Conserved fatty acid profiles and lipid metabolic pathways in a tropical reef fish exposed to ocean warming - an adaptation mechanism of tolerant species?

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4634416
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Year 2021
Title Conserved fatty acid profiles and lipid metabolic pathways in a tropical reef fish exposed to ocean warming - an adaptation mechanism of tolerant species?
Journal Science of the Total Environment
Volume 782
Pages / Article-Number 146738
Mesh terms Animals; Anthozoa; Coral Reefs; Fatty Acids; Lipids; Metabolic Networks and Pathways; Oceans and Seas; Temperature
Climate warming is causing rapid spatial expansion of ocean warm pools from equatorial latitudes towards the subtropics. Sedentary coral reef inhabitants in affected areas will thus be trapped in high temperature regimes, which may become the ”new normal”. In this study, we used clownfish Amphiprion ocellaris as model organism to study reef fish mechanisms of thermal adaptation and determine how high temperature affects multiple lipid aspects that influence physiology and thermal tolerance. We exposed juvenile fish to two different experimental conditions, implemented over 28 days: average tropical water temperatures (26 řC, control) or average warm pool temperatures (30 řC). We then performed several analyses on fish muscle and liver tissues: i) total lipid content (%), ii) lipid peroxides, iii) fatty acid profiles, iv) lipid metabolic pathways, and v) weight as body condition metric. Results showed that lipid storage capacity in A. ocellaris was not affected by elevated temperature, even in the presence of lipid peroxides in both tissues assessed. Additionally, fatty acid profiles were unresponsive to elevated temperature, and lipid metabolic networks were consequently well conserved. Consistent with these results, we did not observe changes in fish weight at elevated temperature. There were, however, differences in fatty acid profiles between tissue types and over time. Liver showed enhanced α-linolenic and linoleic acid metabolism, which is an important pathway in stress response signaling and modulation on environmental changes. Temporal oscillations in fatty acid profiles are most likely related to intrinsic factors such as growth, which leads to the mobilization of energetic reserves between different tissues throughout time according to organism needs. Based on these results, we propose that the stability of fatty acid profiles and lipid metabolic pathways may be an important thermal adaptation feature of fish exposed to warming environments.
Publisher Elsevier
ISSN/ISBN 0048-9697
URL https://www.sciencedirect.com/science/article/abs/pii/S0048969721018064
edoc-URL https://edoc.unibas.ch/85483/
Full Text on edoc No;
Digital Object Identifier DOI 10.1016/j.scitotenv.2021.146738
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/33836377
ISI-Number WOS:000656997100014

Document type (ISI) Journal Article