Effects of Source and Time of Harvest on the Proximate Composition of Maggot (*Musca Domestica*) Larva Meal

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**Abstract**

The effects of source of maggot meal and the time of harvest on the proximate composition of maggot meal were assessed. However, crude protein, fat, ash and crude fibre varied significantly ($P<0.05$) with source. Maggot meal with egg attractant had the highest crude protein (45.84 ± 0.17). Maggot meal without fly attractant had the least crude protein (39.58 ± 0.17). The source of maggot meal also significantly ($P<0.05$) affected fat content with fat content from maggot meal without fly attractant (19.12 ± 0.123) and maggot meal with egg attractant (19.30 ± 0.123) significantly higher than maggot meal with chopped mango attractant (16.34 ± 0.123). Maggot meal with chopped mango attractant had the highest ash content (7.13 ± 0.071). Maggot meal with egg attractant had the highest crude fibre (6.14 ± 0.14).

The effect of time of harvest also significantly ($P<0.05$) affected the crude protein. The highest value was observed after 48 hours (58.06 ± 0.22). Fat content was significantly ($P<0.05$) increased with time of harvest. 120 hours (24.60 ± 0.16) had the highest mean fat and the least was observed in 24 hours (0.00 ± 0.00). The highest mean for crude fibre was observed in 120 hours (7.60 ± 0.18). The least crude fibre was observed in 24 hours (0.00 ± 0.00). These results will help improve methods of producing maggot meal for better productivity.

**Key words:** Fly Attractant, Protein Supplement, Time of Harvest, Animal Nutrition

**Introduction**

Protein is a very important ingredient required for nutrition and for decades a lot of emphasis has been placed on the quality of proteins especially its composition of amino acid. The cost of the particular protein plays a very important role in the selection of appropriate protein sources used in animal nutrition. With the lack of renewable protein sources together with the rise in protein feed costs, it is becoming more important to find good quality alternative and sustainable protein sources (Téguia et al., 2002). Alternative protein sources that are renewable and affordable need to be developed or discovered for animal nutrition. Such a potential protein source can be from *Musca domestica* larvae. Many studies have
reported on the evaluation of fly larvae meal as a complete or partial replacement of other protein sources i.e. groundnut meal (Adeniji, 2007), fishmeal (Ogunji et al., 2006; Agunbiade et al., 2007) and soya bean oil cake meal (Hwangbo et al., 2009).

Maggot meal is an animal protein source produced from waste, it has been reported to be highly nutritive with crude protein ranging between 43.9 and 62.4%, lipid 12.5 and 21%, and crude fibre 5.8 and 8.2% (Awoniyi et al., 2003; Fasakin et al., 2003; Ajani et al., 2004). Maggot meal is also rich in phosphorus, trace elements and B complex vitamins (Teotia and Miller, 1974).

Maggots are produced from the larval stage of the housefly Musca domestica and are used to process magmeal (Ogunji, et al., 2006). This organism grows extensively on animal dung and food waste which it digests to odour free ‘scum’ with high nutrient value (Sogbesan, et al., 2005). Maggot, the larva form of Housefly (Musca domestica) is not competed for as animal protein source by man. Maggot is readily available and has been accredited for its high quality protein with amino acids profile showing its biological value to be superior to soybean and groundnut cake (Eyo, 2003; Adejinmi, 2000).

Materials and Methods

Study Area

The experiment was conducted at the Teaching and Research Farm of the Faculty of Agriculture, University of Port Harcourt, Nigeria, which is located within latitude 4°54’30.38’’N and longitude 6°55’20.39E. The climate is tropical, with an average temperature of 27°C, relative humidity of 78% and rainfall range between 2500mm-4000mm per annum. There are two seasons in this part of World, the long rainy season which last between March-July and a short dry season from September to November, after a short dry spell in August (Akande et al., 2010).

Collection of Samples

Maggots (Musca domestica) larvae production was carried out using natural egg seeding methods in various depths of poultry manure. The maggots produced during these techniques were sun dried for 5 – 7 days and milled.

0.8kg of 4-week old poultry droppings from the Teaching and Research farm unit of the University of Port Harcourt were put in three plastic buckets labelled T1, T2 and T3, respectively for the three different treatments: T1 was poultry dropping without fly attractant, T2 was poultry dropping with raw broken eggs as fly attractant and T3 was poultry dropping with chopped rotten mangoes as attractant. Before the fly attractants were spread on the substrate, water was sprayed on them. For the plastic bucket labelled T2, broken raw eggs were poured on it while on the plastic bucket labelled T3 chopped rotten mangoes were on top the substrate. Flies were allowed access to the buckets and the buckets were kept in a corrugated iron sheet building. This building had very dwarf walls. The pH and temperature readings were monitored. Maggots were harvested at different times: 24 hour duration, 48 hour, 72 hour, 96 hour
and 120 hour durations. Before harvesting, the substrate in the plastic buckets was watered. Within 48 hours, white larvae which are the maggots develop, leading to maggot formation. The maggots were quantitatively harvested, cleaned and steamed to death. They were then spread on aluminium trays, sun-dried for two days before pulverization with an electric blender. The powdered sample was kept in a clean, air-tight plastic container prior to analyses.

**Chemical Analysis**

The proximate analysis of the maggot meal samples were carried out. The samples were analyzed for dry matter, crude protein, crude fibre, fat and ash contents according to AOAC (2004) techniques.

**Data Analysis**

All data collected were subjected to statistical analysis of variance (ANOVA) using Statistics for Agricultural Scientist package and means was separated by Least Significant Difference.

**Results**

Table 1 shows the effect of source of maggots on their proximate analysis. However, crude protein, fat, ash and crude fibre varied significantly (P<0.05) with source. Maggot meal with egg attractant had the highest crude protein (45.84 ± 0.17). This was followed by maggot meal with chopped mango attractant (40.74 ± 0.16). Maggot meal without fly attractant had the least crude protein (39.58 ± 0.17). Fat content from maggot meal without fly attractant (19.12 ± 0.123) and maggot meal with egg attractant (19.30 ± 0.123) were significantly (P<0.05) higher than maggot meal with chopped mango attractant (16.34 ± 0.123). Also, maggot meal with chopped mango attractant had the highest ash content (7.13 ± 0.071). This was followed by maggot meal without fly attractant (5.58 ± 0.07) and lastly maggot meal with egg attractant (4.43 ± 0.07).

Maggot meal with egg attractant had the highest crude fibre (6.14 ± 0.14). There was no statistical difference between crude fibre of the maggot meal without fly (5.42 ± 0.14) attractant and that of maggot meal with chopped mango attractant (5.34 ± 0.40).

Table 2 shows the effect of time of harvest of maggot on the proximate composition of maggot meal. A significant (P<0.05) variation was observed in dry matter with 48 – 120 hours significantly higher than 24 hours.

The effect of time of harvest also significantly (P<0.05) affected the crude protein. The highest value was observed after 48 hours (58.06 ± 0.22). This was followed by 72 hours (53.66 ± 0.22), 96 hours (50.67 ± 0.22) and 120 hours (48.06 ± 0.22).

Fat content was significantly (P<0.05) increased with different times of harvest. 120 hours (24.60 ± 1.59) had the highest mean fat and the least was observed in 24 hours (0.00 ± 0.00). A similar trend was observed in ash content of the maggot meal.
Crude fibre also varied significantly (P<0.05) with time of harvest. The highest means were observed in 120 hours (7.60 ± 0.18) and the least crude fibre was observed in 24 hours (0.00 ± 0.00).

Table 3 shows the interaction between the time of harvest and source of maggot. For all the sources, crude protein was highest at the 48 hour duration with 55.40 ± 0.79; 62.40 ± 0.79; 56.40 ± 0.79 being crude protein for maggot meal without fly attractant, maggot meal with raw egg attractant and maggot meal with chopped mango attractant respectively. The crude protein increased as the time of harvest increased with the lowest in the 120 hour duration (45.20 ± 0.79, 52.50 ± 0.79 and 46.50 ± 0.79 for the three sources of maggot). The fat content was lowest at the 48 hour duration in all the sources (20.80 ± 0.56, 22.80 ± 0.56 and 19.80 ± 0.56 respectively for the three sources) and the highest was in the 120 hour duration (27.40 ± 0.56, 25.20 ± 0.56 and 21.20 ± 0.56 respectively for the three sources). Ash content was lowest at the 48 hour duration (6.83 ± 0.33, 5.18 ± 0.33 and 8.23 ± 0.33 respectively for all the three sources) and increases as time progresses with the highest at 120 hour duration (7.29 ± 0.33, 6.02 ± 0.33 and 10.10 ± 0.33 respectively for the three sources). The crude fibre followed the same as the fat and ash contents.

**Table 1:** Effect of source of maggot on proximate composition of maggot meal

<table>
<thead>
<tr>
<th>Source</th>
<th>Dry matter (%)</th>
<th>Crude protein (%)</th>
<th>Fat (%)</th>
<th>Ash (%)</th>
<th>Crude fibre (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maggot meal without fly</td>
<td>74.16 ± 0.145</td>
<td>39.58 ± 0.17e</td>
<td>19.12 ± 0.123a</td>
<td>5.58 ± 0.07b</td>
<td>5.42 ± 0.14b</td>
</tr>
<tr>
<td>attractant</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Maggot meal with egg</td>
<td>74.16 ± 0.145</td>
<td>45.84 ± 0.17a</td>
<td>19.30 ± 0.123c</td>
<td>4.43 ± 0.07c</td>
<td>6.14 ± 0.14a</td>
</tr>
<tr>
<td>attractant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maggot meal with chopped mango</td>
<td>74.16 ± 0.145</td>
<td>40.74 ± 0.16b</td>
<td>16.34 ± 0.123b</td>
<td>7.13 ± 0.071a</td>
<td>5.34 ± 0.40b</td>
</tr>
<tr>
<td>attractant</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

*abc Means with different superscripts in the same column are significantly different (P<0.05).*

**Table 2:** Effect of time of harvest of maggot on proximate composition of maggot meal

<table>
<thead>
<tr>
<th>Duration(hrs)</th>
<th>Dry matter (%)</th>
<th>Crude protein (%)</th>
<th>Fat (%)</th>
<th>Ash (%)</th>
<th>Crude fibre (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>0.00 ± 0.00b</td>
<td>0.00 ± 0.00c</td>
<td>0.00 ± 0.00c</td>
<td>0.00 ± 0.00d</td>
<td>0.00 ± 0.00d</td>
</tr>
<tr>
<td>48</td>
<td>92.7 ± 0.18a</td>
<td>58.06 ± 0.22a</td>
<td>21.13 ± 1.59d</td>
<td>6.74 ± 0.90b</td>
<td>6.40 ± 0.18c</td>
</tr>
<tr>
<td>72</td>
<td>92.7 ± 1.18a</td>
<td>53.66 ± 0.22a</td>
<td>22.2 ± 1.59c</td>
<td>6.77 ± 0.09b</td>
<td>6.90 ± 0.18c</td>
</tr>
<tr>
<td>96</td>
<td>92.7 ± 1.18a</td>
<td>50.67 ± 0.22b</td>
<td>23.37 ± 1.59b</td>
<td>7.26 ± 0.09b</td>
<td>7.26 ± 0.08c</td>
</tr>
<tr>
<td>120</td>
<td>92.7 ± 1.18a</td>
<td>48.06 ± 0.22a</td>
<td>24.60 ± 1.59c</td>
<td>7.80 ± 0.09b</td>
<td>7.60 ± 0.18c</td>
</tr>
</tbody>
</table>

*a-e Means with different superscripts in the same column are significantly different (P<0.05)*

**Table 3:** The interaction between the time of harvest and source of maggot
Discussion

The results obtained in this study are consistent with those reported by authors in earlier studies. The crude protein obtained from maggot meal with raw eggs and chopped mangoes as attractants indicate that maggot meal treated with attractants yield higher crude protein. The results of maggot meal crude protein have been reported severally by many. Awoniyi et al. (2003) reported 55.1%, Fasakin et al. (2003) reported 43-46%, Sogbesan et al. (2005) reported 50.86%, Aniebo et al. (2008) reported 47.1%, Olele (2011) reported 44.5%, Pretorius (2011) reported 50.86%, Moreki et al. (2012) 63.99-69%, Okah and Onwujiariri (2012) reported 44.44% and Olaniyi and Salau (2013) reported 43.48-44.20% crude protein.

The fat values obtained in this study were significantly different (P<0.05) in all the sources with the highest in the maggot meal with egg attractant and the least in maggot meal with chopped mango attractant. The value of fat obtained in this study fall below the value of 25.3% reported by Ugwumba et al. (2001) and above the value of 8.5% reported by Aniebo et al. (2008). Also the crude fibre values obtained in this study were significantly different (P<0.05) in all the sources of maggot. Awoniyi et al. (2003) and Aniebo et al. (2008) reported a crude fibre of 6.3% and 7.0% respectively which agree with the result of this study. The ash values were also significantly different (P<0.05) in all the sources.
Sogbesan et al. (2005) and Ugwumba et al. (2001) reported ash values of 8.4% and 9.72% respectively which are higher than the values in this study. There were significant differences (P<0.05) in the crude protein, fat, ash and crude fibre contents of the maggot meal harvested at different times. The crude protein of maggot harvested at the 48 hour duration had the highest crude protein percentage. The crude protein contents of the maggot meal tended to be decreasing as time of harvest increases while the reverse was the case for the fat, ash and crude fibre contents of the maggot meal.

Crude protein was highest at the 48 hour duration in all the three sources of maggot and started declining as the time of harvest progresses with the lowest at the 120 hour duration. Fat, ash and crude fibre contents were lowest at the 48 hour duration and started increasing as the time of harvest was increasing. Therefore for all the sources of maggot, it is better to harvest at the 48 hour duration and maggot meal with raw egg attractant proved superior in terms of crude protein content.

**Conclusion and Recommendation**

From the data reported by this current study, it indicates that maggot meal of housefly (*Musca domestica*) can be incorporated into the diets of animals and will not cause any immediate significantly changes in specific carcass characteristics of animals. It is recommended that maggots are better harvested at the 48 hour duration and the best fly attractant is raw egg.

Where 1 = Maggot meal without fly attractant  
2 = Maggot meal with egg attractant  
3 = Maggot meal with chopped mango attractant

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Hosted@www.ijlr.org  
DOI 10.5455/ijlr.20150713102839


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