BIOKEMISTRI 13: 37-41 (January 2003)

Printed in Nigeria

An international journal published by the

Nigerian Society for Experimental Biology

The lipid profile of the pallid emperor moth *Cirina forda* Westwood (Lepidoptera: Saturniidae) caterpillar

Adeolu.T. ANDE

Department of Biological Sciences,University of Ilorin, P.M.B. 1515, Ilorin. Nigeria.

Received 17 November 2002

Abstract

The phospholipid, cholesterol and triglyceride levels, as well as, the fatty acid profile of the caterpillar of *Cirina forda,* a pallid emperor moth, known for its popularity as a food insect in Nigeria, were elucidated and compared with other popular sources of lipids. *C. forda* had 554.96mg/100g, 201.01mg/100g and 244.03mg/100g of phospholipid, cholesterol and triglyceride, respectively. It proved to be a rich source of unsaturates, surpassing other popular lipid sources as a source of polyunsaturates. It is rich in fatty acids such as Linolenic acid (33.84%), Linoleic acid (7.81%) and Oleic acid (12.93%). The possible nutritional implications of the consumption of *C. forda* caterpillar on the human nervous system are highlighted.

Key words: lipid profile, *Cirina forda,* caterpillar

E-mail: andeolu@yahoo.com

INTRODUCTION

The pallid emperor moth, *Cirina forda* Westwood (Lepidoptera: Saturniidae) caterpillar, is a lesser known but readily acceptable food insect in kwara state, Nigeria (Fasoranti and Ajiboye, 1986; Ande, 1991). Like other animal sources, such as fish, shellfishes and beef (Jay, 1978), *C. forda* has a desirably high crude protein content of 64.49% on dry weight basis (Ande, 2002), hence it is a reliable protein food source to peasants. Lipid quality varies widely in plants and animal foods (Swaminathan, 1986). In insects it ranged from 10% in Honeybees (*Apis mellifera*) to 58% in wax moth caterpillars (*Galleria mellonella*) (Dierenfield, 1993). Dunkel (1998) observed that insects have a good fatty acid content and low cholesterol level and concluded that they may be a better nutritional source to man. A commendable ether extract proportion of 21.45% (dry weight basis) was recorded in *C. forda* caterpillar (Ande, 2002), but its quality has not been reported. This dearth of information has been standing in the way of the utilization of this relatively rich lipid source to the benefit of man and the assessment of the extent to which the lipid component fits into the human dietary requirements. This study therefore attempts to determine the phospholipid, cholesterol and triglyceride levels, as well as, the fatty acid profile of the lipid available in *C. forda* caterpillar, and to compare these values with reports on other popular plant and animal lipid sources.

MATERIALS AND METHODS

Dried processed *C. forda* caterpillar procured from Ipata market, Ilorin, Nigeria were pulverized and sifted through a 20-mesh size sieve. 1.5g of each sample were weighed into a 25ml test tube and 20ml of Chloroform: Methanol (2:1v/v) was added (Folch *et al.*, 1957). The extraction was done in three replicates. The tubes were corked and shaken intermittently and left overnight at room temperature. The extracts were purified using the method described by Amenta (1964). The phospholipid and cholesterol levels were quantified using the method of Abell *et al.* (1958).Triglyceride values were calculated by difference as: 100 – (phospholipid + cholesterol). The fatty acid profile was determined using the Gas Liquid Chromatographic technique. The Capillary Gas Chromatograph (Schimadzu GC-14B) fitted with fused Silica Capillary Column (2.5m x 0.25m ID) with GREA integrator was used. The fatty acid quantity and quality were obtained by comparing their retention time with those of standards obtained from Nocheck preparation, USA.

RESULTS AND DISCUSSION

C. forda Westwood caterpillar had a phospholipid, cholesterol and triglyceride composition of 554.96mg/100g, 201.01mg/100g and 244.03mg/100g, respectively. The relatively higher phospholipid content is understandable, as this forms a basic constituent of cell membranes, and lipoproteins, which are abundant in animal samples (Swaminathan, 1989). The cholesterol content (201.01mg/100g) though higher than anticipated, is comparable to values in beef, pork, liver and butter, but lower than that of egg yolk, and it falls in the range described as good (Swaminathan, 1989).

Ritter (1990) observed that sterol composition of insect tissues might change when they feed on a different diet. Thus the cholesterol level of *C. forda* may be

Table 1: The proportions of various fatty acid components of *C. forda* caterpillar as compared with other popular edible plant and animal sources

Fatty acid component	Concentration (%)						
	Animal sources				Plant sources		
	*C. forda	[1]Beef	[1]Pork	[1]Cow milk	[2]Palm oil	[3]G/nut oil	[4]Melon oil
Myristic (14:0)	0.66	-	14	10	2.0	-	-
Palmitic (16:0)	17.15	13	6	30	46.8	8.6	12.8
Palmitoleic (16:1)	0.32	-	-	2	-	-	-
Stearic (18:0)	27.42	65	10	10	4.8	3.7	16.8
Oleic (18:1)	12.93	20	43	30	34.6	61.8	18.1
Linoleic (18:2)	7.81	-	10	2	11.8	19.7	52.3
Linolenic (18:3)	33.84	-	-	-	-	-	-
Saturated acids	45.23	78.0	30.0	50.0	53.6	12.3	29.6
Unsaturated acids	54.90	20.0	53.0	34.0	46.4	81.5	70.4
Polyunsaturated acids	41.65	-	10.0	-	11.8	19.7	52.3

** Values are means of 6 replicates: [1]Alais and Linden (1999), [2]Umoh (1998), [3]Elegbede (1998), [4]Achinewhu (1998)*

modified by offering a special diet wherein Δ5-sterols are replaced with Δ7-, Δ5,7- or Δ0-sterols (Ritter, 1984). The encouragingly high triglyceride composition of *C. forda* may be the resultant effect of the need for the mature larva/prepupa to store energy for metabolism during the prolonged 9-month pupal duration, which is devoid of feeding activity (Ande, 1991).

Although plant oils are generally richer in unsaturates (Alais and Linden, 1999), *C. forda* oil proved to be richer than all animal sources considered in Table 1, as well as, palm oil; a plant source. The relative proportion of unsaturates to saturates in *C. forda* is approximately 1:1. As a source of polyunsaturates (PUFA), *C. forda* surpasses all except soybean in which 85% has been reported (Elegbede, 1998) and melon oil (Table 1). Going by the rating suggested by Swaminathan (1989), *C. forda* is a rich source of Essential Fatty Acid (EFA), with 41.65% unsaturates. Of particular interest is Linolenic acid (33.84%), which is essential for the functioning of the retina and nerve formation and whose occurrence along with

Linoleic acid presupposes a balanced fatty acid diet. The considerably higher Linolenic acid value may however inhibit transformation of Linoleic acid into Arachidonic acid (Alais and Linden, 1999), another desirable EFA not found in *C. forda*. The occurrence of Oleic acid in *C. forda* may be an advantage, as it could be readily converted to either α-Linolenic or γ-Linolenic or both which are EFAs.

C. forda therefore is a good source of unsaturated fatty acids, particularly Linolenic acid. Thus it may be good in the diet of old people since the activity of 6Δdesaturase enzyme falls with age. The oil can also find ready use in pharmaceutical and other industries apart from its food value.

AKNOWLEDGEMENT

The provision of a bench space and financial assistance by the Council for Scientific and Industrial Research (CSIR), India is acknowledged.

REFERENCES

Abell, L. L., B. B. Levy, B. M. Brodie and F. E. Kendall (1958) A simplified method for estimation of total cholesterol in the serum and determination of its specificity. . *J. Biol. Chem.* **195***:* 358 – 363.

Achinewhu, S. C. (1998) *Nuts and seeds*. In: Nutritional quality of plant foods (Osagie, A. U. and Eka, O. U. eds). Post Harvest research unit, University of Benin, Benin City. 134-159.

Alais, C. and G. Linden (1999) *Food Biochemistry*. Aspen Publishers, Inc. Maryland. 2nd Ed. 222pp.

Amenta, J. S. (1964) A rapid chemical method for estimating lipids separated by thin layer chromatography. *J. Lipid Res.* **5**: 270 –272.

Ande, A. T. (1991) Some aspects of the biology of *Cirina forda* Westwood (Lepidoptera: Saturniidae). PhD thesis, Department of Biological Sciences, University of Ilorin, Nigeria. 320pp.

Ande, A. T. (2002) The influence of local harvesting and processing methods on some nutrient *Cirina forda* Westwood (Lepidoptera: Saturniidae) caterpillar in Nigeria. *Nigerian Journal of Pure and Applied Science,* **17***:* 1165 –1168.

Dierenfield, E. S. (1993) Insects and the feeding of zoo animals. *The food insect Newsletter* Vol. VI, No. 3.

Dunkel, E. (1998) *Insects and the Society*; Course Notes. State University-Bozeman, 200pp

Elegbede, J. A. (1998) *Legumes*. In: Nutritional quality of plant foods (Osagie, A. U. and Eka, O. U. eds). Post Harvest research unit, University of Benin, Benin City.

Folch, J. L., M. Lees and G. H. S. Stanley (1957) A simple method for isolation and purification of total lipid from animal tissue. *J. Biol. Chem.* **226**: 479-509.

Fasoranti, J. O. and D. O. Ajiboye (1986) Some edible insects of Kwara State Nigeria. *American Entomologist*, **39**(12): 113-116.

Jay, J. M. (1978) *Modern Food Microbiology.* Litton Educational publishing Inc., D. van Nostrand Company, New York. 479pp

Ritter, K. S. (1984) Metabolism of Δ0-, Δ5- and Δs7- sterols by larvae of *Heliothis zea. Arch. Insect Biochem. Physiol.* **1**:218-296.

Ritter, K. S. (1990) Cholesterol and insects. *The food insect Newsletter,* Vol. III, No. 1.

Swaminathan, M. (1986) *Principles of Nutrition and Dietetics*. Bangalore printing and publishing Co. Ltd., Bangalore, India. 528pp.

Umoh, I. B. (1998) Commonly used fruits in Nigeria. In: *Nutritional quality of plant foods* (Osagie, A. U and Eka, O. U. eds). Post Harvest research unit, University of Benin, Benin City