense dumps and growing to a height of 1.2 to 1.5m with divided narrow, bamboo-like smooth leaves that can be up to 25cm long. The seeds of *A. melequeta* are approximately oval in shape, hard and shiny with reddish brown colour [2]. *Aframomum melequeta* is used as an

effective anti fungal and antimicrobial agent [8;9]. The seed of *A. melegueta* is used as condiment for flavouring corn spirit and beer [8]. It is used for the treatment of measles and leprosy [10]. *A. melegueta* has been shown to reduce hemorrhage, particularly one associated with child birth [3].

Fatty acids occur mainly in plants in bound form, esterified to glycerol as fats or lipids [11]. Saturated fatty acids (Lauric acid, myristic acid, palmitic acid, stearic acid) and unsaturated fatty acids (Oleic acid, Linoleic acid, Linonic acid, arachidic acid) have been shown to exist in plants [11]. Plants lipids, unlike those of animals are rich in unsaturated fatty acids [11;12]. [13] Studied the properties and potentials of Rubber seed (*Hevea sinensis*) and showed that rubber seeds contain 80% lipids. The fatty acids present in the seed are stearic acid (8.32%), palmitic acid (38.2%) and linoleic acid (24.3%). He suggested that the oil could be of great importance in manufacturing industries. Work done on vegetable fats and oil by [14] showed that coconut lipid forms about 66% of the exosperm of the fruit. Fatty acid profile of the lipids are caproic acid (0.44%), caprylic acid (7.77%), lauric acid (5.5%), capric acid (8.75%), palmitic acid (7.22%) and linoleic acid (1.55%).

The fatty acids content of ungerminated and germinated seeds of *Capsicum annuum* and *Aframomum melegueta* have not been clearly studied and documented. This work aims to study such.

## MATERIALS AND METHODS

The method of [10] was employed for extraction. Lipids were extracted by grinding 50g each set of seed sample with a sterile mortar and pestle. Propanol (200ml) was added while grinding to inactivate the enzymes. Each set of the ground seeds were suspended, with stirring in 200ml of chloroform-methanol (2:1V/V). Butylated hydroxytoluene (0.005% W/V) was added as anti-oxidant to protect polyunsaturated fatty acids. The mixtures were filtered and the filtrates were evaporated to dryness in a hot water bath at 50°C. The weight of the total lipids was determined gravimetrically.

The method of [10] was also adopted. Fatty acid esters were prepared by saponifying 20mL of 50% methanol KOH with 3ml of lipids fats for 30 minutes with Conc. Sulphuric acid added to the level of 5%. The mixture was refluxed for a period of one hour and the reflux action was repeated for a period of 30 minutes after addition of water. BF<sub>3</sub> methanol for methylation was used and was dried over sodium sulphate. Analysis of the fatty acid esters with GLC was done using varian 3000 series GC with SPI and FID.

## RESULTS AND DISCUSSION

The ungermination percentage of *Capsicum annuum* and *Aframomum melegueta* were 0±20% and 0±1.5% respectively. The germination percentage of *Capsicum annuum* were 95±2.0% and 90±1.5% respectively. The percentage of the total lipid for both ungerminated seeds of *Capsicum annuum* and *Aframomum melegueta* were 16.0% and 5.1% respectively. Similarly, the percentage of the total lipid of germinated seeds of *Capsicum annuum* and *Aframomum melegueta* were 14.9% and 4.6% respectively.

Based on the constitution of the gas liquid chromatography peaks, the fatty acid component of ungerminated seed of *Capsicum annuum* are cholesteryl heptadecanoate (17.0), 1,3-dipalmitic 2-stearin (C16.0, C18.0) trilinolein (18.1), triolein (C18.1), tristearin (C18.0) and trilinoleic (C18.3) (Table 1, figures 1-3) while those of germinated seeds of *C. annuum* are cholesteryl myristate (C14.0), cholesteryl palmitate (C16.0), cholesteryl heptadecanoate (C17.0), 1,3-dipalmitin 2-stearin (C16.0, C18.0), trilinoleic (18.3), tristearin (C18.0), cholesterol stearate C18.0, trimyristin (14.0). (Table 2 and figures 4-6). Similarly, the fatty acid component of ungerminated seed of *Aframomum melegueta* are trimyristin (C14.0), cholesteryl palmitate (C16.0), 1,2-dipalmitin (C16.0), cholesteryl heptadecanoate (C17.0), 1,3-dipalmitin, 2-stearin (C16.0, C18.0), triolein (C18.1), trilinolein (C18.2), tripalmitolein (C16.1) and trilinolenin (C18.3) (Table 3 and figures 7-9), while those of germinated seeds of *A. melegueta* are 1,3-dipalmitic (C16.0, C18.0), 1,2-dipalmitic (C16.0), tripalmitin (C16.0), tristearin (C18.0), 1,2-dipalmitic (C16.0), tripalmitin (C16.0), tristearin (C18.0), triolein (C18.1), trilinolein (C18.2) trilinolenin (C18.3) and n-hexatetracontane (C36) (Table 4 and figures 10-12). Similar results were reported by [15] who worked on the lipids composition of lesser known tropical seeds, African star apple, bitter kola, *Denetha tripetala* and *Piper guinensis* and they showed that these seeds contained fatty acid such as myristic, palmitic, stearic, oleic, linoleic and linolenic acids. They showed that this oil can be used for frying and industrial purposes. Moreover, [13] who studied the properties and potentials of rubber seed (*Hevea brasiliensis*) also reported that the plant contained fatty acids such as stearic acid, palmitic acid and linoleic acid can be used as cooking oil and production of valuable items. It is suggested that the fatty acid of *C. annuum* and *A. melegueta* can be used as edible oil and for industrial purposes.

Table 1: Fatty acid of ungerminated seeds of *Capsicum annuum* expressed as percentage of the total fatty acids

Type of seed used	Types of lipid	Lipid fraction in percentage	Cholestryl heptadecanoate C17.0	1,3-Dipalmitic 2-Stearin C16.0 C18.0	Trilinolein C18.2	Triolein C18.1	Tristearin C18.0	Trilinolenin C18.3
<i>Capsicum annuum</i> (ungerminated)	Neutral lipid	9.0	15.912	17.824	20.395	19.587	0	0
	Glycolipids	2.0	15.901	17.602	0	0	0	20.390
	Phospholipids	5.0	15.931	17.931	19.988	0	18.005	0
	Total	16.0						

TABLE 2: Fatty acid of germinated seeds of *Capsicum annuum* expressed as percentage of the total fatty acids

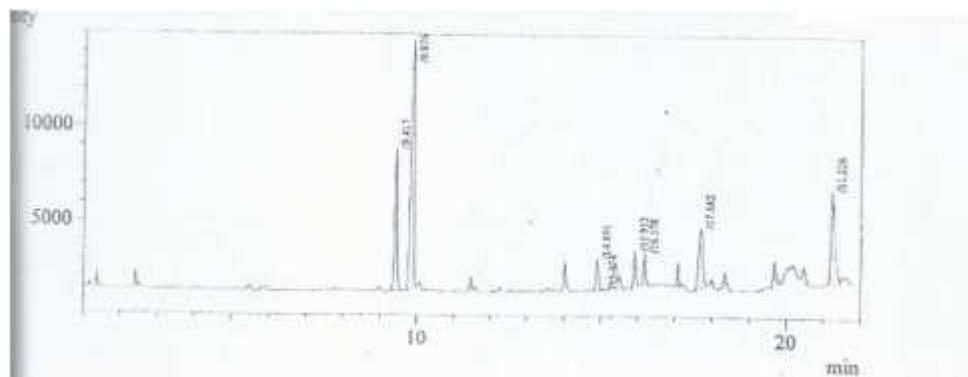
Type of seed used	Types of lipid	Lipid fraction in percentage	Cholestryl myristate C14.0	Cholestryl palmitate C16.0	Cholestryl heptadecanoate C17.0	1,3-Dipalmitic 2-Stearin C16.0 C18.0	Tristearin C18.0	Trilinolein C18.0	Cholestryl stearate C18.0	Trimyristin C14.0
<i>Capsicum annuum</i> (germinated)	Neutral lipid	8.7	14.891	15.074	15.912	17.682	21.226	0	16.178	0
	Glycolipids	1.8	0	15.358	0	17.682	0	18.330	0	14.020
	Phospholipids	4.4	0	0	0	17.194	20.504	0	0	0
	Total	14.9								

TABLE 3: Fatty acid of Ungerminated seeds of *Aframomum melegueta* expressed as percentage of the total fatty acids

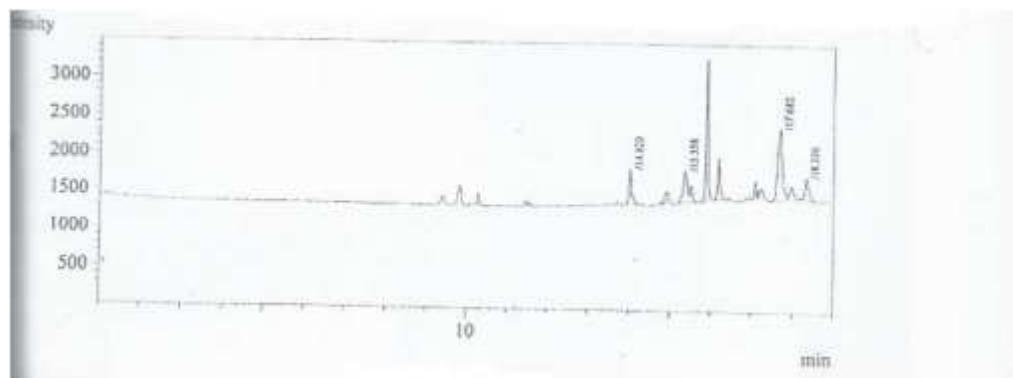
Type of seed used	Types of lipids	Lipid fraction in percentage	Cholestryl palmitate C 16.0	Cholestryl C 16.0	Cholestryl heptadecanoate C 17.0	1,3-Dipalmitic 2-Stearin C16.0 C18.0	Tripalmitolein C 16.1	Trilinolein C 18.2	Trimyristin C 14.0	Triolein C 18.1	Trilinolenin C 18.3	1,2-dipalmitin
<i>A. melegueta</i> (Ungerminated)	Neutral lipid	3.02	15.214	0	17.815	20.98	16.737	0	19.802	21.707	16.737	0
	Glycolipids	0.8	15.414	0	17.713	20.553	0	0	19.78	21.325	0	12.271
	Phosphorus	0.13	0	15.942	17.737	20.66	0	13.148	0	21.312	0	0
	Total	5.1										

TABLE 4: Fatty acid Ungerminated seeds *Aframomum melegueta* expressed as percentage of the total fatty acids.

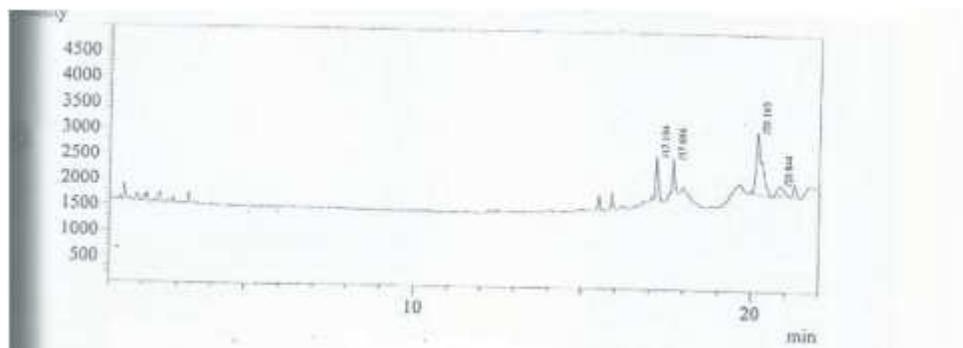
Type of seed used	Types of lipid	Lipid fraction in percentage	Cholestryl Heptadecanoate C17.0	1,3-Dipalmitic 2-Stearin C16.0 C18.0	Trilinolenin C18.2	Triolein C 18.1	Tristearin C18.0	n-hexatriacontane C36	Trilinolenin C16.0	Tripalmitin C16.0	1,2-dipalmitin C16.0
<i>A melegueta</i> (germinated)	Neutral lipid	2.98	0	17.880	20.226	19.924	18.949	8.990	21.541	0	11.268
	Glycolipids	0.72	0	0	20.538	19.648	0	0	21.342	16.525	11.268
	Phosphorus	1.0	0	17.979	20.233	0	0	0	21.439	0	023.536
	Total	4.6	0	35.859	60.997	39.572	18.949	8.990	64.322	16.525	



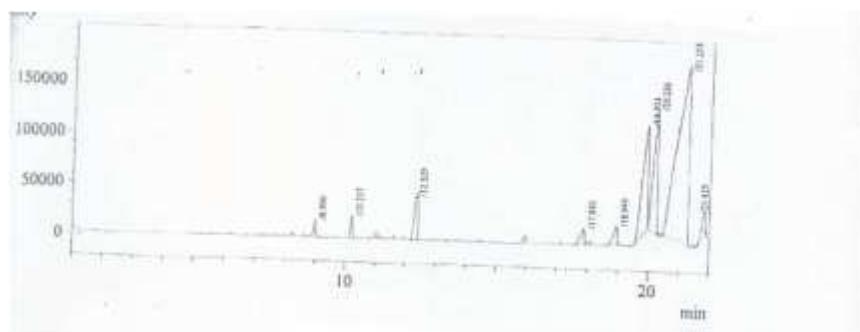
**Figure 1: Fatty acid profile of neutral-lipid of Ungerminated *C. annuum***



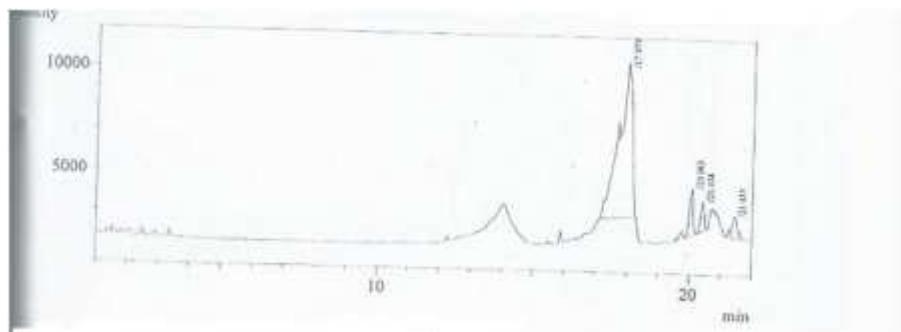
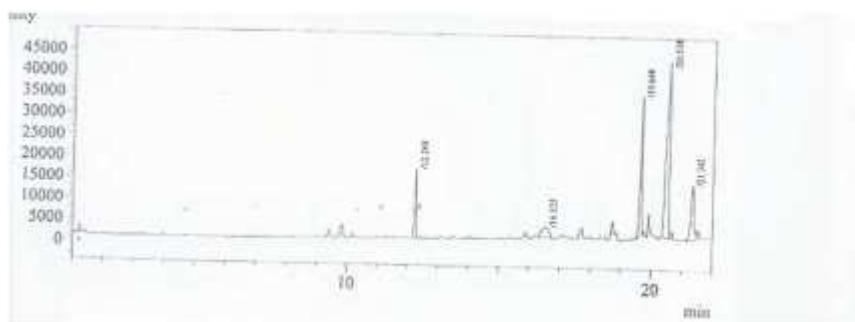
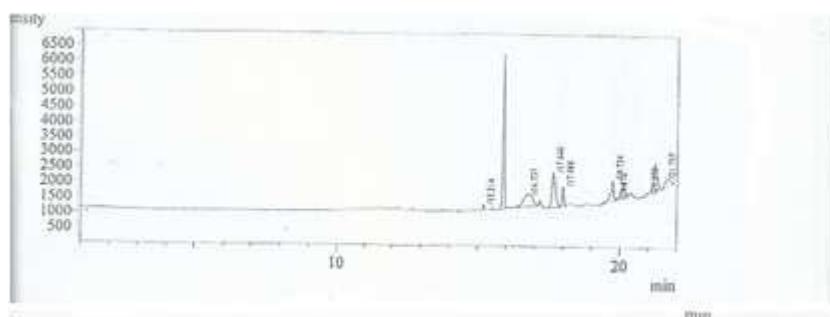
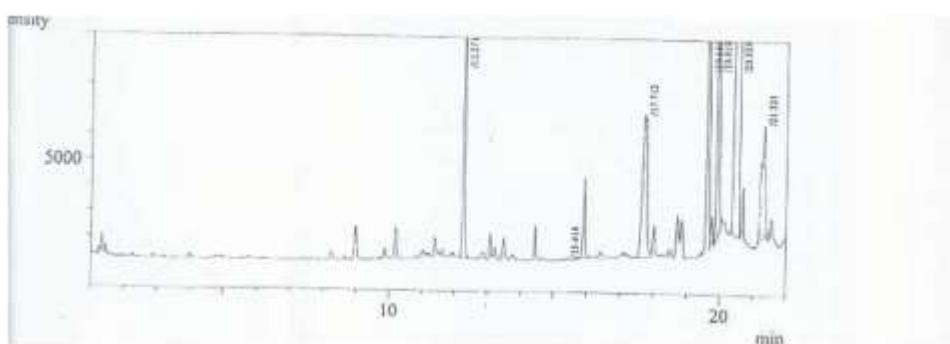
**Figure 2: Fatty acid profile of Glycolipid of Ungerminated *C. annuum***

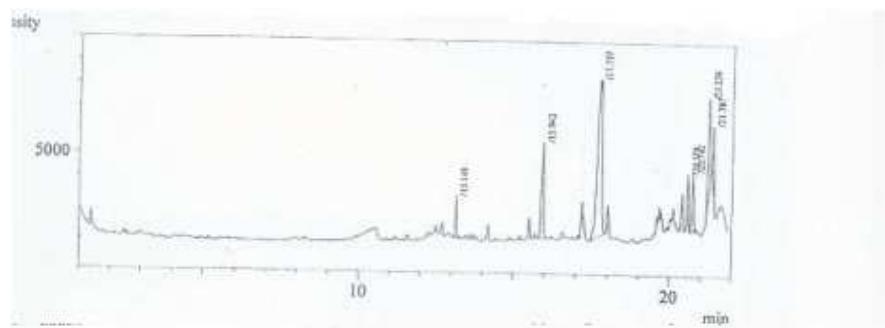
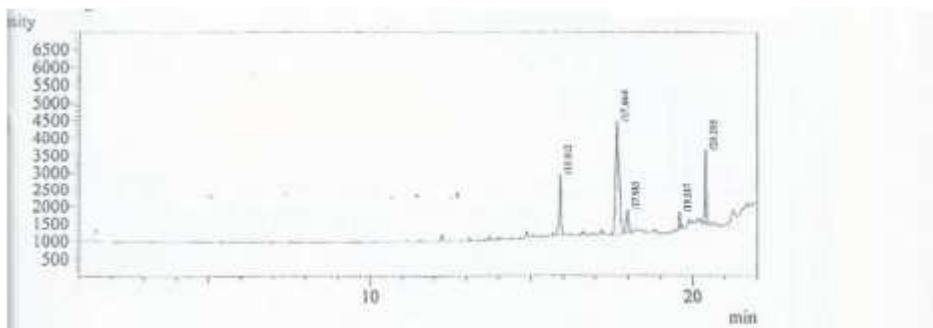
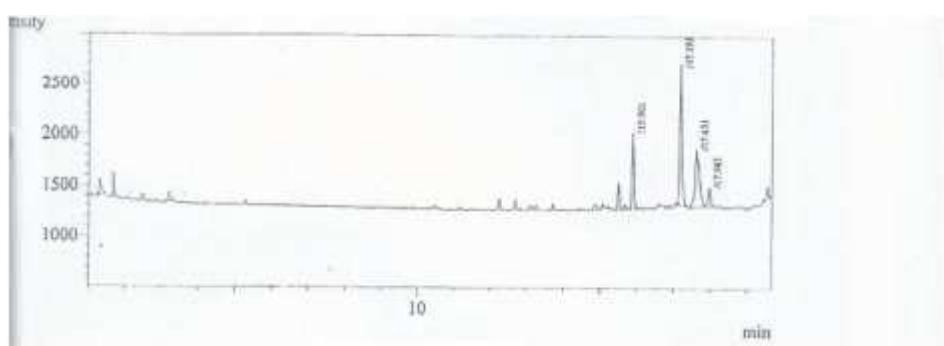
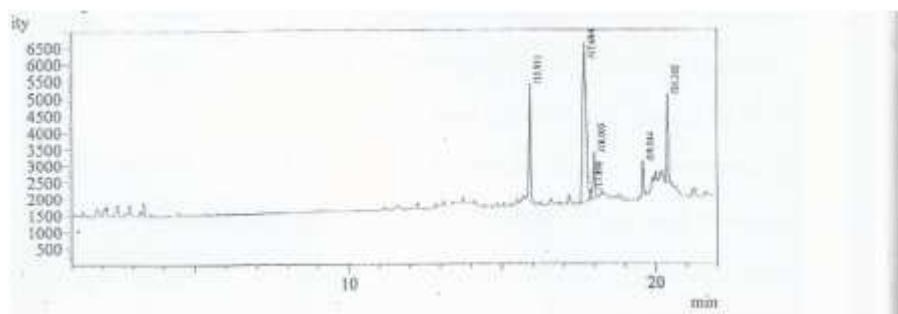


**Figure 3: Fatty acid profile of Phospholipid of Ungerminated *C. annuum***



**Figure 4: Fatty acid profile of neutral-lipid of germinated *C. annuum***

Figure 5: Fatty acid profile of glycolipid of germinated *C. annuum*Figure 6: Fatty acid profile of phospholipid of germinated *C. annuum*Figure 7 Fatty acid profile of neutral-lipid of ungerminated *A. melegueta*Figure 8 Fatty acid profile of glycolipid of ungerminated *A. melegueta*

Figure 9 Fatty acid profile of phospholipid of ungerminated *A. melegueta*Figure 10: Fatty acid profile of neutral-lipid of germinated *A. melegueta*Figure 11: Fatty acid profile of glycolipid of germinated *A. melegueta*Figure 12: Fatty acid profile of phospholipid of germinated *A. melegueta*

## CONCLUSION

Seeds of *Capsicum annuum* and *Aframomum melegueta* contains fatty acids such as stearic acid, palmitic acid and linoleic acid which can be used as cooking oil and production of valuable items. It is suggested that the fatty acid of *C. annuum* and *A. melegueta* can be used as edible oil and for industrial purposes.

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