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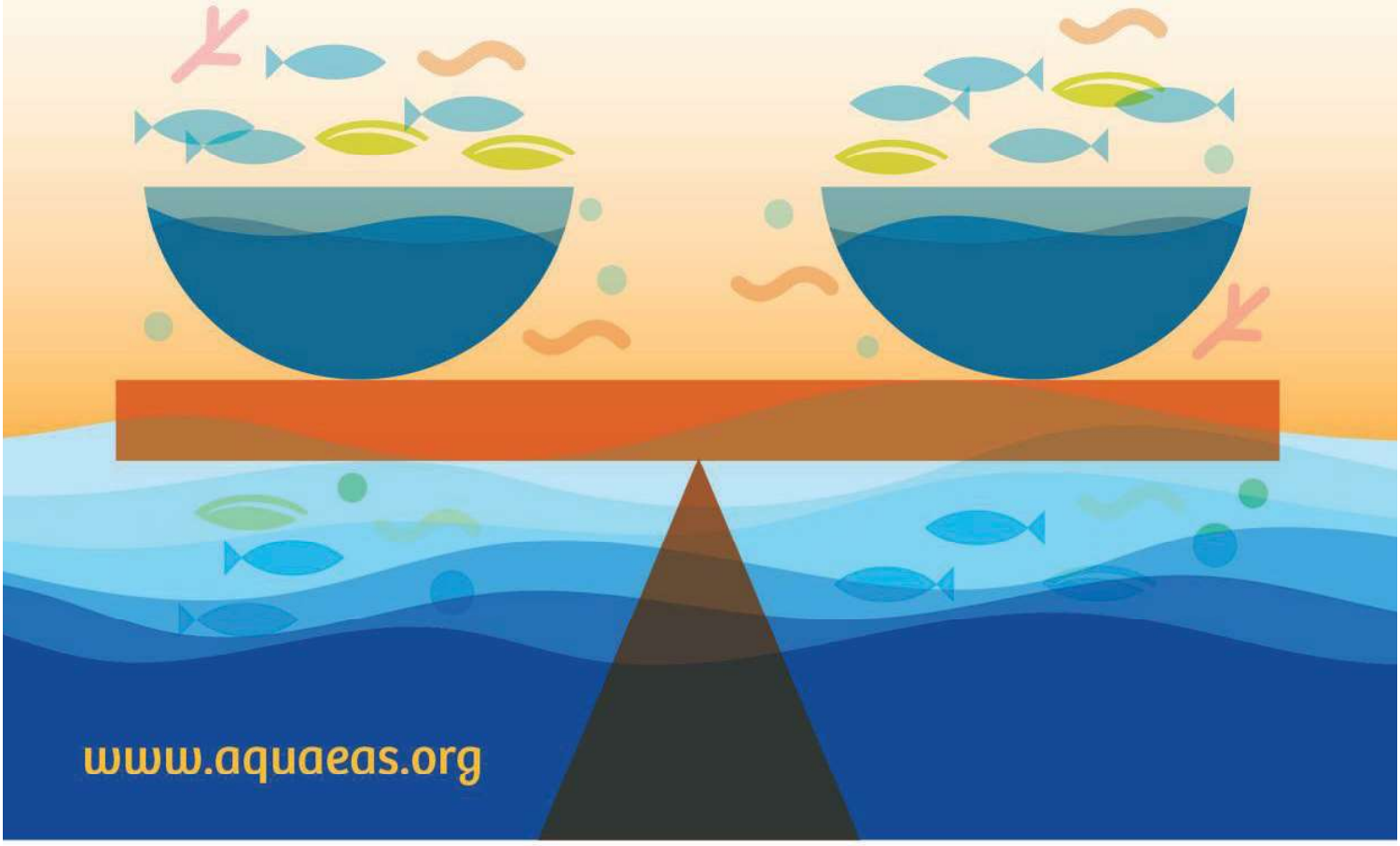

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VALIDATING BIOLOGICAL EFFICACY OF METHIONINE SOURCES IN NILE TILAPIA

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Introduction

Soybean meal-based diets in fish are limited in methionine (Met) and need its supplementation in order to meet requirements of fish for optimal growth performance. DL-methionine (DL-Met) and methionine hydroxy analogue, DL-MHA (DL-2-hydroxy-4-methylthiobutyrate free acid, DL-HMTBa and its calcium salt, MHA-Ca) are the commonly available supplemental Met sources in animal feeds. In Nile tilapia, Teodosio et al. (2022), using labelled sources of DL-Met and MHA-Ca, demonstrated the better utilization of DL-Met versus MHA-Ca for body protein synthesis. While there debate exists in the literature, based on the published data, NRC (2011) concluded that it is reasonable to assume that the biological efficacy (BE) of MHA in fish is 75-80% that of DL-Met on an equimolar basis. This is equivalent to 63-67% for MAH-Ca on a weight basis considering its 84% product purity. This means 1 unit of MHA-Ca and 0.65 unit DL-Met elicit equal performance in fish. With this background, this study was undertaken to validate the 65% average bioefficacy of MHA-Ca versus DL-Met based on the growth performance and antioxidant status of Nile tilapia.

Materials and Methods

The trial was conducted at the experimental facilities of the University of Trás-os-Montes e Alto Douro (UTAD, Vila Real, Portugal) under the full responsibility of SPAROS. The trial comprised 7 dietary treatments (D1-D7) and all diets were based on a single basal formulation (NC) containing 0.47% Met and 1.00 % Met+Cys. The remaining 6 diets were supplemented with three Met sources (DL-Met, MHA-Ca and PROXYMet containing 65% DL-Met and 35% limestone). D2 and D3 with DL-Met at 0.1 and 0.2%; D4 and D5 with MHA-Ca at 0.154 and 0.308%; and D6 and D7 with PROXYMet at 0.15 and 0.31%. Diets were isonitrogenous (crude protein: 37.5 ± 0.5 %DM) and isoenergetic (gross energy: 19.2 ± 0.1 MJ/kg DM). Diets were fed three times daily over 92 days, to quadruplicate groups of Nile tilapia (50 fish per tank) with a mean initial body weight of 22.5 g (1.2 g, SD). The average water temperature during the trial was 26.5 ± 0.4°C and water dissolved oxygen levels were kept above 6.4 mg/L. Ten whole-fish from the initial stock (start of the trial) and a pool of 9 whole-fish from each replicate tank at the end of the trial were sampled and used for whole body composition analysis. Liver of 3 additional fish per replicate tank were sampled, and used for assessing antioxidant status criteria.

Table 1. Growth performance of Nile tilapia fed different diets over 92 days

Methionine sources; doses %	Final body weight g/fish	SGR %/day	Feed conversion ratio	Protein efficiency ratio
-	98.4 $^{a, x}$	1.60 $^{a, x}$	1.34 ^{b}	2.18 $^{a, x}$
DL-Met, 0.1%	113.8 $^{c, y}$	1.76 $^{c, y}$	1.17 ^{a}	2.50 $^{c, y}$
DL-Met, 0.2%	119.9 $^{c, z}$	1.82 $^{c, z}$	1.13 ^{a}	2.61 $^{c, y}$
MHA-Ca, 0.15%	109.8 $^{b, y}$	1.72 $^{b, y}$	1.21 ^{a}	2.42 $^{b, y}$
MHA-Ca, 0.31%	115.6 $^{b, z}$	1.77 $^{b, z}$	1.19 ^{a}	2.42 $^{b, y}$
ProxyMet, 0.15%	117.1 $^{c, y}$	1.79 $^{c, y}$	1.17 ^{a}	2.44 $^{bc, y}$
ProxyMet, 0.31%	119.2 $^{c, z}$	1.81 $^{c, z}$	1.14 ^{a}	2.53 $^{bc, y}$
P values				
Met Source	**<0.001**	**<0.001**	**0.022**	**0.003**
Met Dose	**<0.001**	**<0.001**	0.064	**0.019**
Met Source x Dose	0.084	0.209	0.821	0.279

Different superscripts within a column denote statistical differences (P<0.05).
Supercripts a, b and c for variable Met source. and x, y and z for variable Met dose.

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Results

Fish fed the Met supplemented diets (2 to 7) showed a significantly higher body weight, specific growth rate (SGR) and protein efficiency ratio (PER) and a significantly lower FCR than those fed D1, without Met supplementation (Table 1). Diets supplemented with Met sources DL-Met and PROXYMet led to a significantly higher final body weight, SGR, PER and a significantly lower FCR than those supplemented with MHA-Ca (Table 1). Met dose had also a significant effect on performance criteria, with higher FBW and SGR being found in fish fed diets with the highest supplementation dose. Dietary Met dose or supplementation had no significant effect on the whole-body composition of fish. Fish fed diets supplemented with Met sources DL-Met and PROXYMet showed also a significantly higher whole-body protein, fat and energy retention than those fed diets supplemented with MHA-Ca. Increase in Met supplementation doses led to a significant increase of the hepatic levels of the reduced glutathione form (GSH). Overall, all Met supplemental sources and doses generated significant gains on the performance criteria of Nile tilapia. However, these gains were significantly higher with DL-Met and PROXYMet products than with the MHA-Ca product, suggesting bioefficacy of MHA-Ca is even lower than 65% in Nile tilapia on a weight basis. As in our study, lower BE of MHA-Ca (43-52% on weight basis) versus DL-Met was also reported recently in common carp (Zhou et al. 2021). Results of this study need to be considered in formulating tilapia feeds for optimal production and economic performance.

References

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