

Suitability of blood by-products for use as a sustainable protein source in diets for rainbow trout depends on processing method.

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Introduction.

Fish meal is considered an essential ingredient in feed for farmed carnivorous fish. As demands outgrew availability of fish meal produced from bycatch and trimmings, forage fish is purpose-caught to fill the gap. This led to rising feed costs and growing concerns on environmental sustainability of cultured fish, driving the industry to search for sustainable, cost-effective alternative protein sources¹. For this purpose, low-ash animal by-products may be suitable ingredients for partial replacement of fish meal in aquafeed. We here evaluate the effect of processing method of porcine blood by-products on protein digestibility in trout: spray drying versus contact drying.

Animals, materials and methods.

The pepsin-HCl method² was used to determine *in vitro* protein digestibility of spray-dried hemoglobin (Actipro® 95PHS) and contact-dried blood meal (BM). Next, a digestibility trial was performed using 180 rainbow trout (148±8 g) in twelve 250 L-tanks with 15 fish each. Three pelleted diets were prepared: reference diet (RD) with 40% fish meal, 95PHS-diet (70% RD and 30% 95PHS) and BM-diet (70% RD and 30% BM). Fish were fed one of three test diets with 4 replicate tanks per diet. A 2-wk adaptation period and 2-wk faeces collection period were applied using a continuous automatic device and apparent protein digestibility coefficients (aD_CP) of test diets and test compounds calculated³. Statistics were done using one-way ANOVA and Tukey post hoc test with significance set at p<0.05.

Results and discussion.

The *in vivo* trial revealed an almost double digestible protein content in spray dried hemoglobin compared to contact dried blood meal (p < 0.001), whilst crude protein content and *in vitro* digestibility coefficients were similar (Table 1). Moreover, protein digestibility was similar between the RD (93 ± 0.3%) and 95PHS-diet (94 ± 0.8%), but significantly lower in the BM-diet (74 ± 1.5%, p<0.001). Seen the large discrepancy observed between *in vitro* and *in vivo* protein digestibility, the pepsin-HL method proved to be a non-reliable method to assess digestible protein content of ingredients for aquafeed.

Table 1. *In vitro* (iv) and *in vivo* (rt, rainbow trout) protein digestibility (mean ± sem) of blood by-products.

Ingredient	CP (%)	iv aD_CP (%)	iv DP (%)	rt aD_CP (%)	rt DP (%)
Actipro® 95PHS	92.9	100.0	92.9	94.0 ^a ± 2.1	87.3 ^a ± 2.0
Blood meal	91.3	97.3	88.9	49.5 ^b ± 3.9	45.2 ^b ± 3.6

CP (crude protein), aD_CP (apparent CP digestibility coefficient), DP (digestible protein)

Conclusion. Spray dried hemoglobin showed to be a suitable ingredient to partially replace fish meal in feed for rainbow trout. High amounts of indigestible protein in contact-dried blood meal, in contrast, would deteriorate feed conversion and increase the amount of nitrogen in culture water as well as the systems' effluent.

References: [1] Cashion et al., 2017. Fish and Fisheries 18:837-844; [2] 72/199/EEC. Official Journal L 123, 29.5.1972, p 6-34; [3] Lemos et al., 2009. Aquaculture 295:89-98