Functional properties of dried Imbrasia belina larvae flour as affected by mesh size and pH

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FUNCTIONAL PROPERTIES OF DRIED IMBRASIA BELINA LARVAE FLOUR AS AFFECTED BY MESH SIZE AND pH

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ABSTRACT

Functional properties of Imbrasia belina larvae flour processed by drying was affected by varying the pH and mesh size. The flour seem to have an improved functionality of water binding and oil binding at a lower pH but the emulsion activity and stability decreased with increasing pH. The foam ability of the flour also increased with decreasing pH. The functionalities of the larval protein is affected by the fine nature of the flour. The smaller the particle size, the better the functionality of the flour. The results indicate that the laevae contains quality protein which could be very useful in the food industries as nutritional additives.

INTRODUCTION

Insects have played an important part in the history of human nutrition in Africa, latin America and Asia (Bodenheimer, 1951). Entomophagy, which is the eating of insects, is gradually becoming popular in Africa. There are a number of insects that had been used as food in some parts of Nigeria and to a large extent eaten as titbits or exclusively by children (Ene, 1963). Entomophagy can be divided into two categories: insects used as nutrients source and others as condiments. Some insects are eaten as larvae, others as adults. Over 1200 species of insects are used as food by people throughout the world. Commonly eaten insects and arachnids include grasshoppers, crickets, termites, ants, beetle larvae (grubs), moth caterpillars and pupae, spiders, tarantulas, and scorpions. Insects generally have higher food conversion efficiency than more traditional meats (Ramos-Elorduy, 2006). For example, studies concerning the house cricket (*Acheta domesticus*), when reared at 30°C or more and fed a diet of equal quality to the diet used to rear conventional livestock, show a food conversion twice as efficient as pigs and broiler chicks, four times that of sheep, and six times higher than steers when losses in carcass trim and dressing percentage are counted (Capinera, 2004).

Further, insects reproduce at a faster rate than beef animals. A female cricket can lay from 1,200 to 1,500 in 3 to 4 weeks, while for beef the ratio is four breeding animals to each market animal produced, thus giving house crickets a true food conversion efficiency almost 20 times higher than beef (Capinera, 2004). For this reason and because of the essential amino acids content of insects, some people propose the development of entomophagy as a way of providing protein in human nutrition. Protein production for human consumption would be more effective and consume fewer resources than animal protein. This makes insect meat more ecological than vertebrate meat. In Southern Africa two third of the population's animal protein intake is from insect. *Imbrasia belina* is one of the most popular and best known insect eaten in its larval stage. Its larvae infest mopane trees , which are common in Southern and Central Africa, their relatively high protein (50 %) and low fat (15 %) content, after processing, makes them a very good protein source (Ramos-Elorduy, 2006). Functional properties of foods are intrinsic physicochemical characteristics, which affect the behaviour of protein in food systems during processing, manufacturing, storage and preparation (Onimawo and Akubor). This project was undertaken to assess the functional properties the flour made from *Imbrasia belina* larvae. Such functional properties could be used to determine the suitability or otherwise of this larvae as food additive.

MATERIALS AND METHOD

COLLECTION AND PREPARATION OF SAMPLE

Imbrasia belina larvae were obtained from Oja-Oba market in Ibadan, South-West Nigeria. The larvae were dried by smoking and the outer scale removed. It was again washed in water and sundried for two days before milling. The powder was sieved using two different mesh sizes of 40 and 100.

PHYSICO-CHEMICAL ANALYSIS

pH of the flour suspension was determined using a digital pH meter. Water absorption capacity was evaluated using the method of Lin *et al*., (1974) modified by Okaka and Porter (1979), which expresses Water Absorption Capacity as gram of water absorbed per gram of sample. Oil Absorbtion Capacity was evaluated by the method of Sosulski *et* al*.,* (1976). Emulsion Activity, Stability and Capacity were evaluated by the method described by Okezie and Bello (1988), while Foam Capacity and Stability were evaluated using the method of Narayana and Narasinga (1982).

RESULTS

Table 1: Functionality of *Imbrasia belina* larvae flour as affected by mesh size.

PARAMETER	MESH SIZES	
	40 (Fine)	100 (Coarse)
Water absorbtion capacity (g water/g sample)	2.56 ± 0.30a	2.85 ± 0.49a
Oil absorbtion capacity g oil/g sample	2.22 ± 0.72a	2.38 ± 0.45a
Emulsion activity %	3.48 ± 0.51a	3.02 ± 0.54a
Emulsion capacity	326.3 ± 16.84a	54.58 ± 2.69b
Emulsion stability %	54.28 ± 4.46a	52.64 ± 5.54a
Foam stability %	3.48 ± 1.07a	2.43 ± 1.33b
Foam capacity %	48.6 ± 1.73a	9.8 ± 1.66b
Wettability	2746.8 ± 3.12a	9997.67 ± 187.95b
Bulk density (g/mL)	0.67a	0.71a

Row with same alphabet are not significantly different (P > 0.05

Parameter	pH				
	2	4	7	8	10
Water absorbtion capacity (g water/g sample)	2.3 ± 0.15	2.4 ± 0.09	2.6 ± 0.02	2.8 ± 0.14	3.1 ± 0.31
Oil absorbtion capacity (g oil/g sample)	1.1 ± 0.64	2.5 ± 0.17	2.4 ± 0.12	2.8 ± 0.35	3.1 ± 0.52
Emulsion activity (%)	3.6 ± 0.33	3.2 ± 0.10	3.0 ± 0.01	2.6 ± 0.24	2.1 ± 0.53
Emulsion stability	40.90 ± 1.58	57.48 ± 2.79	48.48 ± 2.40	59.37 ± 3.89	57.52 ±2.82
Foam capacity (%)	11.2 ± 1.50	9.2 ± 0.35	8.6 ± 0.01	7.2 ± 0.81	6.0 ± 1.50
Foam stability (%)	4.0 ± 0.91	3.2 ± 0.45	2.0 ± 0.25	1.2 ± 0.7	0.4 ± 0.01
Wettability	2540 ± 118.9	2665 ± 46.77	2722 ± 13.86	2834 ± 50.81	2911 ± 95.26

Table 2: Effect of pH on the functionality of *Imbrasia belina* larvae flour using mesh size 40
Table 3: Effect of pH on the functionality of *Imbrasia belina* larvae flour using mesh size 100

Parameter	pH				
	2	4	6	8	10
Water absorbtion capacity (g water/g sample)	3.2 ± 6.20	2.3 ± 0.32	2.6 ± 0.14	3.1 ± 0.14	3.6 ± 0.43
Oil absorbtion capacity (g oil/g sample)	1.8 ± 0.30	2.0 ± 0.21	2.5 ± 0.06	2.6 ± 0.13	3.2 ± 0.43
Emulsion activity (%)	40 ± 0.30	3.8 ± 0.18	3.6 ± 0.07	3.0 ± 0.28	2.6 ± 0.50
Emulsion stability	60.29 ± 2.32	56.33 ± 0.03	56.72 ± 0.25	58.06 ± 1.03	53.12 ± 1.82
Foam capacity (%)	11.8 ± 1.15	11.4 ± 0.92	9.2 ± 0.35	8.4 ± 0.81	8.4 ± 0.81
Foam stability (%)	5.1 ± 0.94	4.0 ± 0.30	3.4 ± 0.05	2.2 ± 0.74	1.4 ± 1.20
Wettability	769 ± 131.0	853 ± 83.1	1136 ± 80.3	980 ± 9.8	910 ± 50.2

RESULTS AND DISCUSSION

The results of the functional properties of the flour made from *Imbracia belina* larvae and the effect of particle size is shown in table 1. The values obtained show that the fine flour of *Imbracia belina* larvae has higher functionality than the coarse flour. The difference was found to be significant (P<0.05) for emulsion activity, emulsion capacity, foam stability and foam capacity. The exceptions were water absorption capacity, oil absorption capacity, wettability and bulk density. Comparing the water absorption capacities of the two mesh sizes, the finer the flour the lower the water binding, with mesh size 40 having a water absorption capacity of (2.56g ± 0.30) compared with the more coarse flour of mesh size 100 with (2.85 ± 0.49). Same was found for the oil absorption capacity. The values obtained for emulsion activity and stability are comparable to that reported for African yam bean seed flour (Eke and Akobundu 1993) but lower than that reported for other legume samples such as pigeon pea seed flour (Onimawo and Akpojovwo, 2006) and cowpea (Abu et al., 2005). The implication is that the flour of *Imbracia belina* larvae, though nutritionally rich, may have some potential as food additive when functionality is desired. The effects of pH on the various functional properties were found to vary regardless of particle size (tables 2 and 3). While water absorption, oil absorption capacities and wettability increased with increased pH, the other properties decreased with increased pH. Emulsion stability did not follow any pattern as pH increased. A careful search of literature reveals that there have been no previous attempts at making flour from the larvae of *Imbracia belina.* Thousands of tons of *Imbracia belina* larvae are eaten by people in Africa. Almost all known cooking techniques have been tried on the larvae. It can be eaten fried, dried, raw grilled and boiled.

CONCLUSION

This work has demonstrated that the larvae of *Imbracia belina* can be made into flour. Although the functional properties of the flour were found to be lower than that of traditional plant foods such as legume seeds, the flour still has potential as source of nutrients in human nutrition.

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