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Short Communication

The Potential of Insect Meal in the Animal Feeding and Health Care

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The World ought to be ethical or will extinct. It is valid for its consumption, animal production and companion-pet animal keeping, too. At the same time, the alternatives should be evaluated on a scientific basis. The main challenge in the food supply of the humanity is to ensure the daily protein intake of approximately 60g per capita. One of the promising solution is the use of insects. The human consumption of insects has thousend-year-long history, insects were used as model animal in the experimentation [5], but the use of insects as animal feed source is relatively new. In 2021 the EU authorised the use of seven insect species: black soldier fly (*Hermetia illucens*), common housefly (*Musca domestica*), yellow mealworm (*Tenebrio molitor*), lesser mealworm (*Alphitobius diaperinus*), house cricket (*Acheta domesticus*), banded cricket (*Gryllodes sigillatus*) and field cricket (*Gryllus assimilis*)" in feed for aquaculture animals, pig and poultry [1].

Besides the excellent chemical composition, the insects have environmental adventages. they need less water, less substrate, and at the same time they are producing less greenhouse gases. The nutritional value of insects can be evaluated using the energy, protein and amino acid composition, applying the improved ideal protein concept [14]. In the following the black soldier fly (BSF) will be use of a model to demonstrate the real nutritional value and fields of application of insects in the production animal sector. The fish and pertfood will be described in a separate paper. The composition of the partly defatted BSF larvae is given according to Grinsect [6].

The fish meal would be and excellent protein source for the monogastric pig and poultry, but having environmental concerns, it is substituted by milk and whey powder, blood and plasma meal, extracted soybean meal and partly pea, bean and lupin seeds. According to its amino acid profile, the insect meal seems to be a better candidate for replacement.

The table compare the first limiting amino acids of the SM and BSF with the requirements of the weaning piglet and starter broiler chicken.

			Requiremens	
Crude protein and amino acid concentrations	**BSFL**	**SM**	**Piglets**	**Chicken**
Crude protein, %	57.7	48.0	18-22	19.5-23
SM%	120			
Lysine, g/kg	26.6-31.8	31.2	14.0	14.4
SM%	85-101,9			
Methionine+Cystine, g/kg	12.0-13.13	14.1	8.4	12.0-13.13
SM%	85-93			
Tryptophan, g/kg	13.13	6.3	2.9	2.3
SM%	208			
Threonin, g/kg	20-21	20.5	9.0	9.7
SM%	100			

Table: *Comparison of first limiting amino acid composition of extracted soybean meal (SM), partly defatted black soldier fly larvae (BSFL) with the weaning piglet's and broiler chicken's requirement as fed basis [4,12].*

Consequently, on a crude protein basis the BSF could replace the SM in a proportion of 1 to 1. Nevertheless, if considering the 0.73 - 0.95 ratio of essential to non-essential amino acids in the BSF, instead of the ideal value of 1.0 [9], for the practical substitution level animal trials needed. At the same time it worth mentioning that the SM may cause enteritis, allergy or immunological troubles, which can be prevented by the use of insect meals.

Based on practical tests, the grinded, mechanically defatted BSF larvae (BSFL) can replace the 30-60% of the SM in the feed of the weaning piglets from the age of day 21. This mean approximately 10% of the total feed mixture. The lack of the sulphur-containing amino acids and in some cases of the lysine should be supplemented. On the contrary, the tryptophan deficiency of the cereals is balanced by the high tryptophan concentration of BSF. A inclusion uper limit of the fullfat BSFL is 19% as fed basis.

The table shows the needs of the broiler chicken. The highest concentration stands for the starter and the lower for the grower-finisher diets. The BSF can be used from the first day of life. According to the composition, the mecanically defatted, grinded BSF larvae can replace 50-100% of the SM. The optimum inclusion rate is 10% (approximately 25% of the SM). Nevertheless at 15% of inclusion level the added chitin is high (1 - 1.1%), which may cause a shortening of the gut villi and consequntly a lower by 9% final weight [2]. The increased gluthathion peroxydase activity in the broilers' blood reflect a higher oxydative load, which should have been balanced by extra vitamin E supplemetation.

The replacement of 50% of the SM by BSF (19.5% in the starter and 16% in the grower) may stabilise the muscle pH and extend the shelf-life of the poultry meat [11]. In case of the broiler quails the inclusion of 10 - 15% BSF instead of the SM did not change the fattening parameters. In the feed mixtures of broiler chicken the generally used 1-5% of vegetable oil can be replaced by BSF oil without adverse effects [8].

The 7.5% BSFL instead of the SM in the feed of the *laying hen* did not change the egg production (number, weight), but the eggshell thickness improved. Paradoxiycally, the 5% inclusion rate decreased the egg production [10].

Promissing trials have been carried out at the Uppsala University with the feeding of laying hens by living BSFL. The average daily fresh larva intake was 163 gram. This technology caused pale egg yolk, which can be improved by carotinoids supplementation [13].

Insect meal as a functional feed

The BSFL can be raised on several organic substrates. If during the last 24 to 48 hours the larvae are put on fish offal, the concentration of polyunsaturated fatty acids increase in ther body. The legal authorisation for the later is lacking [7].

Even 1 to 5% of insect meal or insect oil may improve the biological value of the pig and poultry feed. The insect meal contains immuno modulant beta glucan, antimicrobial lauric acid and bioactive peptides [15]. It may improve the health state of the gut wall, optimise the microbiom and the composition of the produced mucine; it kills pathogenic bacteria like Clostridia or Corynebacterium. By this way the use of antibiotics in the pig and poultry production can be minimalized [3]. The BSFL supplementation improves the calcium absorption. The BSFL can be spread on the bedding as a tool of environmental enrichment.

Summerizing the insect meal and oil is an ideal component of the pig and poultry diets. The replacement of the soybean contributes to the circular economy and improved animal health. By this way many environmental concerns (greenhouse gases, antibiotic loading) can be prevented and at the same time the animal welfare can be improved.

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