PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition 9 (5): 485-487, 2010
ISSN 1680-5194

Effects of Age and Method of Drying on the Proximate Composition of Housefly Larvae (*Musca domestica* Linnaeus) Meal (HFLM)

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Abstract: The effects of age at which House Fly Larvae (HFL) is harvested and method of drying the larvae, on its proximate values were studied. Larvae were harvested on three different days representing three different ages and the harvested larvae were dried using both oven and sun light. Results revealed that protein content of HFL processed into meal after drying significantly ($p<0.05$) reduced as the age of larvae increased from 55.4% on 2 day old, through 50.2% on three-day old, to 47.1% on four day old. On the other hand, fat content increased with increase in age of HFL, from 20.8% at age of 2 days, through 22.2% at age of 3 days to 25.3% at the age of 4 days. Fibre content minimally increased with age. Oven-dried maggots had mean higher protein content (50.9%) and less fat (22.8%) than sun dried maggots (47 and 26.4% respectively). Therefore, for maximum protein yield, HFL should be harvested at 2 days old. However, where maggot fat is needed in a diet, increased biomass and or ease of harvesting, processing at later age (4 days old) became desirable. Oven-drying is recommended for superior protein and in rainy season, while sun drying produced higher fat and was cheaper.

Key words: Age, housefly larvae meal, oven-dried, proximate composition, sun-dried

INTRODUCTION

Housefly Larvae Meal (HFLM) like other maggot meals has been found to contain good quality protein for poultry and fish production (Sheppard, 2002; Awoniyi *et al*., 2003; Fasakin *et al*., 2003). However, there are differences in the proximate values reported by various researchers (Teguia *et al*., 2002). These differences were attributed to factors such as age, method of processing and source of maggot (Teotia and Miller, 1994; Fasakin *et al*., 2003, Teguia, 2005). Fasakin *et al*. (2003) attributed the variation in crude protein contents of maggot meal (43.3-46.7%) to drying methods. Atteh and Ologbenla (1993) attributed variation in the chemical composition of the housefly larvae meal to differences in time of harvesting.

Maggots are primarily harvested for its food value which is dependent upon their chemical composition. Since this chemical composition is effected by both age of larvae and method of harvesting, there is great need to identify the actual mature age and method of drying that will give maximum food value (proximate composition). This study is therefore aimed at identifying the optimal age at which maggots will yield maximum food value and the best drying method for processing maggots.

MATERIALS AND METHODS

About 75 kg of Whole Undiluted Blood (WUB) was mixed with 15 kg of Wheat Bran (WB) and spread equally on three open floor spaces (Treatments) of 1.44 cm^2 each, to a thickness of 3.75-5 cm and exposed for biodegradation. This was replicated 3 times. From each of the three replicates, 200 g maggots were separately harvested as follows: treatment one (T1) was harvested on day two of maggot formation, treatment two (T2) on day three while treatment three (T3) was harvested on day four. Each 200 g sample was divided into 2 equal parts of 100 g each, one part was oven dried while the other was sun dried.

Each sample was subjected to proximate analysis using the method described by the Association of Official Analytical Chemist (AOAC, 1990) to determine effects of age and drying method on their chemical composition namely; dry matter, ash, crude protein, fat and crude fibre. Nitrogen was determined using the Kjeldahl procedure, fat was determined by petroleum ether (bp 40-60^{o}C) extraction in a Soxhlet apparatus. Crude fibre determination involved dissolution of starch and protein constituents of the sample through boiling with acid and then sodium hydroxide. The residue was fibre. Ash determination was by ignition of sample at 550^{o}C to burn off organic materials. Data collected were subjected to analysis of variance as described by Steel and Torrie (1980) and means were separated using the multiple test of Duncan (1955).

RESULTS

Results of proximate analysis of HFLM harvested at 2-4 days old and processed dry weight by both sun and oven

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Table 1: Effects of larvae age and method of drying on the proximate composition of housefly larvae meal (%)

Larvae age	Drying method	Dry matter	Crude protein	Fat	Crude fibre	Ash
2 days	Ovum dried	92.7	55.4	20.8	6.2	6.23
p-value	Sun dried	92.8	51.3	23.4	6.3	6.24
3 days	Ovum dried	92.7	50.2	22.2	6.7	6.23
p-value	Sun dried	92.9	47.7	26.0	6.7	6.23
4 days	Ovum dried	92.7	47.1	25.3	7.0	6.25
p-value	Sun dried	92.9	42.3	29.7	7.1	6.26

	Analysis table (%)			
Method	Day 2	Day 3	Day 4	Mean
CP				
Oven-dried	55.4±0.053^{c}	50.2±0.0247^{b}	47.1±0.043^{c}	50.9
Sun-dried	51.0±0.14^{a}	47.7±0.038^{b}	42.3±0.743^{c}	47.0
Fat				
Oven-dried	20.8±0.141^{c}	22.2±0.138^{b}	25.3±0.35^{a}	22.8
Sun-dried	23.4±0.14^{c}	26.0±0.14^{b}	29.7±0.35^{c}	26.4

$^{a, b, c}$means within the same row with the same superscripts are significant ($p<0.05$). P = Proximate

(Table 1), revealed that protein content of HFLM significantly reduced as the age of larvae increased (55-4, 50.2 and 47.1%), while fat contents significantly increased with increased age (20.8, 22.2 and 25.3%). The result also showed that method of drying significantly influenced the proximate composition of HFLM, especially protein and fat. Oven-dried maggot had higher protein than sun dried (51:3%), but lower ether extract (20.8%) in oven-dried than the 23.4% recorded for sun-dried maggot meal.

DISCUSSION

Results of proximate analysis of samples harvested at different ages showed that fat deposit increased with larval age and this had direct effect on the crude protein content. It implied that fat content is inversely related to protein in HFLM. The result is consistent with the findings of Atteh and Ologbenla (1993) that the nearer the larvae are to pupa stage, the lower the protein content and the higher the fat content. It appears that age slightly influenced fibre content. Two days old larvae appeared tenderer with less fibre (6.2-6.32) than 4 days old larvae (7.0-7.1%)

The 2 drying methods applied in this study (oven and sun) tended to affect the fat content and thus protein. It appeared that some level of defatting took place during oven drying, which reduced fat contents and thus increased protein content.

Therefore, the wide range of percentage protein contents of maggot meal (39.0-63.0%) reported between 1971 and 2003 in previous investigations could be attributed to variations in drying methods, age of larvae, growing environment (organic matter), species of insect and method of processing (defatted or full fat). Calvert *et al.* (1971) reported 63%, Gado *et al.* (1982) 45%, Atteh and Ologbenla (1993) 39-54%, Awoniyi *et al.* (2003) 55.1% and Fasakin *et al.* (2003) reported 43.3-46%. Since, the result of this study has collaborated the earlier results, it is concluded that for a maximum protein value, maggots should be harvested on the 2nd day of maggot formation especially where protein is the major dietly need or in a diet where high fat is undesirable. However, where maggot fat is needed in a diet, harvesting at a later age becomes desirable. Similarly, oven drying produced higher protein and less fat while sun drying produced less protein and high fat. Therefore, other than economic considerations in terms of drying cost, where sun drying has comparative advantage, farmers needs and other available options could determine the choice of drying method.

ACKNOWLEDGEMENT

The authors are grateful to Owuno Friday of the Food Science and Technology laboratory, Rivers State University of Science and Technology, Port Harcourt, for the chemical analysis. Chinonso Onyeguili, Nnamdi Aniebo, Nwabueze Chigbu and Mrs Grace C. Aniebo of Phasona Fisheries and Plantation Farms Rumueme, Port Harcourt for sample collection and preparation of the manuscript.

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