ウナギの海水適応に伴うトリメチルアミンおよびトリメチルアミンオキシド濃度の変化

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Short Paper

Changes in Level of Trimethylamine and Trimethylamine Oxide during Adaptation of Young Eel *Anguilla anguilla* to a Seawater Environment

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Trimethylamine oxide (TMO) in fish has been found to widely occur in elasmobranchs and marine teleosts. In elasmobranchs TMO constitutes part of the system for osmoregulation.[1] It has been recognized that the amounts of TMO in various tissues of marine teleosts are larger than those of freshwater fish.[2,3] As we also already reported,[4] chum salmon *Oncorhynchus keta* reared on diets added with trimethylamine (TMA) had higher TMO concentrations in liver and kidney when they were kept in seawater (SW) than in freshwater (FW) environment. TMA oxidation is the only known pathway for the formation of TMO in aquatic animals.[5,6] We reported previously that eel *Anguilla japonica* received TMA by intraperitoneal injection accumulated significantly higher TMO concentrations in muscle, liver, and kidney in the SW environment than in the FW.[7] In the SW environment, TMA monooxygenase responsible for producing TMO in the liver and kidney was extremely elevated in level.[7] In this paper, we describe the changes of TMA and TMO levels in the muscle and whole body of young eel *Anguilla anguilla* without feeding, in relation to SW adaptation.

Young eel *Anguilla anguilla* which were supplied from National Reseach Institute of Aquaculture, Mie, Japan, were grown up to a body weight of approximately 5 g, and then, fish were properly fed on a dumpling made of a commercial dried eel diet (4 g), a drop of fish oil, and distilled water (5 m*l*) per day. Each aquarium was equipped with a plastic filter and aerated by an air pump. The water temperature was thermostatically controlled to approximately 18±1°C. Sixty fish were starved for 24 h in FW and transferred to artificial SW (Jamarine U). For determination of the TMA and TMO concentrations, fish were reared without any feeding and killed after 0, 3, 6, 12, 24, and 48 h. Five fish were separated randomly and analyzed for TMA and TMO levels of the whole body, and other 5 fish were done for those of the muscle tissue. TMA and TMO were determined by gas liquid chromatography as described previously.[7]

Figure 1 shows the changes of TMA and TMO concentrations in the muscle and whole body of young eel after transferring from FW to SW. TMO levels continued to increase until apporoximately 24 h. In FW, however, both TMA and TMO concentrations remained unchanged in muscle and whole body (data not shown). The result suggests that a fasted eel could endogenously synthesize TMO in the SW environment. The synthesis has also been reported to occur in a fasted euryhaline fish *Fundulus heteroclitus*.[8] The

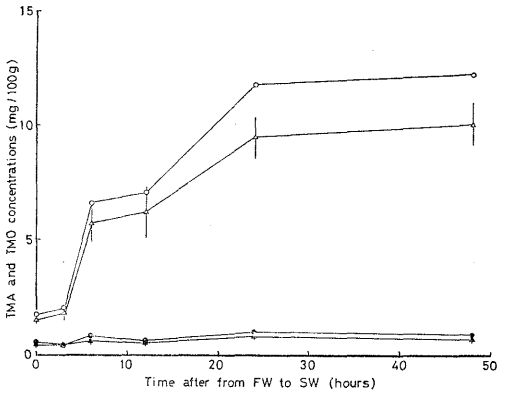

Fig. 1. Changes in TMA and TMO concentrations of young eel after transfer from freshwater (FW) to seawater (SW) (mg/100 g). Vertical bars represent standard deviations. Open and closed symbols represent TMO and TMA, respectively. Circle, muscle tissue; Triangle, whole body.

synthesis of TMO from choline through TMA has been postulated in fish tissues,[2] although TMA levels in eel increased little throughout the experimental period (Fig. 1). If this postulate is true, the synthesis of enzymes responsible for the choline-TMA-TMO system seemed to occur immediately after the transfer to SW. Until approximately 24 h the enzymes could continue to catalize the production of TMO as much as the compound shares the total osmotic pressure in eel body. Further investigation on the choline-TMA-TMO system in fish tissue is now in progress.

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