ELEMENTAL ANALYSIS AND FATTY ACID PROFILE OF THE OIL EXTRACT FROM *RHYNCHOPHORUS FERRUGINEUS* LARVA

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Abstract— This experimental study through elemental analysis and fatty acid profile of oil extract from *rhynchophorus ferrugineus* larva revealed the unsaturation of the oil as a result of the presence of palmitoleate which is an ester of palmitoleic acid (omega 7 mono-unsaturated fatty acid), the appreciable presence of minerals from AAS in parts per million are obtained for Calcium (28.32), Zinc (0.17), Potassium (8.63), Sodium (7.53), Magnesium (12.61), Iron (0.23). Iodine, saponification, cholesterol, , protein, fat, crude fibre, acid, peroxide, mineral and vitamin contents of the oil extract were determined. Iodine value (128.19mg/g) is within the range of class of semi - drying oil. The peroxide value (6.93meq/kg) is in agreement with the maximum Codex standard peroxide value (10meq/kg). The cholesterol value of the oil (20.2mg/dl) is below the tolerable limit of 120 – 200mg/dl. The vitamin A content (500mg/l) of the oil is good. There are presence of vitamins A (500mg/l), D (6.41mg/l), B_1 (92mg/l), E (0.61mg/l) and C (3.00mg/l), protein content (11.55%), crude fibre (52.57%). These data indicate that the oil could serve as a dietary supplement. The high saponification value (257.78mg/KOH/g) indicated that the oil is suitable for soap making. The consumption of raffia palm maggot oil is recommended because of its nutritional and medicinal values, more importantly as a food supplement.

Keywords— Elemental Analysis, Oil extract, Unsaturation, Fatty acid, *Rhynchophorus ferrugineus* larva, Food supplement.

I. INTRODUCTION

Rhynchophorus ferrugineus larva, commonly known as edible maggot is a good source of protein, rich in fatty acid (EPPO, 2008), and contains phosphorus, calcium, zinc, etc (Murphy and Briscoe, 1999).The larva contains a great amount of fibre that provides a great source of diet roughage. The consumption of *Rhynchophorus ferrugineus* larva as a dietary delicacy has continued to be of interest over the years in some tropical areas of the world. But, the mode of preparation for consumption has relied solely on roasting and frying after boiled with little seasoning in water. Some communities consumed the raw larva without minding any health implications including any adverse effects of the oil contained in the larva. Systematic efforts have been made to carry out proximate and elemental characterization of the oil towards establishing the chemical, physical properties and evaluating the cholesterol level, iodine value, etc (Onuchukwu and Ihekire, 2000). The volatility of the oil, odour, colour, specific gravity etc., are issues thrown up for elucidation and other related parameters sought towards establishing the quality of the oil extract.

This study seeks to isolate, identify and characterize the physiochemical compositions of the oil extract. In addition to protein and carbohydrates, fats and oils are the third principal constituents of food, because they represent an important source of energy and contribute to the optimal performance of the body

II. DETAILS EXPERIMENTAL

2.1 Materials and Procedures

The live (*Rhynchophorus ferrugineus*) larvae specimens were sourced from Oraifite town in Anambra State Nigeria, washed with water to keep clean, dried and milled into powdery form and taken to the laboratory for oil extraction and other physio-chemical characterizations.

2.2 Elemental Analysis Using Atomic Absorption Spectrophotometer

The sample is thoroughly mixed by shaking, and 100ml is transferred into a beaker of 250ml capacity. The sample is aspirated into the oxidizing air – acetylene flame or nitrous oxide acetylene flame. When the aqueous sample is aspirated, the sensitivity of 1% absorption is observed.

2.3 Sample Digestion

Weigh out 5ml of the oil sample into a digestion flask and add 20ml of the acetic acid mixture (650ml conc. HNO_3, 80ml perchloric acid, 20 ml conc.H_2SO_4). Heat the flask until a clear digest is obtained. Dilute the digest with distilled water to the 100ml mark. Appropriate dilutions are then made for each element

2.4 Determination of Fatty Acid Profile Using Gas Chromatography

Measure out about 2ml of oil in a small beaker and record the exact weight. The oil was subsequently methylated to obtain the methyl esters of the fatty acids using the method A.O.AC. (2006). One half micro litre of the sample was then injectedinto the Hewlett Packard 6890 Gas Chromatograph and the chromatogram of the separated fatty acid methyl esters was obtained as described by the Standard Analytical Methods (1999).

The saponification value (S.V), iodine value (I.V), peroxide value (P.V), cholesterol value, crude fat, crude fibre, crude protein, glucose content and vitamin contents were determined.

III. RESULTS AND DISCUSSION

Table 1: Fatty Acid Profile Test from Gas Chromatography

Component	Name	Concentration (ppm)
C20	Arachidic Acid	271.95
C30+	Mellistic Acid	454.25
C17	Magaric Acid	17.26
C18	Methyl Stearate	380.73
C14	Myristate	7.70
C12	Lauric Acid	49515.20
C16:2	Palmitoleate	46195.18
C16	Palmitic Acid	249.46

Table 2 : Elemental Characterization by AAS

Element	Concentration (ppm)
Aluminium (Al)	ND
Arsenic (As)	ND
Cadmium (Cd)	ND
Calcium (Ca)	28.32
Chromium (Cr)	ND
Cobalt (Co)	ND
Copper (Cu)	0.26
Iron (Fe)	0.23
Lead (Pb)	ND
Magnesium (Mg)	12.61
Manganese (Mn)	0.05
Mercury (Hg)	ND
Molybdenum (Mo)	ND
Nickel (Ni)	0.18
Potassium (K)	8.63
Silver (Ag)	ND
Sodium (Na)	7.53
Tin (Sn)	ND
Zinc (Zn)	0.17

Note: ND = Not Detectable

Table 3: Chemical Parameters of Oil Extract from *Rhynchophorus ferrugineus* larva

Chemical Parameter	Value
Iodine Value	128.19mg/g
Saponification Value	257.78mgKOH/g
Peroxide Value	6.93meq/kg
Cholesterol Value	20.2mg/dl
Glucose Content	1.04mg/g
Crude Fibre (%)	52.57
Crude Fat (%)	23.25
Crude Protein (%)	11.55

Table 4: Vitamins Composition by weight (mg/l)

Vitamin	Value
Vitamin A	500 mg/l
Vitamin E	0.61mg/l
Vitamin C	3.00 mg/l
Vitamin D	6.41mg/l
Vitamin B_1	92 mg/l

3.1. The Fatty Acid Profile Test by Gas Chromatography summarized in **Table 1,** reveals a preponderance of saturated and unsaturated fatty acids. The oil contains a large quantity of palmitoleate (C16:2) which is an ester of palmitoleic acid (omega 7 monounsaturated fatty acid) which indicates the presence of 16 carbon chains with two double bonds. Thus, the oil contains mono-unsaturated fatty acid as well as saturated fatty acid as a result of the high presence of lauric acid and small quantity of other saturated fatty acids.

The elemental characterization data of the oil extract using AAS as presented in **Table 2,** shows that the oil contains Calcium, Magnesium, Potassium and Sodium in large quantities which are the indices of nutritive value of food. The oil also contains Iron, Copper, Zinc and Manganese in minute quantities. These elemental presences are known to play beneficial roles to the good health of a consumer.

From the chemical characterization as shown in **Table 3**, the fibre, crude fat and protein contents, 52.57, 23.25 and 11.55% respectively suggest the attraction of the oil as a food supplement. The peroxide value of the oil sample (6.93meq/kg) was in agreement with the maximum Codex Standard peroxide value which is 10meq/kg for vegetable oil deterioration. It shows that *Rhynchophorus ferrugineus* larva oil extract has significantly high peroxide value which suggests strongly that the oil extract has high content of unsaturated fatty acids.

The iodine value (128.19mg/g) in **Table 3**, which is a measure of the degree of unsaturation of edible oil, is within the range of class of semidrying oils which are yet another strong suggestion that the oil contains some proportion of unsaturated double bonds.

The cholesterol value of the oil extract (20.2mg/dl), which falls below the tolerable limit of 120 – 200mg/dl (WHO, 2006), implies that using the oil extract in our daily diet would achieve a remarkable degree of protection from cholesterol induced diseases such as, high blood pressures, stroke, clogged arteries and cardiac congestion (PAC, 2007).

The crude fibre content of the raffia larva (52.57%) shows that the maggot is very rich in dietary fibre. According to literature (Bokhari and Abuzuhira, 1992), it helps to prevent constipation by increasing the stool weight and decreasing gut transit time Fibre provides bulk in the diet without added calories and can give a satiating effect on appetite and also helps in body weight management. However, the very low

sugar content (1.04mg/g) is good for adult, but falls short of children's need.

The high saponification value (257.78mgKOH/g) of the oil extract is an indication that the oil is suitable for soap making. But, the limited quantity obtainable from the various modes of extraction makes it commercially unattractive for soap making (Onuchukwu, 1998).

The protein content (11.55%) implies that *Rhynchophorus ferrugineus* larva oil extract can contribute significantly to the daily human protein requirements. Indeed, this is a plus for the quest as food by many communities.

From the results on the test for Vitamins presented in **Table 4**, the bountiful presence of vitamin A (500mg/l) in the oil makes the oil a good dietary supplement in Vitamin A deficient diets. The good presence of Vitamin D (6.41mg/l) showed that the oil may serve as a good dietary supplement in Calcium deficient meals. The oil contains little quantity of vitamin E (0.61mg/l) which is an anti-oxidant and according to literature (Hunter, 2006) is used as an anti-aging portion. Vitamin B_1 level (92mg/l) in the oil implies that it could serve as a good source of Vitamin B_1 in diets. Vitamin C (3.00mg/l) is contained in the oil, therefore it further strengthens its quality as a food supplement because according to literature (Kirk and Sawyer, 1991), Vitamin C holds the cells together, heals wounds and builds bones and teeth.

CONCLUSIONS

In this study, a considerable effort is made to establish the physical, chemical and even the biological compositions of the oil extract from *Rhynchophorus ferrugineus* in order to provide explanation for the insatiable desire in the consumption of these larvae by the people. The characterizations reveal that the oil extract contains condiments of high nutritional values, appreciable vitamins and minerals with low cholesterol value.

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