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Physico-chemical Studies and Fatty acid Composition of Oil Extracted from Black Weevil Larva from Okitipupa Area in Ondo State, Nigeria *(Rhynchophorus phoenicis)*

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Abstract Studies were conducted on the physicochemical activities and fatty acid compositions of oil from larva of black weevil (*Rhynchophorus phoenicis*). The percentage yield of the sample was high (69.100±0.20 %), this showed that it is an oily insect. The refractive index and the specific gravity were 1.410±0.01 and 0.9130±0.01 respectively. The results of the Chemical Composition of Oil From Larva of *Rhynchophorus phoenicis* (Palm Weevil) indicated that the sample had Acid value (mg/g) 8.970±0.02, Iodine value (g/100g) 13.980±0.05, Peroxide Value (mmol/kg) 9.100±0.02 and Saponification Value (mg/g) 460.520±0.20 respectively. The results of the Fatty acid Composition of Oil from Palm Weevil Lavawere: Myristic Acid (0.0914), Palmitic Acid(14.1912), Palmitolei Acid (0.0496), Margaric Acid (0.1140), Stearic Acid (5.7710), Oleic Acid (23.8556), Linolenic Acid (0.0053) and Arachidic Acid (1.7934) respectively. These results indicated that the Larva of *Rhynchophorus phoenicis* is unsaturated and can be employed industrially based on the level of the unsaturated *fatty acid present.*

Keywords Palm weevil, Extraction, oil, Fatty acid, unsaturated

Introduction

Black palm weevils called *Rhynchophorus phoenicis* and its larva popularly known as “Edible worm” is delicacy in many parts of Congo and Nigeria and other countries in Africa where it is found. The larva is known by the name of “Tsombé” by the many ethnic groups in Congo, who strongly believe it to have high nutritive as well as certain pharmaceutical potentials. The weevil is called ‘Ugo’ and its larvae ‘Uton’ in Owo and Idanre town in Nigeria. The mode of preparing for eating differs from one geographical locality to another. In some places, it is boiled (ethnics groups in north of Congo) while others smoke, fry (ethnics groups in South-west of Nigeria) or simply eat it raw (ethnics groups in south of Congo) [1]. The larva of *Rhynchophorus phoenicis* is a “delicacy” and is usually used as a food supplement by those who feed on it. It is usually consumed as part of a meal or as a complete meal with bread or tapioca. When compared with conventional animal food supplements such as beef, chicken, pork and fish, which have moisture content within the range of 40 - 70% [1], the larva is seen as a high moisture food supplement. The high moisture content may imply that most of the essential nutrients in the larva will be in solution and in forms that are easily available to the body when the larva is consumed as food [2]. Dehydration would generally help to increase the relative concentrations of the other food components and in addition would improve the shelf life/preservation of the larva. The fat content of the larva is quite high. On a dry weight basis, the lipid content of the larva is higher than the amount found in most conventional foods like beef, chicken, egg, Herring, Mackerel and milk [3]. This high lipid content of the larva is seen to contribute to its highly acceptable flavour when roasted or fried [2]. Malnutrition in developing countries is as much or more, a problem of caloric deficiency as of protein deficiency [4]. The fat level implies that a 100 g sample of the larva will meet the caloric needs in most developing countries [5]. The protein content of *Rynchophorus phoenicis* larva shown in Table 2 compares with those from most conventional protein sources [3]. The high protein content of the larva is suggestive of the potential of the larva being used in combating protein deficiency. If the larva is dehydrated and defatted, it can be regarded as a good source of protein [2]. A relatively high ash value is observed for the larva, when compared with the reported values for meats, meat products and poultry [1].

Insects are known to be rich sources of various macro and trace elements. These elements are probably accumulated for future use in adult exoskeleton and connective tissue synthesis. Results of the mineral composition of *Rhynchophorus phoenicis* (F) shows that 100 g sample of the insect will meet the RDA values for iron, zinc, copper, manganese, and magnesium, in most third world countries. Iron deficiency is a major problem in women diets in the developing world, particularly among pregnant women, and especially in Africa [6-7]. A rapid method for total [7] Zinc deficiency has been known to cause poor growth and impairment of sexual development.

Insect fatty acids are similar to those of poultry and fishin their degree of unsaturation [8]. Nutritionally, a high level of saturated fatty acids in foods might be undesirable because of the linkage between saturated fatty acids and atherosclerotic disorders [9]. The presence of the essential fatty acids such as linoleic, linolenic and arachidonic acids in substantial amounts further points to the nutritional value of the larval oil. One implication of the high fat content in the insect larva is that it may increase susceptibility of the undefatted larva to storage deterioration via lipid oxidation [10]. This may then be accompanied by increased browning reactions concurrent with reduced lysine availability [11]. Another implication of the high fat content is that defatting the larva will markedly increase the relative proportions of the other nutrients compassed in the proximate composition. This means that greatly increased protein contents can be achieved by defatting the larva, as can be seen in the protein value of the defatted larva [2].

In recent times, the desire to conserve resources spent on importation of oil for domestic and industrial use gave renewed impetus in the search for novel sources to complement the traditional ones. Attention as therefore be focused on under-utilized local seed, insects and their larvae for possible development and used.

The aim of this project work is to characterize oil from black palm weevil and its larval*(Rhynchophorus phoenicis)* and to compare the results from the two samples for their Physico-Chemical and fatty acid composition and the objectives of this project work are; to extract oil from both the weevil and larval of *Rhynchophorus phoenicis* and know the yield difference, to characterize the oil from both samples for their Physico-chemical and fatty acid composition and to determine the suitability and applicability of the extracted oil for industrial application and domestic consumption.

Materials and Method

Collection of plant material: Larva of *Rhynchophorus phoenicis* were obtained from local palm tree farm in okitipupa area in okitipupa Local government area in Ondo state.

Figure 1: palm weevil larva

Figure 2: Larval oil

Preparation of Dried Laval sample: Laval of *Rhynchophorus phoenicis* were manually dried under sun for three days, chopped into pieces ,reduced to fine powder with the aid of a mechanical grinder to pass through 40 mesh sieve to increase the surface area for proper analysis. The milled powder samples were collected and stored in glass jars, tightly covered and kept for analysis.

Extraction Procedure: The extraction was done by soxhlet extraction method. About 10g of the grounded sample was extracted in hexane as a solvent for 4hrs. After the extraction, the hexane is recollected back into the soxhlet apparatus, leaving the oil inside the boiling flask. The remaining hexane in the oil was dried in a vacuum oven at $75^{o}C$ for complete removal of the hexane. This process was done up to five times until a required quantity of the oil has been collected. The oil was stored at room temperature until it is required for analysis4

Characterization of the Extracted Oil: In evaluating the quality of the extracted oil from the Laval, the refractive index, saponification values, acid value, iodine value, free fatty acid value, peroxide value, specific gravity of the oil were determined using AOAC (1990).

Fatty Acid Methyl Ester Analysis (FAME): 50 mg of the extracted fat content of the sample was saponified (esterified) for five (5) minutes at 95 °C with 3.4 ml of the 0.5 M KOH in dry methanol the mixture was neutralized by using 0.7M HCl 3 ml of the 14 % boron triflouride in methanol was added. The mixture was heated for 5 minutes at the temperature of 90 °C to achieve complete methylation process. The fatty acid methyl esters were thrice extracted from the mixture with redistilled n-hexane. The content was concentrated to 1 ml for gas chromatography analysis and 1µ was injected into the injection port of GC.

Results and Discussion

Table 1: The results of the Phycico-Chemical Composition of Oil from Palm Weevil Lava (*Rhynchophorus phoenicis*)

Parameter	Value
Acid value (mg/g)	8.970±0.02
Iodine value(g/100g)	13.980±0.05
Peroxide Value (mmol/kg)	9.100 ±0.02
Saponification Value (mg/g)	460.520±0.20
Refractive Index	1.410±0.01
Specific Gravity	0.9130±0.01
% yield	69.100±0.20
Colour	Light Golden yellow

Table 2: The results of the Fatty acid Composition of Oil from Palm Weevil Lava (Rhynchophorus phoenicis)

Parameter	Value
Myristic Acid (C14 : 0)	0.0914
Palmitic Acid (C16 : 0)	14.1912
Palmitolei Acid (C16 : 1)	0.0496
Margaric Acid (C17 : 0)	0.1140
Stearic Acid (C18 : 0)	5.7710
Oleic Acid (C18 : 1)	23.8556
Linolenic Acid (C18 : 3)	0.0053
Arachidic Acid (C20 : 0)	1.7934

4.2. Discussion

The Chemical and fatty acid composition of *Rhynchophorus phoenicis* larva oil (palm weevil) was carried out to know the health benefits and the industrial application of the oil. The following results were obtained for the physic-chemical parameters; Acidvalue (mg/g) 8.97. However, the acid value of the oil must not be too high, as this denotes an excessively high content of free fatty acids, which causes the oil to turn sour. Iodine value (g/100g) 13.98±0.05, the iodine value of the oil is in agreement with the standard, thus, the oil could be classified as non-drying oil, since their iodine value are less than 100.Peroxide Value (mmol/kg), 9.10±0.02, the peroxide values helps to indicate the rancidity level of the oil. The peroxide value is usually less than 10 per gram of a fat sample when the sample is fresh. Peroxide value is an indication of level of deterioration of oil. Higher values between 20 and 40 results to a rancid taste. The low acid and peroxide values are indicators of the ability of the oil to resist lypolitic hydrolysis and oxidative deterioration [12], Peroxide value correlates with the extent to which oxidative rancidity has taken place in oil, and thus a measure of the shelf life of the vegetable oil. With the low peroxide value obtained it shows that the oil cannot easily oxidize and therefore will be generally acceptable for the absence of odor and flavor in its content. Therefore the oil is not susceptibility to oxidative rancidity and deterioration as confirmed by the low Peroxide Value. The Saponification Value of 460.52±0.20 (mg/g) was obtained for the weevil lava oil respectively. The high saponification values in both seeds' oil indicates that the oil contains a high degree of triglycerides with high fatty acids and low molecular weight, which indicate that both oil are good for soap making According to Ezeagu *et al.*, (1998) [13], a saponification value of 200 mg/KOH/g indicates high Proportion of fatty acids of low molecular weight. This shows that the oil may have a potential for use in soap making and cosmetics industry. The fatty acid composition were presented in table2.the detectable values by percentage were: Myristic Acid (C 14 : 0) 0.0914, Palmitic Acid (C 16 : 0) 14.1912, Palmitolei Acid (C16 : 1) 0.0496,Margaric Acid (C 17 : 0) 0.1140, Stearic Acid (C 18 : 0) 5.7710, Oleic Acid (C 18 : 1) 23.8556, Linolenic Acid (C18 : 3) 0.0053, Arachidic Acid (C 20 : 0), 1.7934 these values were generally lower than the value obtained by Ekpo et al,.2005, for fresh sample of the same sample but different geographical location except Stearic and Arachidic Acid .the lower value in lenolenic acid reduced the off-flavour and oxidation of some harmful product as reported [14]. Figure 1 and 2 indicated the image of the sample and its oil respectively.

Conclusion

The results obtained from the chemical and fatty acid composition of *Rhynchophorus phoenicis* larva oil indicated that the oil is non-drying oil and con not be prone to rancidity due to low acid and peroxide value discovered under examination. Also the percentage of fatty acid composition indicated that the oil had high percentage of monounsaturated fatty acid than saturated fatty acid, which could serve as important values industrially.

Recommendation

Rhynchophorus phoenicis is a good source of monounsaturated fatty acid that has many industrial application, especially the oleic acid for reduction in the risk of coronary heart disease and help in building cellular membranes that attracts oxygen to tissues.

References

1. Watt, B.K. and A.L. Merril, (1963).Consumption of foods - Raw, Processed and Prepared. U. S. Dept. of Agri. Handbook, 8: 1-189.
2. Ekpo, K.E., (2003). Biochemical investigation of the nutritional value and toxicological safety of entomophagy in Sourthern Nigeria. Ph.D Thesis, Ambrose Alli University, Ekpoma, Edo State.
3. Pyke, M., (1979). The Science of Nutrition. In: Science in Nutrition. John Murray (publishers) Ltd., London, pp: 251-258.
4. DeFoliart, G.R., (1992). Insects as Human Food. Elsevier Science (publishers), pp: 295-399.
5. Davidson, S., R. Pasmore and J.F. Brock, (1973). In: Ozimek, L., W.C. Sauer, V. Kozikowski, J.K. Ryan, H. Human nutrition and Dietetics (5th edition). The English language Book Society and Churchill livingstone, P: 77.
6. Orr, B., (1986). Improvement of Women's health linked to reducing widespread anaemia. Int. Health News, 7:3.
7. UNACC-SN, (1993). United Nation Administrative Committee on Coordination–Subcommittee on Nutrition: Micronutrient Deficiency. The Global situation. SCN News, 9: 11-16.

8. DeFoliart, G.R., (1991). Insect fatty acids: Similar to those of poultry and fish in their degree of unsaturation, but higher in the polyunsaturates. Food Insects Newslet 4(1).
9. Rahman, S.A., T.S. Ituah, O. Hassan and N.M. David, (1995). Fatty acid composition of some Malaysian freshwater fish. J. Food Chem., 54: 45-49.
10. Greene, B.E. and T.H. Cumuze, (1982). Relationship between TBA Numbers and inexperienced panel lists assessments of oxidised flavour in cooked beef. J. Fd. Sci., 47: 52.
11. Pokorny, J., (1981). In: Progress in Food and Nutrition Science. Pergamon Press, Oxford, New York, 5 (Nos 1-6): 421.
12. Akinhanmi, T.F., Akintokun, P.O., and Atasie, V.N., (2008). Chemical composition and physiochemical properties of cashew nut. J. Agric. Food. Environ. Sci., 2, 4-8.
13. Ezeagu I.E., Petze, K. J,. Lange. E. and Metges C.C. (1998). Fat content and fatty acid composition of oils extracted from selected wild – gathered tropical plant seeds from Nigeria. Journal of the American Oil Conten.1998, 75(8):1031 – 1035.
14. Gupta, M and Warner, k (2003). Frying quality and stability of low and ultra-low linolenic acid of soybeans oils. J. AM.Oil Chem.Soc.80:275-280.http://dx.doi.org/10.1007/s11746-003-0689x