THE SWAMP EEL, *MONOPTERUS ALBUS*, AVOID AMMONIA TOXICITY DURING “AESTIVATION” IN THE MUD BY SUPPRESSION OF ENDOGENOUS AMMONIA PRODUCTION WITH NO INCREASE IN GLUTAMINE

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**Keywords:** swamp eel, *Monopterus albus*, aestivation, ammonia toxicity, free amino acids, energy charge, adenosine triphosphate

**Abstract**

*Monopterus albus* inhabits muddy ponds, swamps, canals and rice fields, where it can burrow within the moist earth during the dry summer season, thus surviving for long periods without water. Without water to irrigate the gills or the body surface in the mud, *M. albus* has difficulties in excreting ammonia that is endogenously produced. Thus, this study aimed at elucidating the strategies adopted by *M. albus* to defend against endogenous ammonia toxicity during “aestivation” in the mud for 6 or 40 d. Ammonia and glutamine, but not urea, accumulated in the tissues of specimens exposed to air (normoxia) for 6 d, indicating that endogenous ammonia was detoxified to glutamine under such experimental conditions. In contrast, ammonia accumulation occurred only in the muscle of specimens buried in the mud for 6 d, with no increase in glutamine or glutamate content in all the tissues and organs studied. Similar results were obtained with specimens buried in the mud for 40 d, although fish on land could not survive more than 10 d. While living in the mud prevented excessive water loss from the surface of the skin through evaporation, the specimens were necessarily exposed to a lack of oxygen. Indeed, there was a decrease in the P$_{O_2}$ level in the blood of fish which stayed inside the mud for 6 or 40 d. At the same time, there were decreases in the energy charge and ATP concentration, and increases in the concentration of ADP in the muscle of these experimental objects. Hence, it is obvious that glutamine synthesis was discarded as the major strategy to ameliorate ammonia toxicity by *M. albus* when ATP production was at stake during hypoxic exposure. Rather, suppression of endogenous ammonia production appeared to be the major strategy adopted by *M. albus* to avoid ammonia intoxication. Our results indirectly suggest that decreases in rates of proteolysis and amino acid catabolism might have occurred. This appears to be the most effective strategy for a fish to defend against ammonia toxicity because it would have no negative effect on the energy charge and ATP content of the tissues, and at the same time, allow the fish to enter a stage of torpor to bear through this adverse period.