Insect substrates

Reference substrates were poultry meat meal, fish meal and fat. Fat content was highest in housefly pupae. Substrates were analysed for dry matter, ash, fat, N, amino acids and for in vitro organic matter and N digestibility. Amino acid scores were calculated using minimal requirements for growth of kittens and puppies as reference values.

Results and discussion

Crude protein content was highest in house crickets followed by lesser mealworms, the roaches and housefly pupae. Fat content was highest in morio worms and yellow mealworms. Ash content was highest in black soldier fly larvae and pupae.

In vitro N digestibility was relatively high for the yellow mealworms, lesser mealworms and morio worms and low for black soldier fly pupae, six spot roaches and death’s head cockroaches.

The lower digestibility of black soldier fly pupae than larvae is likely caused by a higher degree of sclerotisation of the cuticle.

The first limiting amino acid for most substrates was the combined requirement for Met and Cys.

Poultry meal meat was lower in Met and Cys than in literature.

Roaches had a low digestibility and were low in Arg, Phe and Thr.

Conclusions and recommendations

Selected insect species differed considerably in composition and in vitro OM and N digestibility. Protein quality was highest in house crickets and lowest in the roaches. Next to protein quality, also other aspects like efficiency of conversion of organic side streams, product safety and processability will determine if insect species are used in future pet food formulations. These and other aspects require further study.

References


Table 1. Composition (% of dry matter), in vitro digestibility (%) and AA scores of substrates.

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Composition (g/100g)</th>
<th>Digestibility (%)</th>
<th>AA score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ash</td>
<td>Fat</td>
<td>CP</td>
</tr>
<tr>
<td>Housefly pupae</td>
<td>5.6</td>
<td>19.2</td>
<td>62.5</td>
</tr>
<tr>
<td>BSF larvae</td>
<td>12.6</td>
<td>12.8</td>
<td>56.1</td>
</tr>
<tr>
<td>BSF pupae</td>
<td>13.9</td>
<td>19.7</td>
<td>52.1</td>
</tr>
<tr>
<td>House cricket</td>
<td>5.3</td>
<td>17.7</td>
<td>70.6</td>
</tr>
<tr>
<td>Yellow mealworm</td>
<td>3.9</td>
<td>33.9</td>
<td>52.0</td>
</tr>
<tr>
<td>Lesser mealworm</td>
<td>4.1</td>
<td>22.2</td>
<td>64.8</td>
</tr>
<tr>
<td>Morio worm</td>
<td>3.0</td>
<td>39.6</td>
<td>47.0</td>
</tr>
<tr>
<td>Six spot roach</td>
<td>3.6</td>
<td>25.1</td>
<td>66.3</td>
</tr>
<tr>
<td>Death’s head CR</td>
<td>3.9</td>
<td>22.0</td>
<td>65.0</td>
</tr>
<tr>
<td>Argentinean CR*</td>
<td>4.4</td>
<td>24.5</td>
<td>64.4</td>
</tr>
<tr>
<td>Poultry meal meal</td>
<td>15.4</td>
<td>12.8</td>
<td>69.1</td>
</tr>
<tr>
<td>Fish meal</td>
<td>19.9</td>
<td>9.2</td>
<td>71.0</td>
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<tr>
<td>Soybean meal</td>
<td>6.8</td>
<td>2.5</td>
<td>51.6</td>
</tr>
</tbody>
</table>

Abbreviations: AA, amino acid; CP, crude protein; OM, organic matter; BSF, black soldier fly; CR, cockroach.

*Females.

Figure 1. Amino acid content (% of crude protein) of substrates. Abbreviations: HFp, housefly pupae; BSFl and BSFp, black soldier fly larvae and pupae; HC, house cricket; YMW, yellow mealworm; LMW, lesser mealworm; MW, morio worm; SSR, six spot roach; DHC, death’s head cockroach; AC, Argentinean cockroach; PMM, poultry meal meat; FM, fish meal; SBM, soybean meal; tIAA, total indispensable amino acids.

Objective

To evaluate the protein quality of a selection of insect species.

Materials and methods

• Insect substrates

Housefly pupae (Musca domestica)

Black soldier fly larvae (Hermetia illucens)

Black soldier fly pupae (Hermetia illucens)

House cricket (Acheta domesticus)

Yellow mealworm (Tenebrio molitor)

Lesser mealworm (Alphitobius diaperinus)

Morio worm (Zophobas morio)

Six spot roach (Eublaberus distanti)

Death’s head cockroach (Blaberus craniifer)

Argentinean cockroach (Blaptica dubia)

• Reference substrates were poultry meat meal, fish meal and soybean meal.

• Substrates were analysed for dry matter, ash, fat, N, amino acids and for in vitro organic matter and N digestibility.

• Amino acid scores were calculated using minimal requirements for growth of kittens and puppies as reference values.

Background

The demand for animal-derived protein sources will further increase due to the combined effects of population increase and increasing standards of living in developing countries. Competition for protein sources stimulates the search for alternative and sustainable sources for future pet food formulations. Insects are proteinaceous and some species can be efficiently grown on organic side streams making these potentially sustainable alternatives for current proteinaceous feed ingredients. Insects are commonly consumed by feral cats around the world contributing up to 6% of their diet. Information on the protein quality is, however, currently limited for most insect species.

4.4 24.5 64.4 84.0 83.8 60 75
15.4 12.8 69.1 85.8 87.9 45 56
19.9 9.2 71.0 82.1 85.7 73 92
6.8 2.5 51.6 80.6 94.7 89 108