The Effect of Fasting on the Interaction between Taste Perception and Metabolic Regulation

A thesis presented in partial fulfilment of the requirements for the degree of Master of Food Technology at Massey University

Wenjing Li

2012

ABSTRACT

Taste perception, via reception of tastants and endocrine signalling within the tongue, plays a key role in consumer acceptance and sensory evaluation of foods. Taste perception triggers hormones that are crucial in the control energy balance and appetite exerts a strong effect on food intake, satiety and metabolic regulation. Due to the complex interaction of genetic, biological and psychological factors, the influence of fasting on the relationship between taste perception and associated metabolic parameters remains to be explored.

The present study investigated the effect of fasting on interaction between taste perception and metabolic regulation through three main objectives. The first objective was to explore the relationship between the bitter taste sensitivity and the fatty acid taste sensitivity. Forty healthy male adults were classified into three taster groups based on their sensitivity to bitter agent 6-N-2-propylthiouracil (PROP): nontasters (n=10), medium tasters (n=20) and supertasters (n=10). The groups were also confirmed with fungiform papillae densities. However, no significant correlation was observed between PROP status and fungiform papillae densities. Also, results showed neither PROP status nor the fungiform papillae density associated with fatty acid thresholds.

The second objective was to investigate the effect of overnight fasting or meal consumption on sweet and fatty acid taste perception. Detection thresholds for sucrose and linoleic acid were measured by using ASTM method during fasted and satiated state. The result showed increases in sucrose detection thresholds under the both fasted state and satiated state. The linoleic acid thresholds increased after meal consumption and reduced after prolonged fasting.

This led to a further investigation on the last objective- the role of key plasma metabolites on fatty acid taste perception in fasting and satiated states. The results indicated that neither the effect of metabolic status on fatty acids thresholds nor relationships between fatty acid thresholds and blood metabolic parameters were observed. Furthermore, there was no significant difference in blood metabolites across

PROP taster group, which means that PROP classification cannot be considered as a predictor to the blood metabolites.

In conclusion, the present study provides evidence suggesting that PROP sensitivity cannot predict fatty acid taste sensitivity and metabolic status has no effect on fat taste perception. In addition, blood metabolites do not show any difference among PROP taster group and any relationship with taste perception either.

ACKNOWLEDGEMENTS

I would like to acknowledge my main supervisor, Dr John Grigor, for his tremendous support and guidance in not only my graduate study, but building me up into a successful scientist. It was he who cheered me up when I hit my low periods in experiments and also led me to the right track when I hit problems in my research.

I would also like to express my deepest appreciation to my co-supervisors- Professor Bernhard Breier and Dr Michelle Ji Yeon Yoo. They gave me enormous guidance on the endocrinology and physiology parts of my project. Without their help, I would not even have the courage to start this new section which was an absolutely new area to me. Furthermore, I would like to acknowledge Dr Michelle Ji Yeon Yoo for her great support in the trial. It is undoubted that I could never complete the trial without her help.

In addition, my sincere gratitude goes to Dr Daniel Wash and Insha Ullah with their great support in statistic analysis. Also, I would like to thank Helen Mathews for her support with the laboratory work.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

3-AFC	3-alternative forced choice
ANOVA	Repeated-measure analysis of variance
APC	Aerobic plate count
ASTM	American Society for Testing and Materials
B trial	Breakfast being provided trial
B1	The session before breakfast in B trial
B2	The session after breakfast in B trial
BMI	Body mass index
CCK	Cholecystokinin
CD36	Cluster of differentiation 36
CGRP	Calcitonin-gene related peptide
DRK	Delayed rectifying potassium channels
EDTA	Ethylenediaminetetraacetic acid
FPG	Fasting plasma glucose
GC	Gas chromatography
GLP-1	Glucagon-like peptide-1
GPCR	G protein-coupled receptors
HDL-C	High density lipoprotein cholesterol
LA	Linoleic acid
LMS	Labeled magnitude scale
MT	Medium- taster
NB trial	No breakfast trial
NB1	the session before break in NB trial
NB2	the session after break in NB trial
NEFA	Non-esterified fatty acid
NT	Non-taster
PPG	Postprandial plasma glucose
PROP	6-N-2- propylthiouracil
PTC	Phenylthiocarbamide
PYY	Peptide YY
SEM	Standard error of mean

ST	Super-taster
TC	Total Cholesterol
TG	Triglyceride