Thesis Title Effects of Capsaicin on Intestinal Thiamine Absorption in the Mouse

Name Panadda Hatthachote

Degree Master of Science (Physiology)

Thesis Supervisory Committee

Chaivat Toskulkao, Ph.D.

Thirayudh Glinsukon, Sc.D.

Pawinee Piyachaturawat, Ph.D.

Date of Graduation 19 February B.E. 2535 (1992)

## ABSTRACT

The effects of capsaicin, a pungent principle of capsicum fruits, on intestinal thiamine absorption was examined in mice. In situ study with $^{14}C$-thiamine hydrochloride by using intact jejunal loops, active thiamine absorption (1.5 $\mu$M) was found to reduce after exposed to capsaicin solution (7 to 42 mg%) for 30 minutes. The maximum inhibition was observed approximately 45.82% ($P<0.001$) at a concentration of capsaicin 42 mg%. The percent inhibition of intestinal thiamine absorption was related to the capsaicin concentrations in the intestinal lumen. In contrast, capsaicin did not affect absorption of high concentration of thiamine (20 $\mu$M). The activity of $Na^+$-$K^+$ ATPase and ATP content in intestinal mucosa were determined and found that capsaicin at concentrations of 3.5,7,14 and 21 mg% reduced the activity of $Na^+$-$K^+$ ATPase by 6.97%, 14.26%,

17.21% and 19.40% respectively while the mucosal ATP content was significantly inhibited by capsaicin only at 42 mg%. There are a correlation between capsaicin inhibition of mucosal $Na^+$-$K^+$ ATPase activity and mucosal ATP content and the reduction of thiamine absorption in mouse jejunum in situ.

A similar inhibition of intestinal thiamine absorption was noted after oral administration of capsaicin (1 mg/kg BW/day) for 1,2,4 and 8 weeks as well as capsaicin (2 mg/kg BW/day) for 12 weeks. However, the inhibition of intestinal thiamine absorption was not observed in mice fed with capsaicin (1 mg/kg BW/day) for 12 weeks. The mucosal $Na^+$-$K^+$ ATPase activity was reduced in mice fed with capsaicin (1 mg/kg BW/day) for 1,2 and 4 weeks by 11.17%, 16.62% and 11.50% but it was not significantly declined in mice fed with capsaicin for 8 and 12 weeks. When mice were fed with capsaicin (1 mg/kg BW/day) for 1,2,4 and 8 weeks, the intestinal mucosal ATP content was inhibited. The maximum inhibition was observed in capsaicin-treated mice for 1 week. In mice fed with capsaicin (1 mg/kg BW/day) for 12 weeks, the reduction of mucosal ATP content was not statistically significance. A reduction in the activity of intestinal $Na^+$-$K^+$ ATPase and intestinal mucosal ATP content was also demonstrated in mice fed with capsaicin (2 mg/kg BW/day) for 12 weeks. The percent inhibition was 15.83% and 44.03% respectively. These data showed that the intestinal mucosal $Na^+$-$K^+$ ATPase activity and mucosal ATP

content were not affected by capsaicin (1 mg/kg BW/day) after 12 weeks feeding. However, in mice fed with capsaicin (2 mg/kg BW/day) for 12 weeks, both parameters were decreased and consequently inhibited intestinal thiamine absorption.

The effect of capsaicin on morphological changes of intestinal mucosa was also investigated in the present study. Most of intestinal villi were shortened, the lumens in crypts of Liberkühn were enlarged and the dead lymphocytes were found in mice given capsaicin *in situ*. No remarkable mucosal changes were observed in mice after long term capsaicin administration.

It was revealed that the decrease in intestinal mucosal ATP content was pararelled to the decrease in the activities of mitochondrial NADH cytochrome C reductase and cytochrome oxidase. Moreover, the possible mechanism of capsaicin on intestinal thiamine absorption was studied in the brush-border membrane vesicles. No inhibitory effect of capsaicin on thiamine uptake was found in this case.

Therefore, the present studies show that capsaicin adversely affects the intestinal thiamine absorption in mice both *in situ* and *in vivo*. Such inhibition is partly due to the inhibition of intestinal mucosal $Na^+$-$K^+$ ATPase activity, the reduction of intestinal mitochondrial respiratory enzymes activities with consequent reduction in mucosal ATP content and the morphological changes of intestinal absorptive cells.