

Probiotics Facilitate the Regulation of Growth and Immunity in American shad (*Alosa sapidissima*) through Modulation of the Intestinal Microbiome against Suboptimal Temperature

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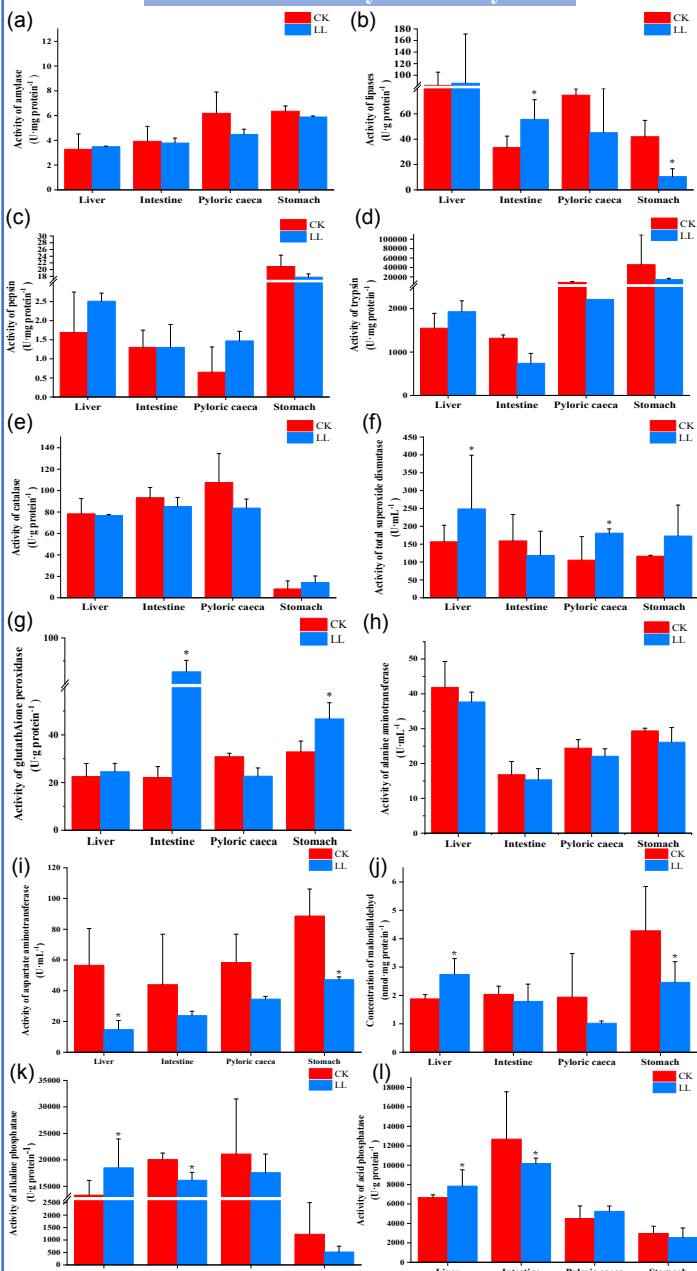
Introduction

- American shad (*Alosa sapidissima*) is an anadromous migratory fish. It is very similar to Chinese shad (*Tenualosa reevesii*), known as one of the three fresh food on the Yangtze River, in taste, nutritional value, and morphology. However, *A. sapidissima* is one of the most sensitive fish species and exhibit pronounced stress reactions to intervention, particularly high temperature. These reactions significantly hinder the expansion of shad aquaculture.
- Using probiotics in the culture of *A. sapidissima* to alleviate high temperature stress and its impact on growth is indeed a potential approach. In this study, *A. sapidissima* were fed *Lactococcus lactis* as dietary additives under high temperature conditions. A combined analysis of microbiomics and transcriptomics was carried out to access the effects on growth performance, biochemical indexes, intestinal microbiota of *A. sapidissima* and reveal metabolic pathway of the intestinal microbe manipulated by probiotic bacteria.



Results

Different enzyme activity

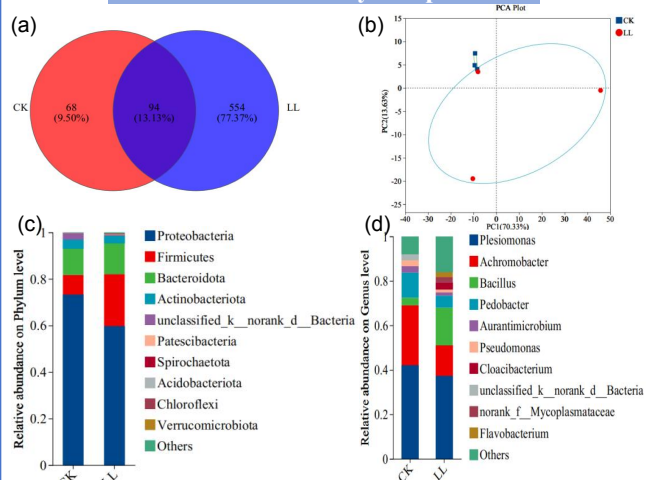


The activities of T-SOD, AKP and ACP in liver increased significantly, while AST activity in liver decreased significantly. The activities of LPS and GSH-PX in intestine increased significantly, while AKP and ACP in intestine decreased significantly. The activity of GSH-PX in stomach increased significantly, while the AST activity and the content of MDA decreased significantly.

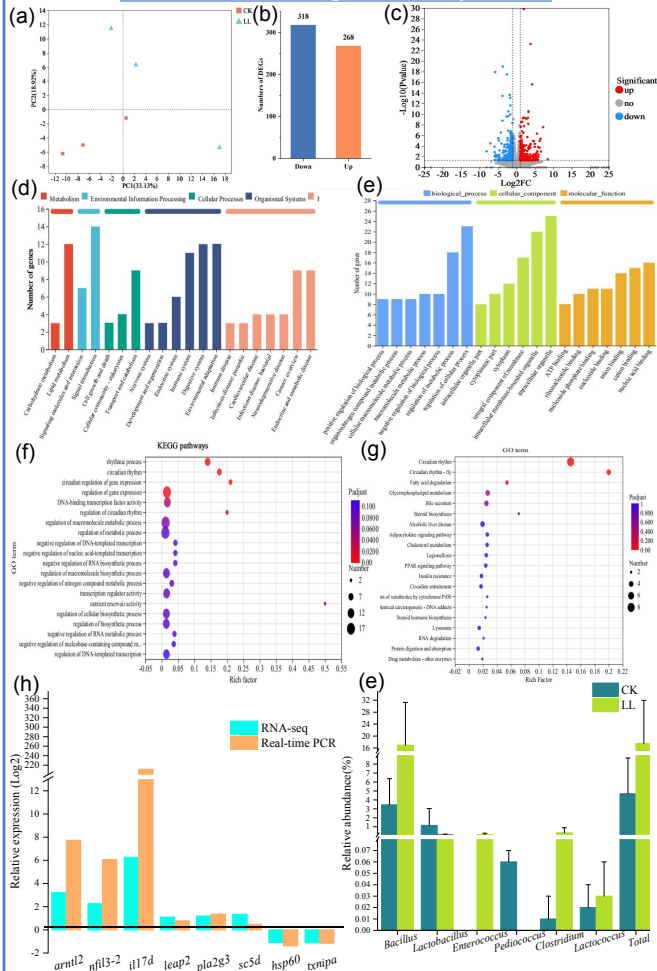
Acknowledgements

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Bacterial community composition



Liver transcriptome analysis



Conclusion

In summary, dietary addition of *L. lactis* is beneficial to improve the growth performance of *A. sapidissima*, reduce feed coefficient, enhance intestinal digestion and absorption, alleviate liver burden. In addition, *L. lactis* promotes the homeostasis of *A. sapidissima* intestinal flora by regulating its structure. The intestinal microbial structure was reshaped with increased relative abundance of potential beneficial bacteria, such as *Bacillus*, *Lactococcus* and *Clostridium*. Remarkably, *L. lactis* affected the expression of genes (e.g. *arn12*, *nfil3-2*, *hsp 60*, etc.) with immunity and stress.

References

Naiel M A E, Shehata A M, El-Kholy A I, et al. The mitigating role of probiotics against the adverse effects of suboptimal temperature in farmed fish: A review[J]. *Aquaculture* 2022, 550.