Effects of Monosodium Glutamate on Pro-opiomelanocortin Gene Expression in Rat Pituitary Gland and AtT-20 Tumor Cells

Khomsorn Lomthaisong[1*] and Anuwat Wanthong[2]

[1]Department of Biochemistry, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand
[2]Department of Biology, Faculty of Science, Mahasarakham University, Mahasarakham 44150, Thailand

**Corresponding author. E-mail: kholom@kku.ac.th*

ABSTRACT

Pro-opiomelanocortin (POMC) is a hormone precursor produced mainly in the hypothalamus and pituitary gland. In the pituitary, post-translational processing of POMC generates secretory peptide hormones – principally, the adrenocorticotrophic hormone. Previous studies showed that administration of monosodium glutamate (MSG) to neonatal rat induces several neuroendocrine, metabolic and behavioral abnormalities. The objective of this work was to evaluate the expression of POMC mRNA in the rat pituitary and AtT-20 tumor cells following MSG administration. It was found that POMC mRNA expression in the pituitary gland of MSG-treated rats increased dramatically to 50%, while expression in pituitary AtT-20 tumor cells was inhibited. The POMC mRNA expression in the treated groups was reduced by more than 50% at every concentration of MSG used, ranging from 25 μM to 1,600 μM. POMC derived peptide, gamma 1-MSH, was also reduced, corresponding to mRNA expression level. This result has demonstrated that MSG has different effects on POMC gene expression between pituitary gland and pituitary tumor cells. This suggests that MSG has a neuronal excitatory effect on pituitary functions that enhances POMC gene expression by increasing the stress input through the central nervous system in response to high doses of MSG treatment. In contrast, in vitro, MSG decreased POMC gene expression in pituitary tumor cells; this may be a result of an excitatory toxic effect of MSG on those cells.

Keywords: Monosodium glutamate (MSG), Pro-opiomelanocortin (POMC), Hypothalamic-pituitary axis (HPA-axis), gene expression

INTRODUCTION

Monosodium L-glutamate (MSG) is widely used as a food additive. Numerous studies have shown that glutamate is the main excitatory neurotransmitter in the central nervous system and is responsible for most fast synaptic neurotransmission (Fonnum 1984; Robinson and Coyle 1987; Michaelis 1998;