Digestible energy versus net energy approaches in feed evaluation for rainbow trout (*Oncorhynchus mykiss*)

Ruben Groot[1,2], Philip Lyons[2], Johan Schrama[1]*

[1] Aquaculture and Fisheries Group, Wageningen University & Research, The Netherlands

[2] Alltech Coppens, The Netherlands

* Corresponding author. E-mail: ruben1.groot@wur.nl

Currently, a digestible energy (DE) approach is used in fish feed evaluation which assumes a constant utilisation of digestible energy for growth (k_gDE). However, carbohydrates in rainbow trout (*Oncorhynchus mykiss*) feeds are, compared to protein and fat, not only considered to be lower in digestibility, but also to be utilised to a lesser extent for retained energy and thus growth. A lower utilisation of carbohydrates would thus suggest an overprediction of k_gDE at higher dietary carbohydrate levels and an inaccuracy in the DE approach. Recently it has been proposed to use a net energy (NE) approach in feed evaluation for fish, which considers differences in the utilisation of the different digestible macronutrients (digestible protein, fat, carbohydrates). This study aimed to examine if a NE approach can increase the prediction precision of growth performance compared to a DE approach in feed evaluation for rainbow trout. Therefore, a feeding trial with feeds having different DE levels and with a wide contrast in macronutrient composition which reflect those found in practical rainbow trout diets was done. Eight different diets were formulated to include two protein levels (40 and 50%) and four different fat levels (14, 19, 25, 30%) coinciding in a wide range in carbohydrate levels (8-35%). NE was calculated both using linear efficiencies of digestible macronutrients (NE_{lin}=15.1×dCP+35.0×dFat+12.1×dCarb) and with a curvilinear effect of carbohydrates included (NE_{curv}=13.5×dCP+33.0×dFat+34.0×dCarb–3.64×(dCarb)^2) (NE as kJ/kg$^{0.8}$ BW per d and dCP, dFat and dCarb as g/kg$^{0.8}$ BW per d) (Schrama et al 2018). The results of the current study showed that growth was significantly ($P < 0.5$) linearly related to DE and NE_{lin} intake within each protein level, which suggested a constant efficiency of digestible carbohydrates even at the relatively high dietary carbohydrate levels used in this study. NE_{lin} showed the best prediction of growth (R^2=0.94 compared to R^2=0.93 for DE intake and R^2=0.91 for NE_{curv} intake), which also showed that a NE approach with linear efficiencies of digestible macronutrients can increase the prediction of growth performance in feed evaluation for rainbow trout. A NE approach, which assumed the utilisation of carbohydrates to be curvilinearly related to carbohydrate intake did not lead to an increased prediction of growth performance as compared to DE in the current study.