Dietary Protein Level-dependent Effect of Methionine Supplementation on the Fate of Methylmercury in Mice

Tatsumi ADACHI,^{*,a,†} and Kimiko HIRAYAMA^b

Biochemistry Section, Department of Basic Medical Sciences, National Institute for Minamata Disease,^a

Minamata City, Kumamoto 867, Japan and Kumamoto University College of Medical Science,^b

Kumamoto City, Kumamoto 862, Japan Present address : Environmental Health

Sciences Division, National Institute for Environmental Studies,[†]

Tsukuba City, Ibaraki 305, Japan

Introduction

We recently reported that dietary levels of protein and sulfur amino acids were an important modifying factor on the fate of methylmercury (MeHg).¹⁾ When mice fed on a 7.5% protein diet (low protein diet, LPD) supplemented with methionine to the level of a 24.8% protein diet (normal protein diet, NPD), the fate of MeHg markedly changed compared with NPD- or LPD-fed mice.¹⁾ We suggested that the marked alterations might be partly caused by a change in the metabolism of sulfur amino acids induced by their excessive levels compared with other amino acids. Since the fate of MeHg is closely related to glutathione (GSH) metabolism and the effect of supplementation of sulfur amino acids on GSH metabolism is influenced by dietary protein levels, it is possible that the effect of the supplemented amino acids on the fate of MeHg might depend on these protein levels.

To confirm the above speculation, tissue distribution and excretion of Hg after administration of MeHg were investigated in mice fed on NPD or LPD with or without supplementation of methionine (1%).

Methods

C57BL/6N male mice (7 weeks of age) were housed individually and fed on NPD, a methionine-supplemented normal protein diet, LPD, or a methionine-supplemented low protein diet for 5 d before the experiment. The mice were orally administered MeHg (20 μ mol/kg) on day 0, and housed in metabolism cages. On days 1 and 7,

urine and feces were collected and each mouse was sacrificed as reported previously.¹⁾ Another group of mice was sacrificed under ether anesthesia 2 h after oral administration of MeHg (20 μ mol/kg). Blood was collected from femoral artery and immediately centrifuged. Fresh plasma was subjected to ultrafiltration to obtain a low molecular weight (LMW) fraction. Hg content in each sample was determined by the oxygen combustion-gold amalgamation method.

Results and Discussion

Brain Hg concentration increased from supplementation of methionine to LPD, but not to NPD. Hg concentration in liver increased and that in kidney decreased from supplementation of methionine to both NPD and LPD. Urinary Hg excretion drastically increased from supplementation of methionine to both diets, whereas no effect of the supplementation on fecal Hg excretion was observed. Hg concentration in blood and whole plasma decreased but that in plasma LMW fraction increased from supplementation of methionine to LPD alone. This would be a reason for the difference in the brain Hg concentration, since plasma LMW MeHg metabolites are a driving force in tissue uptake of MeHg.

The present results suggest that the effect of supplementation of methionine on the fate of MeHg depends, at least partly, on the dietary protein levels.

Reference

- 1) Adachi T., Yasutake A., Hirayama K., *Toxicology*, **93**, 225 (1994).