

A systematic review and meta-analysis on the effects of glutamate and glutamine on fish nutrition

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INTRODUCTION & AIM

Glutamine (Gln) and glutamate (Glu) are traditionally considered nonessential amino acids as they can be synthesised de novo in the body from other amino acids and ammonia. Modern aquaculture diets with low fish meal and high plant feedstuff levels challenge the intestinal epithelium, potentially increasing Glu and Gln requirements.

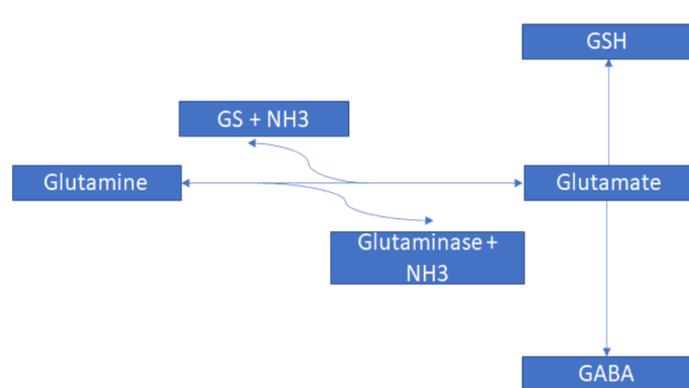


Figure 1. Pathways of synthesis and degradation of glutamate and glutamine in fish. Glutamine is converted into Glutamate through the action of Glutaminase and ammonia (NH₃), and glutamate is converted into glutamine through the action of glutamine synthetase (GS) and ammonia. Glutamate can also be converted into Glutathione (GSH) and Gamma-AminoButyric Acid (GABA).

This work aimed to gather available knowledge on the supplementation of glutamine or glutamate in fish feeds and systematise this data in order to identify knowledge gaps, their metabolism, and potential challenges to improve global aquafeeds.

METHOD

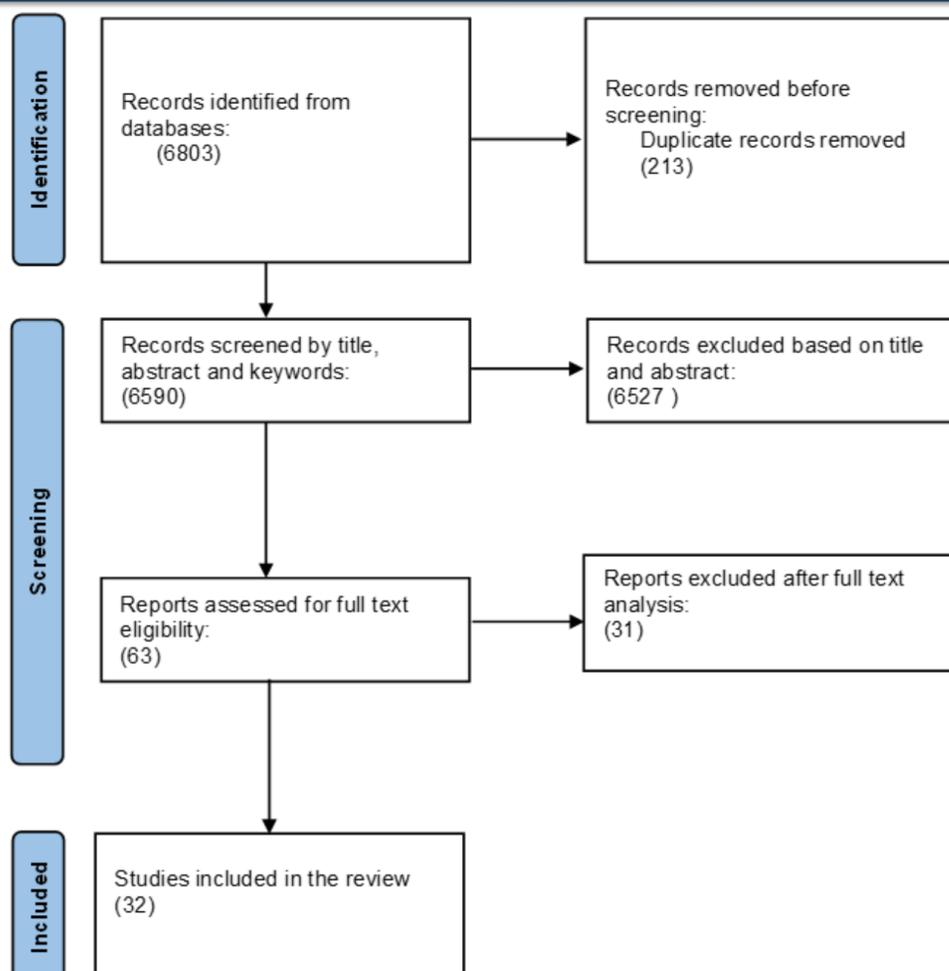


Figure 2. Flow chart of the methodology followed for the identification and selection of studies, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Numbers within brackets indicate the number of records.

RESULTS & DISCUSSION

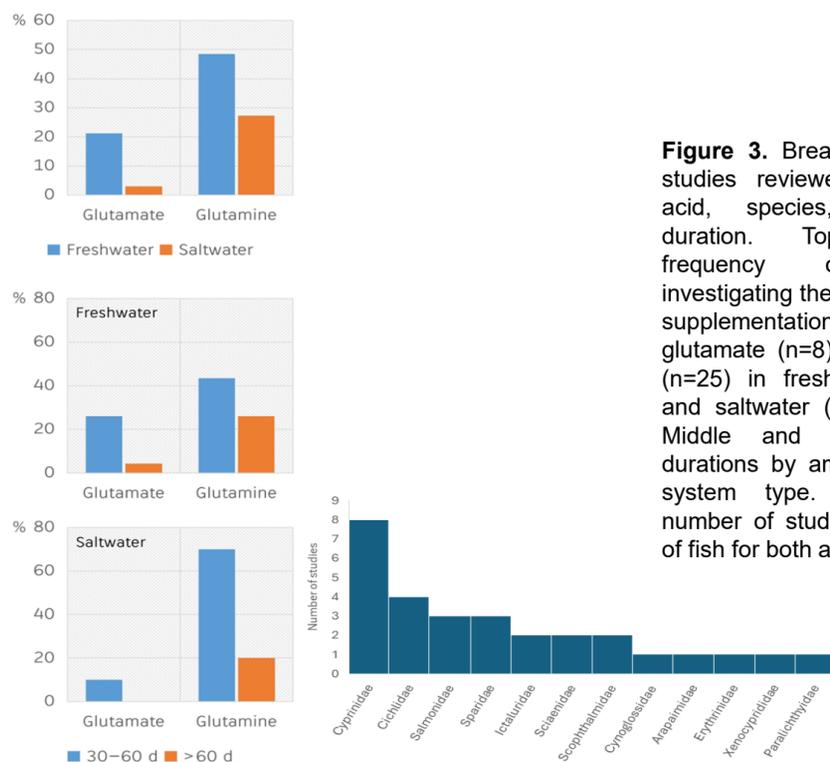


Figure 3. Breakdown of the studies reviewed by amino acid, species, and trial duration. Top: Relative frequency of studies investigating the effects of diet supplementation with glutamate (n=8) or glutamine (n=25) in freshwater (n=24) and saltwater (n=9) species. Middle and bottom: trial durations by amino acid and system type. Bottom left number of studies per family of fish for both amino acids.

Figure 4. Distribution of the number of dietary treatments tested across the studies included in the meta-analysis.

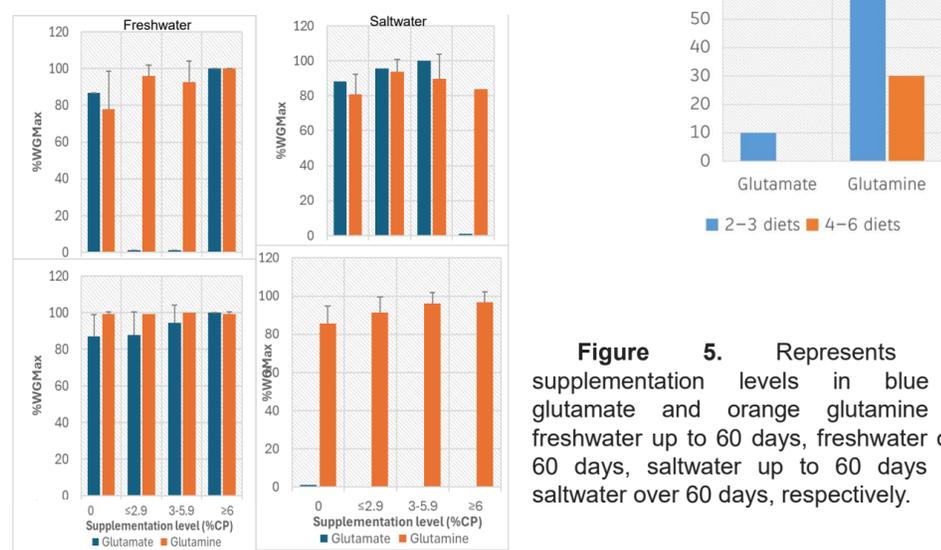


Figure 5. Represents the supplementation levels in blue of glutamate and orange glutamine for freshwater up to 60 days, freshwater over 60 days, saltwater up to 60 days and saltwater over 60 days, respectively.

CONCLUSION

- Results indicate that dietary glutamate and glutamine supplementation can affect growth performance in a species-specific manner.
- For some species, supplementation at levels slightly above conventional dietary inclusion may promote growth. Conversely, high supplementation levels, may reduce growth performance.
- Further studies should be conducted in different life stages, stressors, and combinations of these amino acids to understand their potential

Acknowledgments

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