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Possibilities for black soldier fly larvae meal in pork production: A source of rare saturated fatty acids (#198)

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Introduction

Black soldier fly (*Hermetia illucens*) larval meal (BSF) has been intensively researched as a promising protein source to replace soy in swine diets and has been found to be a suitable alternative from an animal nutrition and a meat quality perspective (Altmann, Neumann, Rothstein, Liebert, & Mörlein, 2019; Neumann, Velten, & Liebert, 2018). Besides its protein content, the incorporation of BSF into swine diets presents two opportunities. First, its high content and the uniqueness of lauric and myristic acid may qualify them as biomarkers for alternative production systems, i.e. to identify the incorporation of BSF in meat production. Secondly, BSF's high saturated fatty acid (SFA) content could increase the SFA content in animal-flesh, which would be advantageous for production systems that are specialized for the cured-meat market, such as heavy ham pigs. Increased proportion of SFA could make products less susceptible to lipid oxidation. Therefore, the aim of this abstract is to illustrate possible advantages of influencing pork backfat through the inclusion of BSF in swine diets.

Methods

Two replicates totalling 15 Pietrain x (Large White x German Landrace) barrows were fattened on diets where soybean meal was replaced between 50% and 100% (dependent on physiological stage) by partially-defatted BSF meal (Altmann et al., 2019). A control group (n=16) without soybean meal substitution accompanied. At approx. 116 kg, animals were slaughtered and backfat samples were collected from the cranial-dorsal side of the *longissimus thoracis et lumborum* 24hr *post mortem.* Fatty acid composition was analysed using fatty acid methyl ester extraction followed by gas chromatography; fatty acids were quantified with relative areas. Mixed ANOVAs (fixed effect: diet, random effect: replicate, and covariate: carcass weight) were conducted. Fischer's least significance difference test with a $p < 0.05$ threshold determined statistical significance.

Results

The fatty acid composition of the BSF meal used in the feeding experiments was chiefly composed of lauric acid (Table 1) and was found to alter the fatty acid composition of pork backfat. Lauric acid (C12:0) content in the backfat of swine fed BSF five-times higher compared to the control. A similar trend was observed for myristic acid (C14:0). Both fatty acids are uncommon in animal-flesh products; thus, in light of the growing importance of production factor traceability, both fatty acids could be utilized as indicators for BSF as a dietary protein feed used in production. Identifying such indicators will be vital to ensuring consumers' trust in the meat industry; especially regarding feed-type statement claims, which are increasing in popularity in Germany. Secondly, BSF could increase the overall SFA content in pork backfat, given that BSF meal fatty acid composition is 77% SFAs. However, in our experiment these effects were jeopardized by a high amount of soybean oil (up to 50 g/kg DM) in the experimental diets. Therefore, when considering BSF as a means to increase SFA content for cured-products, the diet formulation plays a significant role. Further research should focus on incorporating full-fat BSF to completely substitute soybean meal and oil in swine diets.

Conclusion

Black soldier fly larval meal's unique fatty acid composition containing high levels of lauric and myristic acid distinctively influences the saturated fatty acid composition in pork backfat; therefore making the fatty acids plausible biomarkers for indicating a BSF dietary protein source. The dietary high inclusion of BSF alone is not sufficient to increase SFA proportion in backfat, rather total diet formulation is more relevant.

References

Altmann, B. A., Neumann, C., Rothstein, S., Liebert, F., & Mörlein, D. (2019). Do Dietary Soy Alternatives Lead to Pork Quality Improvements or Drawbacks? A Look into Micro-Alga and Insect Protein in Swine Diets. *Meat Science*, *153*, 26–34. http://doi.org/https://doi.org/10.1016/j.meatsci.2019.03.001

Neumann, C., Velten, S., & Liebert, F. (2018). N Balance Studies Emphasize the Superior Protein Quality of Pig Diets at High Inclusion Level of Algae Meal (Spirulina platensis) or Insect Meal (Hermetia illucens) when Adequate Amino Acid Supplementation Is Ensured. *Animals*, *08*(02), 163–183. http://doi.org/10.4236/ojas.2018.82012

Notes

Table 1: Relative areas of saturated fatty acids and major fatty acid groups in partially defatted black soldier fly larvae (BSF) meal and pork backfat (estimated marginal means with standard error in brackets)

		Pork backfat[1]	
Fatty acids	**BSF meal**	**Control**	**Produced with BSF**
Saturated fatty acids (SFA)	77.29	40.37[a] (0.44)	38.39[b] (0.47)
C10:0	0.36	0.064 (0.002)	0.058 (0.002)
C11:0	0.01	0.003 (0.001)	0.000 (0.002)
C12:0	**47.09**	**0.097[b] (0.014)**	**0.551[a] (0.015)**
C13:0	0.10	ND	ND
C14:0	**11.14**	**1.205[b] (0.042)**	**2.150[a] (0.046)**
C15:0	0.20	0.031 (0.003)	0.027 (0.003)
C16:0	16.00	25.22[a] (0.25)	24.13[b] (0.27)
C17:0	0.21	0.211 (0.017)	0.216 (0.019)
C18:0	2.05	13.34[a] (0.23)	11.07[b] (0.25)
C19:0	0.02	ND	ND
C20:0	0.09	0.154 (0.005)	0.142 (0.005)
C22:0	0.02	ND	ND
C24:0	ND	0.038 (0.002)	0.041 (0.002)
Monounsaturated fatty acids	15.15	43.89[a] (0.42)	39.95[b] (0.46)
Polyunsaturated fatty acids	7.56	15.74[b] (0.39)	21.66[a] (0.40)

[1]Fatty acid composition from Altmann et al. (2019).
Superscript letters indicate significant differences ($p < 0.05$)
ND = not detected

Table 1

Notes