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AMMONOTELIK AIR TAWAR *Leptobarbus hoevenii* MEMBENTUK SEMULA KEPERLUAN FISIOLOGI UNTUK MENGHADAPI PERUBAHAN PERSEKITARAN

NOR SUHAINI BINTI MOHAMAD

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Penyelia utama : Prof. Madya Liew Hon Jung, PhD
Institut : Institut Akuakultur Tropika dan Perikanan

Pemanasan air semasa dan pengasidan air tawar tidak diragui akan menjejaskan kehidupan haiwan akuatik terutamanya ammonotelik teleos dengan mengubah tindak balas fisiologi mereka. Kajian ini direka bentuk untuk menyiasat kesan suhu (28°C lwn. 32°C) dan pH (7 lwn. 5) ke atas strategi kompromi metabolisma ikan jelawat. Ikan didedahkan kepada keaadan (i) 28°C + pH 7 ($N_{28°C}$, kawalan); (ii) 32°C + pH 7 ($N_{32°C}$); (iii) 28°C + pH 5 ($L_{28°C}$) dan (iv) 32°C + pH 5 ($L_{32°C}$) selama 20 hari diikuti dengan cerakinan osmorespirasi. Keputusan menunjukkan bahawa prestasi pemakanan menyusut, apabila ikan jelawat terdedah kepada keadaan pH yang rendah ($L_{28°C}$ dan $L_{32°C}$) sebanyak 63.30 dan 30.61%. Walau bagaimanapun, mendedahkan ikan jelawat kepada keadaan $L_{32°C}$, mempengaruhi pengambilan metabolisma oksigen dan perkumuhan ammonia iaitu kira-kira dua kali ganda lebih tinggi berbanding kumpulan kawalan. Bagi mobilisasi tenaga, ikan jelawat memobilisasikan protein daripada hati dan tisu otot serta glikogen daripada tisu otot dalam keadaan $L_{28°C}$. Manakala pada keadaan $N_{32°C}$ dan $L_{32°C}$, ikan jelawat didapati menyimpan protein, glikogen, dan lipid pada organ hati. Ikan jelawat pada keadaan $L_{32°C}$ meningkatkan plasma osmolaliti dengan pengambilan elektrolit secara aktif melalui pengambilan makanan bagi mengekalkan keseimbangan plasma Na^+ dan Cl^-. Keputusan juga menunjukkan bahawa pada suhu tinggi dan pH yang rendah menyebabkan perubahan teruk ke atas lamela primer dan sekunder serta sel-sel di dalam lamela dengan beberapa

jenis pengubahsuaian insang termasuklah aneurisme, edema, hipertrofi, pengerintingan lamela sekunder, pengangkatan epitelium, hiperplasia dan percantuman lamela. Kajian ini mendedahkan bahawa ikan jelawat sangat sensitif terhadap pH air yang rendah dan suhu yang tinggi. Oleh itu, ikan jelawat membentuk semula keperluan fisiologi untuk menghadapi perubahan keadaan persekitaran.

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FRESHWATER AMMONOTELIC *Leptobarbus hoevenii* REMODEL THEIR PHYSIOLOGICAL NEEDS TO COPE WITH CHANGING ENVIRONMENT

NOR SUHAINI BINTI MOHAMAD

2023

Main Supervisor : Assoc. Prof. Liew Hon Jung, PhD
Institute : Institute of Tropical Aquaculture and Fisheries

Current water warming and freshwater acidification undoubtedly affecting the life of aquatic animals especially ammonotelic teleost by altering their physiological responses. This study was designed to investigate the effect of temperatures (28°C vs. 32°C) and pH (7 vs. 5) on the metabolic compromising strategies of Hoven's carp. Fish were conditioned to (i) 28°C + pH 7 ($N_{28°C,}$ control); (ii) 32°C + pH 7 ($N_{32°C}$); (iii) 28°C + pH 5 ($L_{28°C}$) and (iv) 32°C + pH 5 ($L_{32°C}$) for 20 days followed by osmorespiration assay. Results showed that feeding performance was significantly depressed when Hoven's carp exposed to low pH conditions ($L_{28°C}$ and $L_{32°C}$) by 63.30 and 30.61%. However, by exposing Hoven's carp to $L_{32°C}$, induced high metabolic oxygen intake and ammonia excretion to about 2-folds higher compared to control group. As for energy mobilisation, Hoven's carp mobilized liver and muscle protein as well as muscle glycogen under $L_{28°C}$ condition. Whereas under $N_{32°C}$ and $L_{32°C}$, Hoven's carp was found to reserve protein, glycogen and lipid in liver. In order to maintain plasma Na^+ and Cl^- balance, Hoven's carp increased its plasma osmolality by allowing active uptake of these essential electrolytes through feed intake under $L_{32°C}$. Results also shown that high temperature at normal temperature ($N_{32°C}$) and low pH group ($L_{28°C}$ and $L_{32°C}$) caused severe changes on the primary and secondary lamellae as well as the cells within lamellae with several degree of gill modifications including aneurysm, oedema, hypertrophy, curling of secondary lamellae, epithelial lifting, hyperplasia and lamellae fusion. This study revealed that Hoven's carp is sensitive to

lower water pH and high temperature, thereby Hoven’s carp remodelled their physiological needs in order to cope with the environmental changes condition.