Gastro intestinal effects of partly defatted insect meal (Hermetia illucens) and micro algae meal (Spirulina platensis) as substitute for soybean meal in mixed diets for meat type chicken.

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Aim of the study

To examine the effects of partly defatted *Hermetia illucens* meal (HM) from larvae of black soldier fly and blue green algae (*Spirulina platensis*) meal (SM) as 50% replacement for soybean meal (SBM) diets on praecaecal digestibility (pcD) of CP, factors of intestinal microbiota, mucosal morphometry and microstructure of the small intestine in meat type chicken.

Material and Methods

- Animals: 180 one-day-old male growing chicken (Ross 308) from a commercial hatchery; 6 birds/pen
- Growth study: starter period 1-21d, grower period 22-34d; feed supply on free choice level with 3 isonitrogenous diets (22%/20% CP for starter and grower period, respectively)
- Control diet (CD): main ingredients: wheat, corn, SBM; 39%/32% SBM in starter/grower diets; basic supplementation of Lys and Met; (n=12)
- HM & SM diet: 50% of of SBM was replaced by HM or SM, respectively
- After fattening, 12 (CD) and 16 per test diet (HM and SM) representative broiler were slaughtered
- Microbiology: Pooled samples (n=4, Duodenum until 1/3 behind Meckel's Diverticulum (MD)) for bacterial growth (CFU total aerob, gram-negatives, clostridia, enterococci & lactobacilli) and parasitological examination
- pcD: Pooled samples (n=4, 1/3 behind MD until 1 cm before caecum) for detection of DM, N and TiO_2, F as marker molecules
- Morphometric analysis: Additional 8 birds per diet (n=24); slaughter after 12 hours fastening; stereologic estimation of entire mucosal surface on macroscopic (S(pm) = primary mucosal surface area) and microscopic (S(v)/S(pm) = villous amplification factor) level by Systematic Uniform Random (SUR) sampling from 3 intestinal sections (I1: duodenum, I2: proximal jejunum I3: distal jejunum/ileum)
- Histology: 5 SUR segments per intestinal section: formalin-fixed (4%), paraffin-embedded, vertical tissue sections (4µm, hematoxylin-eosin stain); villous surface S(v) estimation by cycloid test arcs (Stepanizer®)
- Statistics: one-way ANOVA connected with Tukey- and Games-Howell-test; Kruskal-Wallis test (ANOVA and multiple comparisons) for gut morphometry

Results

Table 1: Final body mass and pcD after fattening (Mean ± SD)	CD (n=4)	HM (n=4)	SM (n=4)
Final body mass (g)	2177^{c} ± 112	1495^{b} ± 89	1050^{a} ± 69
Praecaecal CP digestibility pcD(%)	64.63^{b} ± 5.2	65.25^{b} ± 4.9	49.03^{a} ± 6.2

Mean values in the same column with different superscript letters are significantly different (p ≤0.05)

- Final body mass and pcD of CP were significantly lower with diet SM, while pcD of diet HM tended to be slightly higher than pcD of CD (Tab.1)
- Isolated bacteria and total bacterial counts were not significantly influenced by the different test diets; Parasites were not detected

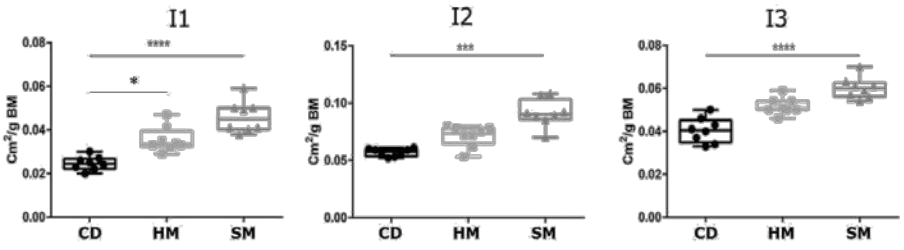

Fig. 1 As compared to CD, diet SM obtained significantly enlarged relative S(pm) in all intestinal sections; less pronounced observations resulted with diet HM while differences between HM and CD were only significant in I1 (****P<0.001, ***P<0.005, *P<0.05)

- Preliminary histologic data show conspicuously lower S(v)/S(pm) with diet SM, compared to CD and diet HM, especially in I2, indicating a reduced villous surface on microscopic level

Conclusions: Insect meal based diets yielded superior pcD of CP and only minor effects on intestinal morphometry. In contrast, algae meal provided low pcD and increased the primary mucosal surface with concurrent reduction of the villous surface, indicating certain adverse effects on the intestinal microstructure that need further attention in ongoing experiments.

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