

Nutrient Composition of Alternative Protein Sources Used in Fish Feed Formulation

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Abstract

The aquafeed industry is heavily dependent on fishmeal (more than 60%) as the primary protein source to satisfy the needs of numerous aquaculture species. The rapid expansion of global aquaculture output has become an urgent concern and has encouraged the discovery and use of alternative protein sources in fish feed. The aim of the study was to evaluate the nutrient composition of alternative protein sources in comparison with fishmeal for potential replacement thereof. The proximate composition of fishmeal, black soldier fly (*Hermetia illucens*) larvae (BSFL) meal and moringa (*Moringa oleifera*) leaf powder (MoLP) was determined according to the AOAC official methods. Amino acid separation and detection were performed using a waters Acquity Ultra Performance Liquid Chromatograph (UPLC). BSFL ($47.05 \pm 0.52\%$) and MoLP ($27.58 \pm 4.06\%$) demonstrated a significantly ($p < 0.05$) lower protein content compared to fishmeal ($67.38 \pm 2.43\%$). Fishmeal had a significantly higher ($p < 0.05$) ash content ($15.86 \pm 0.07\%$) compared to BSFL ($8.88 \pm 0.27\%$) and MoLP ($10.82 \pm 0.11\%$). The moisture content of BSFL ($0.04 \pm 0.03\%$) was significantly lower ($p < 0.05$) than that of fishmeal ($3.40 \pm 0.04\%$) and MoLP ($4.99 \pm 0.18\%$). Of the ten essential amino acids (EAA) required for fish growth, fishmeal [(arginine ($6.53 \pm 0.26\%$), histidine ($2.98 \pm 0.13\%$), isoleucine ($4.89 \pm 0.14\%$), leucine ($9.36 \pm 0.19\%$), lysine ($5.66 \pm 0.21\%$), methionine ($2.51 \pm 0.15\%$), phenylalanine ($6.40 \pm 0.40\%$), threonine ($4.93 \pm 0.16\%$), tryptophan (ND), and valine ($6.13 \pm 0.15\%$)] demonstrated a significantly higher ($p < 0.05$) amino acid content compared to BSFL and MoLP. There was no statistical significance ($p > 0.05$) for lysine (a first limiting amino acid that is essential in fish diet) between fishmeal ($5.66 \pm 0.21\%$) and BSFL (4.97 ± 0.85). BSFL demonstrated nutritional content that is required for fish feed formulation, indicating high potential as an alternative protein source. As a result, investigations on feeding trials with fish at various levels of BSFL should be conducted to assess acceptable levels of these feed ingredients, their effects on the eating quality of fish muscle and to find long-term and sustainable solutions in fish nutrition.