Effects of Bicarbonate Stress on Serum Ions and Gill Transporters in Alkali and Freshwater Forms of Amur ide (*Leuciscus waleckii*)

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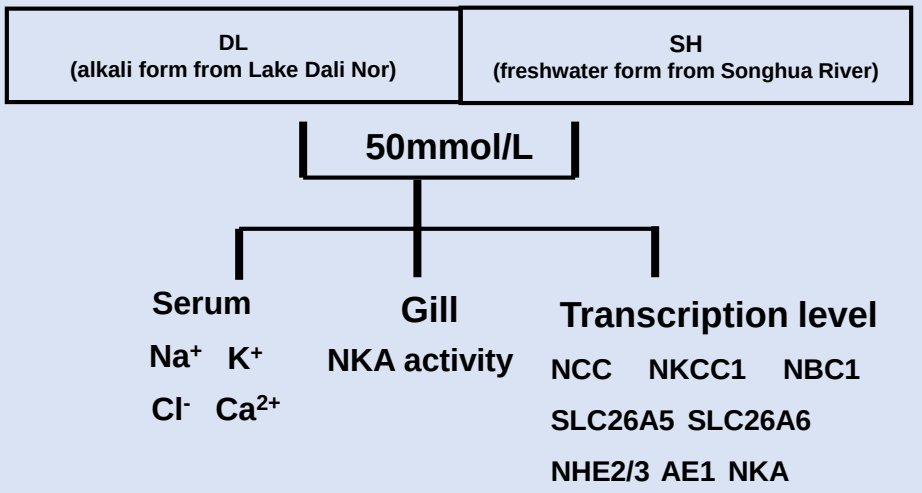
Introduction

The Amur ide (*Leuciscus waleckii*) is a fish in the Cyprinidae family. Compared with other Amur ide living in freshwater ecosystems, the Amur ide population in Lake Dali Nor of China is famous for its high tolerance to the alkaline conditions of 54mM (pH 9.6). Yet, surprisingly, the ionoregulatory mechanism responsible for this remarkable alkaline adaptation remains unclear. Therefore, this study sought to investigate how bicarbonate affects the acid-base balancing and ionoregulatory responses of this animal.

Materials & Methods



Results

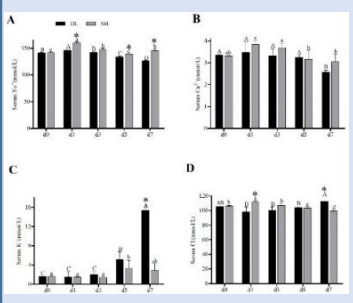


Fig.1 Serum ion concentrations of DL and SH acclimated to AW (alkaline water) for 7 days.

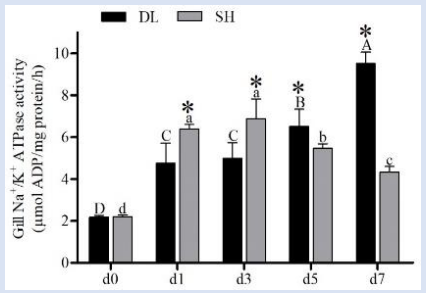
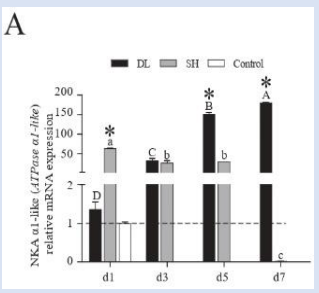


Fig.2 Gill NKA activity (n = 9) of DL and SH fish forms acclimated to AW for 7 days.



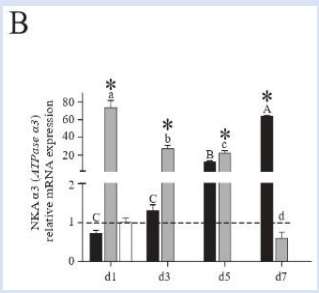
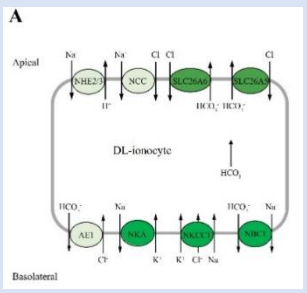


Fig.3 Gill NKA α1-like (*ATPase α1-like*) and NKAα3 (*ATPase α3*) mRNA levels for DL and SH fish forms.



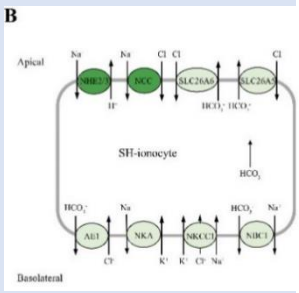


Fig.4 Hypothetical model of mRNA expression of each gene in the gills of DL and SH fish forms in AW.

Conclusion

We found that the close relationships among the serum Na^+ and mRNA levels of NCC, NKCC1, and NHE, and also NKA and NBC1, in addition to serum Cl^- and bicarbonate transporters (e.g., SLC26A5 and SLC26A6), characterized the alkali form of Amur ide. We propose that this ecotype can ensure its transepithelial Cl^- and Na^+ uptake/base secretions are highly functional, by its basolateral NKA with NBC1 and apical ionic transporters, and especially NCC incorporated with other transporters (e.g., SLC26). This suggests an evolved strong ability to maintain an ion osmotic and acid-base balance for more effectively facilitating its adaptability to the high alkaline environment. This study provides new insights into the physiological responses of the alkaline form of the Amur ide fish for adapting to extreme alkaline conditions. This information could be used as a reference to cultivating alkaline-tolerant fish species in abandoned alkaline waters.