**Effects of lysine supplementation on Black Soldier Fly larvae**

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**Introduction**

Edible insects may contribute to a satisfactory supply of animal protein for the growing world population in the future. This may be directly by utilizing them for food or indirectly by feeding them to other livestock like pigs or poultry. The Black Soldier Fly, Hermetia illucens, is a promising insect species for that purpose since it is able to convert a variety of organic materials into biomass, resp. protein. In pigs and poultry, production of protein biomass is limited by the supply of amino acids such as lysine and others. Feeding these animals with lysine-rich feed (e.g. insects) could facilitate growth and protein increase.

Therefore, the aim of the study was to elucidate, if it is generally possible to influence the larval lysine content by enrichment of the substrate with crystalline lysine.

**Materials and Methods**

Substrate consisted of mostly cooked and homogenized food [potatoes, rice, carrots, cauliflower, red cabbage, curd, sugar, soaked bread, mozzarella] alligoted at 120 g in plastic food boxes. In four groups, crystalline L-lysine was added up to three percent [0, 0.5, 1.0, 3.0 %] and 80 Black Soldier Fly larvae were added per substrate alligot. In total, 520 to 560 larvae were applied per approach and ten repetitions were performed. The general workflow is illustrated in Fig. 1.

All values were statistically analyzed using ANOVA followed by Bonferroni post test.

**Results**

Supplementation of substrate with lysine expectedly resulted in higher crude protein and lysine content of the substrate. However, neither larval lysine content nor crude protein content increased substantially (Fig. 2). Besides this, elevated lysine led to decreased survival rates and, especially when three percent lysine were added, to a substantially lower rate of prepupae. Larvae also were smaller in presence of three percent lysine and tended to weigh less (Table 1).

**Conclusions**

Since the lysine content of Black Soldier Fly larvae tended to increase in dependence of rising substrate lysine concentrations, the amino acid is apparently ingested by the larvae to some extent. The detected decrease of true-crude protein ratio indicated, however, that the lysine is not incorporated into larval protein mass. The slightly elevated lysine values may be explained by presence of the unchanged amino acid in the larval intestine or on the larval surface.

In general, data showed that the lowest lysine concentration of approx. 0.3 % [no lysine added] seems sufficient for optimal growth and protein formation and that addition of crystalline lysine did not lead to a higher larval protein content.

![Fig. 1: Scheme of project workflow](image)

![Fig. 2: Crude fat, crude protein and lysine content of substrate (top) and Hermetia illucens larvae (bottom) after addition of crystalline lysine](image)

Although statistically not significant, lysine content seemed to be higher in larvae fed with substrate supplemented with three percent lysine. Analysis of true-crude protein ratio revealed a coincidental decrease [0.79, 0.78, 0.77, 0.69 for groups with no, 0.5, 1.0, and 3.0 % lysine added, respectively].

<table>
<thead>
<tr>
<th>Group</th>
<th>Survival rate [%]</th>
<th>Preparated rate [%]</th>
<th>Mean size [mm]</th>
<th>Mean weight [mg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>no lysine</td>
<td>77.0 ± 4.5 b</td>
<td>77.0 ± 3.9 b</td>
<td>25.6 ± 0.3 a</td>
<td>151.2 ± 6.9 a</td>
</tr>
<tr>
<td>+ 0.5 % lysine</td>
<td>77.0 ± 4.5 b</td>
<td>80.5 ± 3.9 b</td>
<td>25.6 ± 0.3 a</td>
<td>256.2 ± 6.9 b</td>
</tr>
<tr>
<td>+ 1.0 % lysine</td>
<td>77.0 ± 4.5 b</td>
<td>80.5 ± 3.9 b</td>
<td>25.6 ± 0.3 a</td>
<td>256.2 ± 6.9 b</td>
</tr>
<tr>
<td>+ 3.0 % lysine</td>
<td>77.0 ± 4.5 b</td>
<td>80.5 ± 3.9 b</td>
<td>25.6 ± 0.3 a</td>
<td>256.2 ± 6.9 b</td>
</tr>
</tbody>
</table>

Different letters indicate statistically significant differences (p < 0.05)