Australian National University

Nutrition labelling of food to promote consumer health in transitional Thailand

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DECLARATION

Unless where otherwise stated, this thesis is my own work undertaken at the National Centre for Epidemiology and Population Health (NCEPH), Research School of Population Health (RSPH), ANU College of Medicine, Biology and Environment (CMBE), the Australian National University (ANU) from July 2012 to November 2016.

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ABSTRACT

Over the last century, population transitions linked to development have affected disease and longevity, especially in middle-income countries. In Southeast Asia, the food supply is changing and processed food diets are increasing intakes of energy, fat, sugar, and sodium. This has resulted in diet-related non-communicable diseases (NCDs) that are now major public health problems. Interest in this nutrition transition of changing environment, diet, and lifestyle generated the nutrition labelling research conducted for this thesis.

Thai nutrition labelling aims to promote healthier eating among consumers. The labels have not been revised although many complain of difficulty in interpreting the information and we know little about Thai consumer response. This thesis aimed to generate evidence for policies to enhance the utility of future labels in Thailand. Five first author papers resulted (four published and one under review).

The first study looks back at food and nutrition labelling in Thailand across the last century and found 81 relevant documents dated between 1908 and 2015. Thai food labelling began to protect consumers from adulterated foods in 1927. Labelling regulations interacted with economic development and international trade in complex ways. The Thai food industry emerged after World War 2 and Thailand joined the international Codex Alimentarius. Consumers became concerned about food and the government created consumer-friendly labels. Over the last two decades, nutrition labelling expanded to promote population health by inducing appropriate changes in eating behaviours and lifestyle. However, domestic protection is now in tension with the rules of the global food trade.

The second and third studies were qualitative and used semi-structured in-depth interviews with open-ended questions of a sample of Thai adults. The interview data were obtained by the candidates from 14 university-educated Bangkok members of the Thai Cohort Study (see below) and 20 less educated walk-in supermarket Ranong customers southwest from Bangkok. The second study used a combined Knowledge-Attitude-Behaviour and Health Belief Model to explore participant experiences and motivations in relation to nutrition labels. The third study explored barriers in interpreting information on labels. Participants had difficulties due to low awareness, literacy and numeracy and they thought label formats could improve.

The fourth and fifth studies were epidemiological and large in scale. They generated new data on labelling from the nationwide antecedent Thai Cohort Study (TCS) at its 8-year mark in 2013. Cohort members were 42,750 distance learning Sukhothai Thammathirat Open University (STOU) adults under observation since 2005 for multi-faceted research on development-related health-risk transitions. The new TCS data on nutrition label experience and intake of processed

foods revealed associations of labels and food choices with socio-demographic factors and with consumption of transitional indicator foods (fourth study) and with elevated lipids or blood pressure or Body Mass Index (fifth study). Labels were most useful for cohort members who read them, understood, and reacted with better health behaviour regarding processed foods.

This thesis reveals the challenges of Thai nutrition labels and suggests how to improve label appearance and impact, enhancing utility of future labels and preventing diet-related NCDs.

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PUBLICATIONS AND PRESENTATIONS

This thesis includes four research articles published in peer-reviewed journals, one research article submitted to a journal for peer-review, and five presentations at scientific conferences.

Peer reviewed journal articles

1. **Rimpeekool W**, Seubsman S, Banwell C, Kirk M, Yiengprugsawan V, Sleigh A. Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders. *Food Policy*. 2015;56:59-66. PubMed PMID: 26538793. Pubmed Central PMCID: 4608433.
2. **Rimpeekool W**, Banwell C, Seubsman S, Kirk M, Yiengprugsawan V, Sleigh A. "I rarely read the label": factors that influence Thai consumer responses to nutrition labels. *Global Journal of Health Science*. 2015;8(1):45505. PubMed PMID: 26234978.
3. **Rimpeekool W**, Banwell C, Seubsman S, Kirk M, Yiengprugsawan V, Sleigh A. Thai consumer difficulties and barriers in understanding nutrition labels: a qualitative study. *Journal of Safety and Health (STOU)*. 2015;8(28):34-47.
4. **Rimpeekool W**, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Nutrition label experience and consumption of transitional foods among a nationwide cohort of 42,750 Thai adults. *British Food Journal*. 2017;119(2):425-39.
5. **Rimpeekool W**, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Nutrition label experience and obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults. *PLOS ONE*. (submitted manuscript)

Conference presentations (3 abstracts and 2 posters included in Appendix A)

1. **Rimpeekool W,** Seubsman S, Banwell C, Kirk M, Yiengprugsawan V, Sleigh A. Use of nutrition labels among educated Thai adults: socio-demographic factors and motivations. *The 12th Asian Congress of Nutrition (ACN2015)*; 14–18 May 2015; Yokohama, Japan, 2015. (Poster presentation)
2. **Rimpeekool W,** Banwell C, Seubsman S, Kirk M, Yiengprugsawan V, Sleigh A. Motivations and barriers of using nutrition labels in Thai consumers. *The 2015 RSPH student conference*; 19 October 2015; Australian National University, Canberra, Australia, 2015. (Oral presentation)
3. **Rimpeekool W,** Seubsman S, Banwell C, Kirk M, Yiengprugsawan V, Sleigh A. Evolution of Thai food and nutrition labelling policy: health transition, consumer protection, and food industry. *21th Biennial Conference (Asian Studies Association of Australia, ASAA 2016)*; 5–7 July 2016; Australian National University, Canberra, Australia, 2015. (Oral presentation)

4. **Rimpeekool W**, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Impact of nutrition label use and other factors on frequency of sugar sweetened beverage consumption in Thailand. *Australian Epidemiological Association Conference (AEA2016)*; 14–16 September 2016; Australian National University, Canberra, Australia, 2016. (Oral presentation)
5. **Rimpeekool W**, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Associations between socio-demographic factors, nutrition label experiences, and processed food consumption in 42,750 Thai adults. *The 10th Thailand Congress of Nutrition (TCN2016)*; 18–20 October 2016 Bangkok International Trade & Exhibition Centre, Bangkok (BITEC), 2016. (Poster presentation)

Related co-author publications (title page and abstract shown in Appendix B)

1. Mercer R, Young M, **Rimpeekool W**, Marshall A, Hector D, Dickson J, et al. Literature review on the impact of label format on consumers' attention and comprehension for mandated label elements. *Food Standards Australia New Zealand*: 2013.
2. Banwell C, Dixon J, Kelly M, Seubsman S, Yiengprugsuwan V, **Rimpeekool W**, et al. Methodological approaches connecting the food system to the urban nutrition transition: fresh food retailing in Thailand. *First Mediterranean Conference on Food Supply and Distribution Systems in Urban Environments*; 6–7 July 2015; Rome 2015.
3. Banwell C, Dixon J, Kelly M, Seubsman S, **Rimpeekool W**, Sleigh A. What's old is new again: innovative policies to support Thai fresh markets within a healthy food system. *World Food Policy*. 2016;2(2):51-66.
4. Yiengprugsuwan V, **Rimpeekool W**, Papier K, Banwell C, Seubsman S, Sleigh A. Relationship between eight-year weight change, body size and health in a large cohort of adults in Thailand. *Journal of Epidemiology*. 2016. (In-Press)

Table 1 Candidate's contribution for each paper presented in this thesis

Chapter*	Publication title	Journal	Year of publication	No. of authors	Candidate contribution		
					Conception design	Analysis & interpretation	Drafting & revising
Chapter 3 History of food and nutrition labelling in Thailand	Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders	Food Policy	2015	6	✓	✓	✓
Chapter 4 Attitudes and motivations	"I rarely read the label": factors that influence Thai consumer responses to nutrition labels	Global Journal of Health Science	2016	6	✓	✓	✓
Chapter 5 Difficulties and barriers	Thai consumer difficulties and barriers in understanding nutrition labels: a qualitative study	Journal of Safety and Health (STOU)	2015	6	✓	✓	✓
Chapter 6 Socio-demographic factors and food intake	Nutrition label experience and consumption of transitional foods among a nationwide cohort of 42,750 Thai adults	British Food Journal	2017	6	✓	✓	✓
Chapter 7 Nutrition labels and disease	Nutrition label experience, obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults	Submitted to *PLOS ONE*	-	6	✓	✓	✓

* The published or submitted articles are reproduced in each chapter.

CONTRIBUTION DECLARATIONS FOR PUBLICATION

Paper 1: Rimpeekool W, Seubsman S, Banwell C, Kirk M, Yiengprugsawan V, Sleigh A. Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders. *Food Policy*. 2015;56:59-66. PubMed PMID: 26538793. Pubmed Central PMCID: 4608433.

Candidate and co-authors' contribution:

I did the comprehensive literature search, collecting, reviewing, and analysing all relevant information and documents and other materials. I also interviewed Thai nutrition labelling experts. I drafted and revised the manuscript and responded to the journal's reviewer comments. AS assisted with the writing and organizing the manuscript. SS, CB, MK, and VY gave comments and feedback for revising until the final version. All authors contributed to and approved the final version.

Authors' approval:

Each author certifies the level of contribution by the candidate above is appropriate and that permission is granted for candidate to include this paper in this thesis.

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Author 4: Martyn Kirk		21/11/16
Author 5: Vasoontara Yiengprugsawan	V. Yiengprugsawan	22/11/16
Author 6: Adrian Sleigh	A Sleigh	18/11/2016

Paper 2: Rimpeekool W, Banwell C, Seubsman S, Kirk M, Yiengprugsawan V, Sleigh A. "I rarely read the label": factors that influence Thai consumer responses to nutrition labels. *Global Journal of Health Science*. 2015;8(1):45505. PubMed PMID: 26234978.

Candidate and co-authors' contribution:

I am primary author of this paper. I submitted the human ethics approval document. I performed the interviews with participants in Thailand (both Bangkok and Ranong). I also verbatim audio transcribed the recording into texts. I did the data analysis, and data interpretations. I also prepared the first manuscript and revised the manuscript for publication. CB advised on data analysis, data interpretations, and paper drafting. AS had the initial idea for the qualitative study, and assisted in writing the academic article. SS supported the random list of Bangkok participants and gave valuable advice during the field study in Thailand. CB, SS, MK, VY, and AS supported with valuable comments on research planning, paper submission, and evaluated the final version of the manuscript. All authors contributed to and approved the final version.

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Candidate and co-authors' contribution:

I did the literature search and conducted the literature review for both national (in Thai) and international studies (English). I did the research planning, and submited the human ethics approval documents. I conducted the interviews of participants in Thailand and also verbatim audio transcribed and analysed the qualitative data, and drafted the manuscript. CB advised and supported me on the qualitative study measures, revising and editing the manuscript. AS had the initial idea on this qualitative study and supported me in academic writing. SS supported my fieldwork in Thailand, sorting the Bangkok participant list, and gave valuable advice during the time. CB, SS, MK, VY, and AS supported with valuable comments on research planning, paper submission, and evaluated the final version of the manuscript. All authors contributed to and approved the final version.

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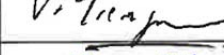
Author 5: Vasoontara Yiengprugsawan		22/11/2016
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Candidate and co-authors' contribution:

I conceptualized and conducted the quantitative analysis for this paper with contributions from supervisors. I wrote the first and later drafts of the manuscript and did the literature search. I performed statistical analysis under supervision from MK and VY. I have been the corresponding author and dealt with all editor comments. AS and VY advised regarding the development of the work and helped in data interpretation. AS and SS conceived and executed the Thai Cohort Study. CB, SS, MK, VY, and AS assisted in analysis planning, supported the revisions, and assisted in editing the paper. All authors contributed to and approved the final version.

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Paper 5: Rimpeekool W, Yiengprugsawan V, Kirk M, Banwell C, Seubsman S, Sleigh A. Nutrition label experience, obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults. *PLOS ONE.* (Submitted manuscript)

Candidate and co-authors' contribution:

I conceptualized and conducted the quantitative analysis for this paper with contributions from supervisors. I performed statistical analysis under supervision from MK and VY. I did the literature search and wrote the first and all later drafts of the manuscript under supervision from VY. AS and VY advised on development of the work and helped in data interpretation. I am the corresponding author. AS and SS conceived and executed the Thai Cohort Study. CB, SS, MK, VY, and AS assisted in analysis planning, supported the revisions, and edited the paper. All authors contributed to and approved the final version.

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ACRONYMS AND ABBREVIATIONS

ANU	Australian National University
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CAC	Codex Alimentarius Commission
DV	US Daily Values
FAO	Food and Agriculture Organization
GDA	Guideline Daily Amounts (shortcut form)
INMU	Institute of Nutrition at Mahidol University
MOI	Ministry of Industry
MOPH	Ministry of Public Health
MLT	Multiple Traffic Light
NCDs	Non-Communicable Diseases
NCEPH	National Centre for Epidemiology and Population Health
NFNP	National Food and Nutrition Plan
NHMRC	National Health and Medical Research Council
NIP	Nutrition Information Panel (Table form)
NLEA	Nutrition Labeling and Education Act
NRV	Codex Nutrient Reference Values
OR	Odd Ratios
PFO	Preserved Foods Organization
QUID	Quantitative Ingredients Declaration
RDAs	Recommended Daily Allowances for Healthy Thais
RDI	Reference Daily Intakes
RSPH	Research School of Population Health
SEA-RDAs	Southeast Asia Recommended Dietary Allowances
STOU	Sukhothai Thammathirat Open University

TCS	Thai Cohort Study
Thai FDA	Thai Food and Drug Administration
TNFC	National Food Commission
UN	United Nations
WHO	World Health Organization
WTO	World Trade Organization

CHAPTER 1: INTRODUCTION

This chapter introduces the topic of my doctoral research and outlines the content of this PhD thesis. The setting is Thailand. The study begins with an overview of the history of Thai nutrition labelling and public health concerns about consumer responses to the labels. The population transitions associated with development in Thailand (demographic, epidemiological, health, health risk, and nutrition transitions) are reviewed. The eco-social framework adopted for the research is described. Then unanswered questions arising from existing studies of nutrition labelling and the rationale for conducting this study in Thailand are discussed. A conceptual framework is constructed and research questions are defined. Aims and objectives are specified in response to important questions regarding nutrition labelling and its effects in Thailand. The sources of data and the thesis chapters are described.

The thesis draws on the disciplines of history, anthropology, epidemiology, and community nutrition and responds to concerns about the transitional dietary behaviour of the Thai population. A literature review initiated the research and this appears in the next chapter, complemented by more specific literature reviews appearing with each of the result chapters. The main findings are presented in five peer-reviewed journal articles with the candidate as first author. The research focused on nutrition labelling in Thailand beginning with its history and evolution, then moving on to consumer attitudes and motivations, consumer difficulties and barriers, influential socio-demographic factors and food choices, Body Mass Index (BMI) and nutrient-related non-communicable diseases (NCDs). In addition, arising directly from the thesis were five scholarly presentations – three in Australia, one in Japan, and one in Thailand (Appendix A).

As well I contributed to four co-authored articles on other topics related to various aspects of this thesis (impact of label format, supporting fresh food markets in Thailand, body size and health). Summaries of these four co-authored papers are included in Appendix B.

All knowledge produced by this study could be of benefit in making policy recommendations regarding nutrition labelling in Thailand in the future. The new information should be helpful to other countries as well, especially middle-income South East Asia.

1.1 Overview

Research presented in this thesis investigates a government response to the nutrition transition in one South East Asian country as processed foods increasingly intrude into daily diets. I focused on nutrition labelling in Thailand as a national program to promote healthy diets.

Overall, an eco-social approach to population health is followed, recognizing the importance of historical, economic and social factors as determinants of health. The research places development of labelling into a historical perspective and examines the impact on nutritional problems emerging today. This research on nutrition labelling uses mixed qualitative and quantitative methods to investigate the impacts of changing diets on the Thai population.

As countries transform from traditional agriculture to modern industrial and service economies many social, cultural and economic changes affect population health and nutrition. Over the last century the highlights of these development changes have been recognised as a *demographic transition* from high to low mortality and fertility (1, 2), an *epidemiological transition* from epidemics and famine to chronic disease (3), and a *health transition* from traditional healers to modern health systems (4). Two additional transitions have been noted in the last 20–30 years – a *nutrition transition* from natural agrarian diets to processed industrial foods (5) and a *health-risk transition* as environments changed, altering the risk of disease, and behaviour changed with increasing belief in scientific medicine and national development of modern health services (6).

Today we recognize that population health problems in any setting are driven by social, economic, cultural, and political factors which need to be understood and addressed when devising solutions. This is especially important when analysing population health outcomes connected to the transitions of development because they involve profound changes operating at many levels to produce the outcomes. Previously, the epidemiological focus on populations was generally directed at individuals within them and associated proximate biomedical phenomena. Now explanations are more complex and some of this understanding is captured by "eco-epidemiology", which explicitly recognizes multi-level causation contributing to public health outcomes (7). To understand the determinants of population health beyond proximate, individual-level risk factors requires a social-ecologic system perspective (8). Scholars have contributed to Krieger's eco-social theory of 1994 and the collective impact of such socially responsive epidemiology has been substantial over the last two decades (9). This thesis has been conducted to address multiple levels of change and this is explained further below as well as in the Discussion section.

The "mother" project for the research reported here on nutrition labelling in Thailand was the health-risk transition study ongoing since 2004 (6) (Figure 1). This health-risk investigation was supported by the Wellcome Trust UK and the National Health and Medical Research Council of Australia. It looked back 50 years to contextualize the health situation as Thailand modernizes. It also looks forward by studying a large nationwide cohort of 87,151 epidemiologically informative distance learning Open University adults. Most cohort members remained embedded in their communities and were of modest means typical of the Thai population. This group constitutes the Thai Cohort Study (TCS) prospectively followed in 2005, 2009, and 2013

with trends and outcomes widely published in Open Access scientific journals. Many TCS analyses are multi-level and most sub-studies deployed mixed methods for the topics investigated. Mixed methods and an eco-social approach were used for the nutrition labelling research reported here.

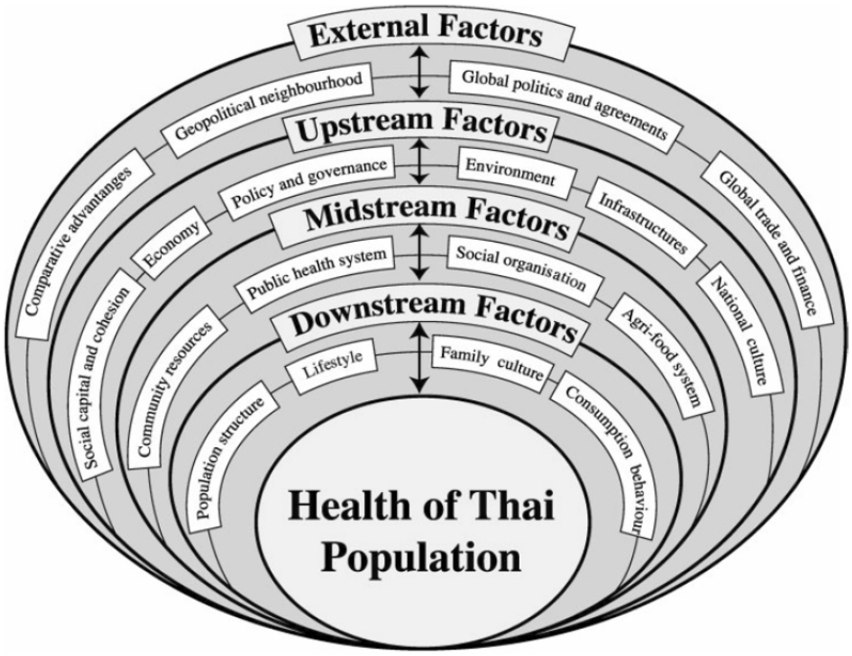

Figure 1 Multi-level model adopted for the Thai Health-Risk Transition Study

Source: Cohort profile … journal article (6)

1.2 Health-risk and nutrition transitions in Thailand

Thailand is a country in South East Asia well advanced in the health-risk and nutrition transitions. At this point hunger and child malnutrition have receded (10) and processed industrial foods have become integrated into modern Thai diets (11). At least 33% of Thai total deaths are caused by cardiovascular diseases and diabetes (12). Thailand now faces serious population health problems due to the emergence of overweight and diet-related non-communicable diseases (NCDs) including diabetes, hypertension, kidney failure, and stroke. Such a transitional situation has become a major public health problem around the world over the last two decades. For example, globally at least 3.4 million people die each year as a result of being overweight or obese (13). In 2012, WHO estimated that 52% of global deaths for the age group 0–69 years were due to NCDs and of these 37% were cardiovascular disease and 4% were diabetes (13).

Diet-related NCDs are now leading global causes of death but more comprehensive estimates of the dietary component are yet to be published and would include some cancers (eg colorectal), hypertension, and kidney disease. Western Pacific and South-East Asia are regions projected to

have the greatest total number of NCD deaths in 2020 and Thailand is an important component of this looming regional problem (14).

Due to economic and social changes, and globalization of food supplies, many middle-income countries are facing a rapid nutrition transition. The changes include low physical activity and increased consumption of industrial processed foods and beverages (15). In the past, foodstuffs were classified into only two categories, unprocessed and processed. Nowadays almost all food is "processed" and extensive processing has become widespread and is now categorized as "ultra-processed" (16). Most ultra-processed foods are ready-to-eat or ready-to-heat, requiring little or no preparation and containing added sugar, less fibre, and high levels of saturated fat, sodium and energy (17). This energy-dense food consumption is associated with obesity and diet-related NCDs emerging in middle-income countries (18). Food prepared at home is now being purchased ready-to-eat and this is changing the nutrition of the population and is linked to pandemic obesity and related NCDs (11, 19). Many middle-income countries, including Thailand, are now developing policies, plans, and strategies to respond to the nutrition transition and to combat emerging diet-related NCDs.

Thailand's nutrition transition has been visible for the last 20 years as diets changed and nutrient-related chronic disease became increasingly prevalent (20). By 2011, 17.1% of Thai adults were classified as overweight [BMI 23.0-24.9 kg/m^2] (21). At present, ischaemic heart disease and stroke are in the top three causes of death in Thailand (22). The high prevalence rate of diabetes in Thailand is still increasing but already ranks among the top ten in Asia (23).

Traditional Thai foods (eg rice, fish, dipping sauce "Namprik" and herbs) are being replaced by energy-dense diets containing high fats and animal products, and convenience foods and sweetened beverages that are considered as risk factors for obesity (24). Food consumption patterns have changed with a falling proportion of foods prepared at home and rising consumption of ready-to-eat foods away from home (11). Thai people are shopping more frequently at supermarkets and convenience stores. This change in food purchasing is associated with increased consumption of processed foods such as soft drinks, snacks, instant and deep fried foods, processed meats and western-style bakery products (25). A recent Thai National Health Survey reported that snack food consumption amongst children has increased two-fold between 2003 to 2009 (26). Nutrition education and promotion have become important strategies used by the Thai government to combat negative consequences of the nutrition transition. The focus is on healthy eating, especially for the emerging problems of obesity and nutrient-related NCDs.

Many middle-income countries, including Thailand, are now developing policies and strategies to respond comprehensively to the nutrition transition and to prevent emergence of diet-related conditions. Nutrition labelling of processed foods was an early response and has been deployed in Thailand for nearly two decades as an education tool to address nutritional problems and to

educate consumers to make healthy choices. For example, they must learn that energy-dense food consumption is associated with obesity and diet-related NCDs (18). A Nutrition Information Panel (NIP) was the first form of Thai nutrition labelling and has been promulgated by the Thai Food and Drug Administration (Thai FDA) since 1998, legally enforced by Ministry of Public Health notification No.182 (27). NIPs are voluntary unless health claims are made on food packages. The labels provide quantitative information about the amount of fat (total and saturated), cholesterol, protein, carbohydrate (dietary fibre and sugar), and sodium in food. As well, information on the NIPs is given on five micronutrients which address an old Thai under-nutrition problem that was first tackled in 1977 by the 1st National Food and Nutrition Plan. These micronutrients include calcium, iron, vitamin A, thiamine, and riboflavin (28).

It is widely believed that Thai consumers find it difficult to understand the information on nutrition labels but few studies have explored this topic. In one small unpublished Thai government consumer survey of 2,000 adults purposively sampled nationwide in 2009, about half (55%) had correctly understood the information on NIPs (29). An international study conducted by the Nielsen company in 2011 included a small sample from Thailand; their internet report indicated that 27% of Thai consumers understood the nutrition information available in NIPs (30). Consumers were looking for labels that are easier to use and understand.

The Thai government has responded to consumers by introducing additional Front-of-Packaging nutrition labels that were designed to be easy to use. These are called Guideline Daily Amounts (GDA) introduced in 2012 as supplementary nutrition labels mandated for five categories of snack foods, expanded to almost all ready-to-eat foods in 2016. Another small government consumer survey in 2012 showed that about 60% of participants understood the information on a GDA (31). A recent marketing survey by the Thai FDA in 2013 showed that about 80% of ready-to-eat foods in supermarkets and convenience stores displayed NIP and about 30% displayed GDA (32). Collectively the consumer and marketing information available for Thailand in 2013 was useful but quite limited in scope and based on small samples. In 2014, when the research reported in this thesis was being planned, we still knew little about the impact of nutrition labels on the dietary knowledge and behaviour of Thai consumers.

Lack of food and nutrition labelling studies has created an important knowledge gap for Thailand, a situation also noted in other middle-income countries. Indeed, insufficient scientific information often leaves new regulations protecting consumers vulnerable to World Trade Organization (WTO) intervention about technical barriers to trade (33). It is usually not possible to apply information on food in one country to support regulation in another due to different nutrition labels, eating patterns, and diets. Insufficient knowledge is also an obstacle for developing better nutrition education and promotion strategies. Accordingly, the research for this thesis aims to provide some key information about food and nutrition labelling in Thailand.

To document the current situation and to improve the utility of future nutrition labels, understanding of influences on nutrition labels and on consumer responses are necessary. The thesis was designed to address these issues nationwide with large scale epidemiological analyses about nutrition label experiences and the effects on food choices, obesity and two nutrient-related NCDs (hypertension and elevated blood lipids). In addition my research included in-depth interviews about nutrition labelling among informative rural and urban Thais.

The Thai Cohort Study (TCS) provided a unique and timely opportunity to explore the impact of nutrition labels in a large population of Thai adults residing across the nation. In-depth interviews of an array of urban and rural Thai consumers, as well as extensive historical research, enabled eco-social understanding and connection to community, national, and international factors driving Thailand's nutrition transition and its NCD consequences.

1.3 Substantive questions about nutrition labelling in Thailand

There are five critical knowledge gaps about nutrition label development in Thailand. First, there is no historical research on Thai food and nutrition labelling so there is no organized information on the evolution of Thai policies and regulations, and of international forces interacting with those regulations. Second, we have little understanding of Thai consumer motivations and behaviour in using labels. Third, information is limited on difficulties arising when consumers use nutrition labels. Fourth, information on the associations between nutrition label experiences and transitional processed food behaviour is unavailable in Thailand. Fifth, nutrition label experience among Thai consumers and its association with nutrient-related NCDs has never been reported.

Thailand has a lengthy experience in world food markets but we know little about development of Thai food and nutrition labelling policies. Future label makers or policy developers who had not been involved in the process since it began would be assisted in their work through an understanding of the history of the process. Thai nutrition labelling needs to be understood in relation to public health, consumer protection, and nutrition transition.

Thailand still lacks important information regarding consumer use of nutrition labels. Although labels have been promoted since 1998 no peer-reviewed research reports on this topic have appeared. We do not know why Thai consumers decide to use (or not use) nutrition labels when making food choices. Exploring the attitudes and motivations behind their decision to use nutrition labels will help us understand consumer mindsets. Such information should help improve nutrition labelling and related education and promotion in the future.

Consumer difficulty reading and understanding nutrition labels are of worldwide concern and led to an easy-to-read version of NIP for the USA launched early this year. The reform was introduced by First Lady Michelle Obama on May 20, 2016 and she commented humorously

that consumers "will no longer need a microscope, a calculator or a degree in nutrition to figure out whether the food [they are] buying is actually good for our kids" (34). Such a concern is frequently mentioned in the social media in Thailand but reform of the NIP label has not been attempted. The Thai government has provided an easier version of the nutrition label by creating the GDA in 2011 but we do not know much about consumer reaction. Local problems would differ from other countries due to language, regulations, nutrition education, and label history.

Little information is at hand identifying socio-demographic influences on nutrition label utility among Thai consumers. Consequently, the Thai government cannot target important sub-groups and cannot reform the labels to reach these groups. Many studies of consumer attributes affecting use of nutrition labels have been conducted, but these were mostly in developed countries and such information is not available for Thailand (35). A socio-demographic breakdown of nutrition label utility needs to be conducted on a large scale.

A major goal of nutrition labelling of food packages is to combat nutrient-related NCDs. However, nutrition label experiences in Thai consumers with such diseases have rarely been reported due to the small number of available cases in typical small government surveys. Indeed, only one Thai nutrition label study was reported among type 2 diabetes patients (36). Another study assumed that consumers with nutrient-related NCDs may pay attention to nutrition labels more than healthy consumers (37). This assumption has never been explored in Thai studies.

1.4 Rationale for nutrition labelling research in Thailand

Most studies of nutrition labelling were performed in developed countries. In Thailand, information on this topic remains limited. Development of Thai food and nutrition labelling policies usually followed international standards and often used scientific evidence from developed countries, especially the USA and UK, as supporting documents for those improvements. The nutrition labelling research for this thesis is designed to improve local information. The thesis aims to fill this information gap in Thailand and to assist the development of appropriate nutrition labelling policy in the future.

Nutrition labelling regulations in Thailand responded to national nutrition issues as well as other factors that can have an impact, including local and regional politics, and international trade rules. Thai information about the evolution of nutrition labelling had never been collected and this was a barrier for comprehensive understanding of the current situation and for designing useful research. Accordingly, the thesis research began with a historical study based on primary sources dating from the beginning of Thai food and nutrition regulation and labelling. The documents gathered were mainly from government sources and were dated from 1908 to 2015. A large number of manuscripts and reports were identified, scanned, classified, analysed, and

summarized, becoming the source data for the first paper of this thesis. This historical paper clarified the local context and the factors influencing food labelling policy planning over the last century in Thailand.

For appropriate nutrition label strategies for Thai consumers in the future, consumer studies of knowledge, attitudes, behaviours, and beliefs are essential. Such studies will shed light on Thai consumer behaviour. In response to this need to understand consumer behaviour, a series of qualitative interviews in different socioeconomic sub-groups were performed. The interviews revealed how consumers perceived and understood the labels and how the labels affected food choices. This information facilitates policy making regarding nutrition labels in Thailand and is presented in the thesis as the second published paper.

The qualitative study also obtained information about consumer difficulties with nutrition labels. Consumers were invited to read and interpret information in nutrition labels on real food packages. The results provided critical insight into the nutrition label information available for consumers and on the common errors made and difficulties encountered. This topic was the basis for the third published paper presented in the thesis.

To understand the overall situation of nutrition labels in Thailand, there was a need for large-scale nationwide epidemiological information on the nutrition label experiences and socio-demographic factors influencing the outcomes. For this research a connection was made to a large cohort study underway nationwide from 2005 and focused on the health-risk transition (ie TCS). At the 2013 follow up wave more than 40,000 TCS members participated and answered questions on nutrition labelling. It was then possible to relate socio-demographic data already collected to the new information provided by responses to the questions about labels. It was also possible to document the nutrition transition and its effect on consumption of processed foods and this became the basis of the fourth paper of the thesis.

As well, it was possible to analyse the association between nutrition label experiences and the occurrence of obesity and two nutrient-related NCDs – high blood pressure and high blood lipids. The large TCS cohort provided many cases of high blood pressure (n=3,062), high blood lipids (n=5,656), and obesity (n=12,717). Also detectable was the association between nutrition label experiences (read, understand, and use) and the three indicators of nutritional disorders. This quantitative epidemiological information on connections between nutrition label experiences and obesity, hypertension and high blood lipids became the basis of the fifth paper submitted for publication as the final component of the thesis.

The studies described above were needed in Thailand and were feasible tasks within the framework, timing, and resources available during a PhD. The doctoral thesis focused on these topics which collectively covered the challenges and benefits of nutrition labelling in Thailand.

1.5 Aim and Objectives

Aim

The aim of this research is to document the current situation with nutrition labels in Thailand, generating evidence for policies to enhance the utility of future labels.

Objectives

1) review and interpret historical data noting influences on Thai food and nutrition labelling policy development over the last century
2) understand consumer knowledge, attitudes, behaviours, and beliefs about nutrition label use
3) document consumer difficulties and barriers in interpreting the information on nutrition labels
4) determine the influences of nutrition labels on transitional processed food consumption, noting socio-demographic associations
5) ascertain the associations between nutrition labelling, obesity, and two prevalent nutrient-related NCDs (high blood pressure and high blood lipids)

1.6 Conceptual framework

The conceptual framework I developed for the research is shown in Figure 2. It reveals the connections between the various components of the thesis. The study objectives relevant to each section of the framework are shown as highlighted numbers 1 to 5.

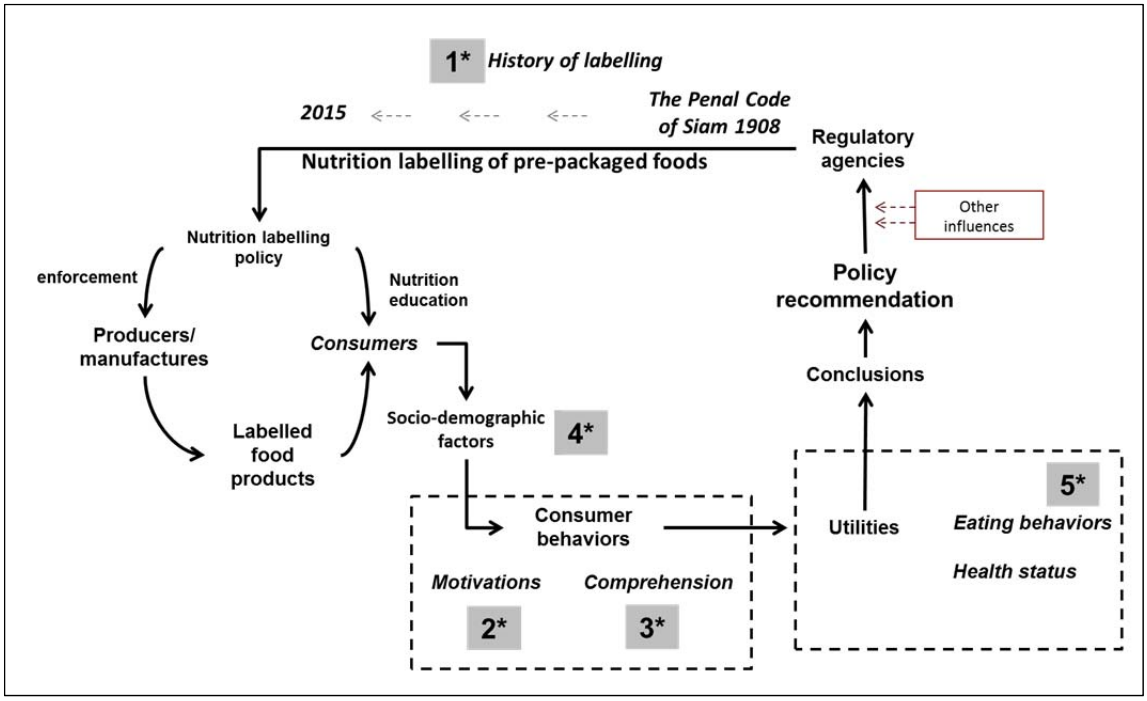

Figure 2 Conceptual framework for Thai nutrition labelling studies

1.7 Research questions and hypotheses

The matrix table below connects the study components showing the links for six questions, six hypotheses, five objectives, five peer-reviewed journal articles, and five thesis result chapters (Chapters 3 to 7). This table also reveals the thesis structure and the detailed elements that constitute the whole body of work.

It must be noted that philosophy has a lot to say about scientific method and terminology. Some disciplines restrict the meaning of "hypothesis" to quantifiable measurements that can be tested statistically. This thesis did not deploy such a restricted terminology or enter into debate about the meaning of the word hypothesis. Rather it is used in the general sense here of a proposition or idea that could explain an observed phenomenon in ways that are specified in the text. Sometimes the hypothesis is tested statistically and sometimes not. If not found to be untrue, it is described as not disproved. Readers who restrict hypotheses to quantitative measurements can substitute the word "proposition" in those sentences using "hypothesis" in "qualitative" work.

Table 2 Thesis structure: research questions, hypotheses, objectives, articles, and chapters

Research Questions	Hypotheses	Objective	Articles	Chapter
1. How did Thai food and nutrition labelling evolve?	[1A] Thai food labelling policies began with food safety. [1B] When Thailand began to industrialize and joined world trade, it used international standards in food labelling.	1	1 History of food and nutrition labelling in Thailand	3
2. What factors influenced Thai nutrition labelling policies?	[2A] Thailand balances inter-national rules with local needs. [2B] Thai nutrition label format followed US nutrition labels.			
3. What are the knowledge, attitudes, behaviours, and beliefs of Thai consumers about nutrition labels?	[3] Nutrition label users are more educated and more exposed to the media.	2	2 Attitudes and motivations	4
4. What kind of difficulties and barriers confront consumers in understanding nutrition labels in Thailand?	[4] Information on nutrition labels requires a high literacy and numeracy to understand.	3	3 Difficulties and barriers	5
5. How do socio-demographic factors associate with nutrition label experiences and with food choices?	[5A] Some population sub-groups are more likely to use nutrition labels than other subgroups. [5B] People with more experience of nutrition labels will have better food choices.	4	4 Socio-demographic factors and food intake	6
6. How does nutrition label experience relate to obesity and nutrient-related NCDs (high blood pressure, high blood lipids)?	[6] Proportions of nutrition label users in groups with obesity and nutrient-related NCDs are higher than among people without the problem.	5	5 Nutrition labels and disease	7

1.8 Data sources

Here I summarize the data sources for each of the studies reported in Chapters 3 to 7. This summary enables a reader to understand how the research coheres. A more detailed account of data sources is given in each of the results chapters.

1.8.1 International literature and historical Thai materials

Historical information on Thai food and nutrition labelling (Chapter 3) was sought and collected from national and international databases. All laws, registrations, and notifications were collected from the Royal Thai Government Gazette e-database, the largest public record of Thai laws. The search for information also included reports and monographs from the Thai Food and Drug Administration (Thai FDA) e-library, rare old documents from Kasetsart University Knowledge Repository e-database; as well as more than 100 documents of "the DSS bulletin", the Thai government Department of Science Service (DSS) digital archive.

In addition to the above information sources a search was made for published and unpublished reports bearing on nutrition labels and their effects. This search used keywords "nutrition label" or "nutrition labelling" or "nutritional label" and examined Index Medicus, Sciencedirect, Thai Library Integrated System (Office of the Higher Education Commission), and Thailand Research Fund electronic library. This search strategy identified published and unpublished articles and reports in both international and Thai knowledge domains.

1.8.2 Thai Cohort Study

The Thai Cohort Study (TCS) was a source of data for both the qualitative and quantitative studies (Chapters 4 to 7) and it is first mentioned in some detail in the text above Figure 1 earlier in this Introduction. TCS is a large nationwide cohort of Sukhothai Thammathirat Open University (STOU) students who have been followed for a study of the health-risk transition. This transition is changing socioeconomic and environmental circumstances and related health outcomes throughout the country. The cohort was initially recruited from approximately 200,000 STOU students by mailing out the 20-page health, socioeconomy, and lifestyle questionnaire from April to November 2005 and 87,151 returned completed questionnaires and consent forms (6, 38).

The questionnaires covered a broad variety of topics including socio-demographic and economic status, health behaviours, and health outcomes. Questionnaires were returned by 87,134 students and when latecomers were added the number grew to 87,151. Overall, the 421 primary variables were recorded well for most questionnaires and eventually with editing became 509 baseline variables (6). The follow-up surveys each had more than 70% response with 60,569 participants in 2009 (38, 39) and 42,785 in 2013 (40). Overall, 49% of respondents completed the three surveys. For analyses the cohort size would sometimes be reduced. For

example, when studying dietary behaviour institutionalized individuals were excluded and that is why the analysis in this study excluded monks and prisoners, resulting in a cohort of 42,750.

The TCS population represents well the distribution of the Thai population for sex ratio, median age, religion, geographic location, and median income (6). TCS also represents well the distance learning student body studying at STOU in 2005 (39). Compared to official Thai statistical data in 2011 (41), the 2013 TCS cohort population has a slightly higher proportion of females (54.3% vs 50.1%). For age, the 2013 TCS cohort had proportionally more adults aged 30–39 years than the national Thai population (45.1% vs 23.4%). The TCS population also has a higher proportion of educated individuals than the average of the Thai population. Demographically Bangkok and central Thailand were represented well in the TCS compared to the Thai population (46.5% vs 40.2%).

1.8.3 Consumer interviews

Interviews (Chapter 4 and 5) were conducted with 34 participants in two areas: Bangkok (the capital city) and Ranong (rural area, about 600 km southwest of Bangkok). The aim was to include participants with a range of educational and health knowledges in the age-groups likely to benefit from future nutrition labelling (20–45 years). The number of interviews conducted was guided by the emergence of saturation, or the perception by the interviewer that a point had been reached so that little new information was being gained in additional interviews. Overall, more non-university educated than university educated participants were recruited as some non-university educated participants felt that they did not know enough about food labels to discuss the topic in detail with the interviewer. Consequently, more participants were recruited to compensate for these relatively uninformative interviews.

Each participant was face-to-face interviewed for 30–45 minutes using a semi-structured schedule of questions and open-ended approach, a technique in Thai language adapted from Grounded Theory (42). Both audio and video were recorded with participants' consent. Interview questions began with a general topic such as everyday eating, and moved on to basic nutrition knowledge, attitudes and health beliefs. For nutrition labels, interviews explored consumer knowledge (basic literacy and numeracy skill), perceptions, motivations, difficulties, barriers, and feedbacks for label improvement. Each participant was given examples of real food packages with both NIP and GDA labels and asked to explain some information on the nutrition label and to compare two different food products. Consumer understanding of information on nutrition labels was determined by the accuracy of answers when they were asked to explain the meaning of information on the labels, to select the healthier products among two food samples, and to select a sample for persons with specific health concerns (such as high blood pressure, and diabetes). Overall, participants were classified as having full, partial, or no understanding of nutrition information in the label.

The audio content of the recordings was transcribed verbatim into Thai text. To help validate the information, the video recording was cross-referenced to the written transcripts to confirm the verbal transcript and to observe body language. Socio-demographic information was collected (sex, age, weight, height, and occupation) as well as responses to additional questions arising from the interview. I am a fluent and literate Thai speaker and I transcribed each interview into Thai text. I then used Atlas.ti software to analyse the Thai language text searching for recurring words, themes, and topics. The results from this analysis were transcribed into English language and prepared for discussion with the research team before writing up final conclusions.

Transcribed data were coded by words, themes, and topics. Finally, there were 8 major themes including knowledge, attitudes, behaviours, turning points and motivations, nutrition label experiences, ability to interpret information, problems and scepticism or suggestions for label improvement. The findings were separated into two manuscript topics as follows: explaining consumer motivations; detecting problems in using nutrition labels. The later topic aimed to understand what problems consumers had and what nutrition label they wanted.

The 14 Bangkok participants interviewed represented urban university-educated people. TCS participants resident in Bangkok formed the source population for this small random sample representing four age-sex groups (young/old, male/female). Sampled TCS Bangkok residents were contacted by phone. Each random age-sex group sample contained a list of up to 100 cohort members together with contact phone numbers. Beginning at the top of the list, they were invited by phone to join the study. Once the quota of four TCS Bangkok residents for each age-sex group sought as participants in the consumer interview study was completed the selection process moved on and was repeated on another age-sex group. Once they agreed, interviews were arranged at an appointed place and time, maximizing convenience for interviewees.

For Ranong consumer interviews, the participants were representing rural less-educated Thais. Overall, 20 supermarket walk-in Thai customers were purposively chosen and invited to join the study if they were between 20–45 years old and had attained lower than university education. Interviews were performed at Tesco Lotus Supermarket, the only supermarket in Ranong province in 2013. The interview location was set up near the entrance of the building. Finally, 20 Ranong interviews were conducted. As mentioned above this exceeded the number planned because data did not saturate as quickly as anticipated so more interviews were done.

1.8.4 Ethical approval for the Thai Cohort Study and Consumer Interviews

Ethics approval for the Thai Cohort Study was obtained from Sukothai Thammathirat Open University Research and Development Institute (protocol 0522/10) and the Australian National University Human research Ethics Committee (protocols 2004/344 and 2009/570). Informed written consent was obtained from all participants.

For Consumer Interviews, the study protocol was approved by the Australian National University Human Research Ethics Committee (Protocol 2013/148). All participants gave their informed consent and received an information sheet before the interviews (Appendix B). They were free to withdraw from the research at any time.

1.9 Thesis structure

The text below is the key to the thesis. It contains a description of the contents of each Chapter and it is intended to provide a detailed guide to the overall body of work.

Chapter 1: This chapter contains an introduction, overview, conceptual framework, rationale, research questions, and hypotheses for the research on nutrition labelling in Thailand. Also described are the health-risk and nutrition transitions in Thailand. The Aim and Objectives of the research are specified, and the anticipated contribution is mentioned. This chapter also describes methods and data sources used for the studies reported in Chapters 3 to 7.

Chapter 2: This chapter is a literature review which covers all issues related to this study and provides definitions of terms and current nutrition labelling policy in Thailand. It also discusses published Thai research on consumer understanding of nutrition labels, and knowledge, attitudes, behaviours, and beliefs regarding nutrition labels. Also considered are the nutrition transition, and links between consumer behaviour and health outcomes, and evolving labelling practices around the world. In addition, health behaviour theories are reviewed along with the impact of nutrition labelling on dietary behaviour and health status.

Chapter 3: This published scientific paper addresses Objective 1: "review and interpret historical data noting influences on Thai food and nutrition labelling policy development over the last century". The paper is entitled "Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders" and is published in *Food Policy*.

Chapter 4: This published scientific paper addresses Objective 2: "understand consumer knowledge, attitudes, behaviours, and beliefs about nutrition label use". The paper is entitled "'I rarely read the label': factors that influence Thai consumer responses to nutrition labels" and is published in *Global Journal of Health Science*.

Chapter 5: This published scientific paper addresses Objective 3: "document consumer difficulties and barriers in interpreting the information on nutrition labels". The paper is entitled "Thai consumer difficulties and barriers in understanding nutrition labels: a qualitative study" and is published in *Journal of Safety and Health (STOU)*.

Chapter 6: This published scientific paper addresses Objective 4: "determine the influences of nutrition labels on transitional processed food consumption, noting socio-demographic associations". The paper is entitled "Nutrition label experience and consumption of transitional

foods among a nationwide cohort of 42,750 Thai adults" and is published in the *British Food Journal.*

Chapter 7: This submitted scientific paper addresses Objective 5: "ascertain the associations between nutrition labelling, obesity and two prevalent nutrient-related NCDs (high blood pressure and high blood lipids)". The paper is entitled "Nutrition label experience and obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults" and is currently under review for publication in *PLOS ONE*.

Chapter 8: In this chapter, I discuss the principal findings from Chapters 4 to 7. I examine the many factors involved with Thai nutrition labelling regulations and policies, consumer behaviours, and the current utility of nutrition labelling. The information is summarized to help develop policies and strategies improving nutrition labelling in Thailand. I also discuss limitations of this research and indicate questions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

The information included in this chapter complements the literature reviews in each of the journal articles presented in the results chapters 3, 4, 5, 6, and 7. This Chapter 2 reviews scientific literature on nutrition labelling, consumer behaviour, and factors that would affect policies. Also included are key definitions for labels, and for related elements of food science. As well there are detailed descriptions of the many types of nutrition labels that have evolved around the world. The review finishes with an extensive account of existing knowledge regarding label use and effects, mostly reported from Europe and the USA.

When appropriate the situation of Thailand is mentioned as this literature review is intended to support the research on labelling in Thailand. One section (2.7) contains considerable detail on current rules and labels used in Thailand. Another section (2.15) reviews Thai research on nutrition labelling and a final section (2.16) reviews future prospects in Thailand.

Nutrition labels are intended to promote health. They educate people about nutrition to support healthier eating. In the past, nutrition labels have been an education tool for combating undernutrition but now they are used for preventing obesity and diet-related diseases which have become important public health issues in many countries. However, consumers still indicate difficulty in using nutrition labels. Researchers attempt to develop better versions of nutrition labels but label improvement involves many considerations.

2.1.1 Definition of terms

“Food” means any substance, whether processed, semi-processed or raw, which is intended for human consumption (including drinking and chewing) and any substance which has been used in food manufacture, preparation or treatment but it does not include cosmetics or tobacco or drugs (43). In the current Thai Food Act, "food" means edible items and those which sustain life including substances which can be eaten, drunk, sucked or got into the body whether by mouth or by other means, no matter in what form and also includes any substance that is intended for use as an ingredient in food production such as food additives, colorants and flavoring. Medicine, psychotropic substances, and narcotics are not included but may be considered in some cases (44).

“Label” means any tag, pictorial, artwork or other descriptive matter, written, printed, stencilled, marked, embossed, impressed on or attached to a container of food (43).

"Labelling" includes any written, printed or graphic matter that is present on the label, accompanying the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal (43).

"Food labels" means a piece of paper, tag, picture, trademark or other written printed materials containing words, statements or any article providing information including all of which appear on the outside of the food container or attached to the container or wrapper of a retail package (43, 45). In the Thai Food Act 1979, "food labels" means any figures, invented design or text shown on the food or food package (44).

"Nutrition labelling" means a description intended to inform about nutritional properties of a food to consumers (43).

"Prepackaged" mean packaged or made up in advance in a container, ready for offer to the consumers or for catering purposes (43). In Thai Ministry of Public Health (MOPH) notifications, "prepackaged foods" means foods packed in containers for sale (46).

"Nutrition" means the process of providing or obtaining the food necessary for health and growth (47).

"Nutrient" means any substance in food that is normally consumed as a constituent of food for providing energy; or for growth, development, and maintenance of life. Deficit of nutrient will cause characteristic bio-chemical or physiological changes (43). Excess energy intake and excess nutrients are associated with emerging obesity and nutrient-related non-communicable diseases such as high blood pressure and high blood lipids.

"Ingredient" means any substance, including a food additive, used in the manufacture or preparation of a food and present in the final product (43).

"Claims" means any representation which states, suggests or implies that a food has particular qualities relating to its origin, nutritional properties, nature, processing, composition or any other quality which aims to transfer a message from manufacturers to consumers in relation to nutritional and health benefits which may be obtained from components or nutrients in food products such as nutrient content claims and percentage claims (43, 48).

2.2 Nutrition transition

Developing countries are now undergoing a nutrition transition. Change in the agricultural system, rapid growth of modern retail and associated food service sectors lead to a shift in diet, physical activity, and nutrient-related non-communicable diseases (NCDs) (15). Rapidly increasing rates of overweight and obesity are widely documented in both middle and high-income countries (49). As well, the prevalence of metabolic syndrome—at least three of five conditions: obesity, high triglycerides, low High-density Lipoproteins (HDL) cholesterol, high blood pressure, high fasting blood sugar—and other diet-health diseases are projected to grow (50, 51). Processed foods and beverages contribute to the nutrition transition because they tend to be high in sugar, fat, and sodium and an excess of these nutrients is associated with obesity and nutrient-related NCDs (18).

Processed foods, especially snacks, often hide high levels of sugar, fat, and salt (52, 53). "Health" snacks are also loaded with sugar (54). High intakes of sugar, fat, and salt are now considered to be health risks. Global consumption of sugar increased from 160 to 172 million tons in the last five years (55). In 2010, the estimated mean level of global sodium consumption was 3.95 grams per day, and regional mean levels ranged from 2.18 to 5.51 grams per day, exceeding the WHO recommendation (56). Thai staples and side dishes are also being replaced by diets containing higher proportions of animal products. As well, people are shifting from prepared meals at home to purchasing of ready-to-eat-foods (11).

Along with the eating behaviour changes in the last few decades, nutrition labels have evolved as nutrition education tools to reveal the nutritional component of foods. In the past, nutrition labels were devised to prevent both under- and over-nutrition and related NCDs (28). Due to the recent dramatic and rapid shift from under-nutrition to over-nutrition, overweight and obesity are now major public health problems in many countries (11, 57). Nutrition labels have now become a tool for people to make healthy choices, especially for weight management or diet-health disease prevention.

2.3 Processed foods

Today, world food systems and supplies are changing and traditional freshly prepared meals are being replaced with ready-to-eat or ready-to-cook products. Processed foods which are high in energy, with added sugar, saturated fat, sodium, and less fiber are frequently identified as a turning point of nutrition transition (17). However, past binary classification of foods as only processed and unprocessed is not enough now because almost all food consumed today is processed in some way (58). Monteiro and others, emphasizing methods and techniques of industrial processing, now classify foods into three groups as shown in Table 3 below (16).

Table 3 Classification of food based on the extent and purpose of industrial processing

Group	Classification	Definition	Example
1	Unprocessed or minimally processed	No process or physically processed as a single whole foods	Fresh, chilled, frozen, vacuum-pack fruits, vegetable, meat, poultry, meats, and eggs; fresh and pasteurized milk, plain yogurt; tap water
2	Processed culinary or food industry ingredients	Extraction and purification of components of single whole foods in order to use as ingredients for preparation and cooking of dishes and meals	Vegetable oils, margarine, butter, sugar, sweeteners, salts, starches, flour, raw pasta and noodles; food industry ingredients including high fructose corn syrup, lactose, preservatives and additives
3	Ultra-processed food products	Processing of mix of group 1 and group 2 ingredients in order to create durable, accessible, convenient, and palatable ready-to-eat or ready-to-heat foods	Breads, biscuits (cookies), cakes, pastries, ice cream, jams; canned and dehydrated foods; cereal with added sugar; sugared fruit and milk drinks and "no-cal" cola, and other soft drinks; processed meat

2.4 Food labels

Today most food is packaged and presented to customers in a labelled container. Food labelling serves many functions. Two major objectives of food labelling are to provide information for consumers and to help manufacturers sell the food products. The labels include information on ingredients, storage conditions, shelf life, cooking instruction, and allergy (59). The standards used for labels have evolved over many years with considerable international guidance from the United Nations through its joint Food and Agriculture Organization of the United Nations and World Health Organization (FAO/WHO) agency, the Codex Alimentarius Commission. This agency aims to protect consumer health and fair food trade and produces the Codex

Alimentarius, a collection of internationally adopted food standards for each country's food control and enforcement authorities. The Codex general standard for the labelling of prepackaged foods (CODEX STAN 1-1985, Rev 1991) is now applied to food labelling regulations in many countries (60).

National food labelling laws are encouraged to follow the Codex standards but are also affected by international fair trade. Food labelling helps manufacturers transmit information to the importing country and foreign purchasers but stringent food labelling requirements may create trade barriers under the current rules of the World Trade Organization (WTO). Any mandatory food labelling regulations should be shaped in a way to increase competitiveness for exporters and avoid trade disputes under the Agreement on Technical Barriers to Trade (TBT agreement) and/or the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS agreement) (61). Fair trade may impact government ability to regulate food labelling of highly processed foods (62).

Prepackaged foods in Thailand are required to follow the rules and guidance of the current Ministry of Public Health Notifications no. 367 entitled "pre-package food labelling" which is in line with the Codex standard and agreed by WTO members. This harmony includes the general rules for food labelling, but not for nutrition labelling (46). The notification no. 367 and nutrition labelling notification are under the current Thai Food Act 1979, which is the major law containing the compliance requirement for food businesses operating in Thailand (44). The Ministry of Public health (MOPH) has a responsibility to create up-to-date notification while the Food and Drug Administration (Thai FDA) has roles and responsibility in applying laws to control food labelling, and food advertisement. The Thai FDA is also involved with consumer education and technical support in food labelling for all related sectors (63).

2.5 Origin and evolution of nutrition labels

This section will focus on the evolution of nutrition labels, especially in the USA and UK, and the influences on Thai nutrition labelling will be mentioned. Nutrition labels are labels on food packages with information on the nutritional component of foods aiming to support both consumers and producers (64). Nutrition labels help consumers determine the amount of calories and nutrients in food products, thus promoting healthy foods. The labels inform about the nutritional properties by stating the quantitative information on declared nutrients such as calories, protein, fat, and sodium in prepackaged foods. The labels also include the recommended daily intake of those nutrients.

Codex standards and guidelines of nutrition labelling were first promulgated in 1985. But development of nutrition labels had already happened as information on calorie and sodium content was actually displayed as food labels for special dietary uses in the USA from 1941 to

1966. At that time meals were generally simple with basic ingredients (65). However, increasing numbers of processed foods as part of the nutrition transition created consumers who had more concerns about nutrient information in the last three decades of the twentieth century.

Nutrition labelling began in the USA in the 1970s. It was initiated by the US FDA responding to concern about nutrient deficiencies, and as support information for food and health claims. A recommendation that the US FDA document nutrition information for each food was first issued in a report of a White House Conference on Food, Nutrition, and Health in 1969 (66). In 1973, the US FDA promulgated regulations on nutrition labelling which were voluntary for most foods (67) and later (in 1990) mandatory for all packaged foods. USA consumer market surveys began to include questions about nutrition labels in 1978 (68). European Union (EU) nutrition labelling procedures (directive 90/496/EEC) were a decade behind, coming into practice about 1990 (69, 70).

Nutrition Information Panels (NIPs) are a popular type of nutrition label and are now available in many countries. Although NIPs display a lot of nutritional information, many studies have reported that consumers find these labels confusing. Actual use and understanding of NIPs appears to be limited (71). NIPs are thought to be too technical and difficult to understand in many countries (72). Many studies reported that consumers preferred simplified versions of nutrition labelling (73). Nutrition labels have been improved many times, aiming to help consumers understand the information better.

Label makers have tried to improve the informativeness of (back or side of package) NIPs by creating supplementary nutrition labels on the Front-of-Package (FOPs). It seems to be a good way to help consumers make food choices (74-76). Many FOP variants have been tested with consumers, such as Guideline Daily Amounts (GDA), Multiple Traffic Light (MTL), and Healthier Choice Tick. Among FOPs, MTL labels were widely supported by consumers and their representatives in the last decade because they performed well for interpretation in many studies (77-79). However, food manufacturers argued that MTLs could lead consumers to wrong perceptions of healthfulness. Consumers may choose a large amount of green light products that could contribute to higher intakes of sugar (80). GDA is another popular form of FOP label originating from collaboration among the UK government, an industry group, and consumers in the late 1990s (81). GDAs are now used as supplementary nutrition labels in many countries. However, determining the healthiness of individual foods is still difficult for consumers (82).

Researchers keep trying to develop a simple nutrition label and summary indicator systems are now under consideration for the next generation of nutrition labels in many countries. These summary labels tend to assess overall healthiness of particular products based on established criteria or index or ranking, such as nutrient profiling models, which drew from dietary guidelines and scientific evidence towards diet and diseases (83). Good examples include Smart

Choices and Health Star (84). However, many features are still debated. For example, Food Standard Australia and New Zealand (FSANZ) and the EU model now only provide a limited number of food categories. Unhealthy carbonated soft drinks may be classified as healthy in the UK by Food Standard Association (FSA) models (85).

Serving size is also an issue on labels and often difficult to understand. Information on serving sizes usually appears on nutrition labels in the USA and some other countries such as Thailand. Establishing "standard serving size" was first attempted in the USA around the 1990s. The US FDA considered that the information could mislead and confuse consumers if they allowed food manufacturers to specify their own serving size. Data on food intake from existing national government food consumption surveys of 139 food categories were used to create serving sizes (69). US standard serving sizes, and comments from food manufacturers, were used to create the Thai standard serving size (86).

In many other countries there is no clear standard serving size and food manufacturers determine the serving size specified on packaged products. This creates great variation of serving size within and between food categories in the UK and Australia. This variability can be a source of confusion among consumers (87). However, serving size may not be a major issue in some countries because nutrient information can also be declared and compared with "nutrients per 100 grams" (88, 89). But many consumers have a hazy concept of "100 grams" and they will not be able to follow the information on serving size without education on that topic.

Another source of variation is the choices of nutrients listed on nutrition labels. A suggested list has been described in the Codex guidelines of nutrition labelling since 1985. However, nutrients listed on the USA nutrition labels originated before that. The nutrients listed on USA nutrition labels were suggested by many sources including an influential FDA 1978 Consumer Food Labelling Survey, a series of public hearings, and responses from viewers on an interactive cable television system. These surveys and opinion-gathering procedures in the USA covered all issues related to food labelling (68) and were very important to the content of nutrition label today.

The order of nutrients within nutrition fact panels in the USA initially tended to prioritize nutrient concerns as expressed by consumers and nutritionists (69). In the 1978 Consumer Food Labelling Survey, 38 nutrient items were rated. Calories, Protein, Vitamin C, and Fat were the top four of the ranks for conveying interesting information on the labels (68). Finally, the decision on actual nutrient listing was based on consideration of health problems and diet-related disease concerns. As well, nutrient information on USA labels had to be presented at the correct level of detail. For example, fats were divided into saturated fat, and polysaturated fat (90). Later in 1985, the USA also required nutrient listing to follow the Codex standards. These standards require nutrient declarations regarding energy value, amount of protein, available

carbohydrate, fat, and other nutrients specified by national legislation (91). USA nutrient listings combined many considerations to become the modern prototype for many other countries in the 1980s and 1990s.

During the 1990s, additional reference information for nutrients known as "% Daily Values (DVs)" was devised to show what percent of daily requirement one serving would supply for a given listed nutrient. Only a few countries require display of DVs on NIPs including the USA and Canada. Thailand has developed a derivative of DVs called Recommended Daily Intake (RDI). Thai NIPs now list the specified nutrients declaring the percentage of RDI one serving would supply. For the USA, a reference list of required DVs per day was established in 1990 based on the highest values suggested in 1968 by the National Academy of Sciences Recommended Daily Allowances (for the values of most vitamins and minerals). Also considered when setting DVs per day were consensus documents of many diet and health reports (for the values of protein, fat, fatty acids, cholesterol, sodium, potassium, total carbohydrate, and dietary fiber) (69).

The pathways followed in Europe to develop reference information for nutrition labels were different to those described above for the USA. In the United Kingdom (UK), "Reference Intakes (RIs)" are special terms use only for nutrition labelling. The listing of "%RI" is not mandatory in the UK (92). The UK labelling RI values were considered and extracted from many sources of information including the population reference intake values from a number of European countries, from the USA, and from the FAO/WHO Codex Alimentarius (93). The values are maximum amounts based on an average adult but there is no RI for fiber (92).

2.6 Nutrition labelling today

Nutrition labelling rules and guidance are now different in each country due to different concerns and enforcements. There are many issues involved with regulatory status such as facilities, public policies, and international trade. Regulatory status of nutrition labelling around the world can be now classified into two groups: mandatory and voluntary. In most high-income countries such as member states of the EU, USA, UK, Australia and New Zealand, nutrition labelling is mandatory while nutrition labelling is voluntary in Singapore, Vietnam, and the Philippines (94). In Thailand, nutrition labelling is mandatory only for specific groups of foods as described later in Section 2.7.

Nutrition label formats and details presented on food packages are also different across the world. All countries have a sovereign power to create nutrition labels but they follow the same Codex guidelines (CAC/GL 2-1985) to harmonize national standards, and ensure fair practices in food trade as well as to protect consumers. However, national public health strategies in each country create different information and details that appear on nutrition labels (43). Some

countries may be concerned about particular nutrients or minerals while the other countries may not. For example, USA nutrition labels give information on vitamin A, vitamin C, calcium, and iron while Thai nutrition labels focus more on vitamin B2.

Around the world, nutrition labels can be now grouped into two broad categories based on the format and appearance of the labels: Nutrition Information Panels (NIPs) and Front-of-Package nutrition labels (FOP).

2.6.1 Nutrition Information Panel

The Nutrition Information Panel (NIP) is a traditional form of nutrition label that originated in the 1980s. It is also labelled as “Nutrition Facts” or “Nutrition Information” on food packages. NIPs were developed to inform consumers of the nutritional properties of a food by displaying the calories and amounts of macro- and micro-nutrients in the foods (64). They are usually displayed as a table on the back or side of the package. NIPs include information on calories, nutrients, vitamins, minerals, and recommended daily intakes. Presentation of nutrient content can be expressed as the amount of nutrient per 100 g or per package or per single portion (91).

Nutrition labels in each county may be different in details and formats but they all generally try to follow the same international standards. The Codex Alimentarius Guidelines on Nutrition Labelling (CAC/GL 2_1985, revised 2013) is used as a global reference to develop the nutrition labelling regulations. The standard specifies guidelines for listing nutrients, calculating nutrients, and presenting nutrient content. However, each country is able to consider additional information appropriate to their national nutrition strategies and concerns (91). Figure 3 shows that NIPs across countries generally look similar but differ in information details.

Nutrition Facts
Serving Size 2/3 cup (55g)
Servings Per Container About 8

Amount Per Serving

Calories 230	Calories from Fat 72
	% Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**12%**
Dietary Fiber 4g	**16%**
Sugars 1g	
Protein 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

USA

Source: US FDA (95)

Nutrition Facts
Per 4 crackers (20 g)

Amount	% Daily Value
Calories 90	
Fat 2 g	**3** %
Saturated 0.3 g + Trans 0 g	**2** %
Cholesterol 0 mg	
Sodium 90 mg	**4** %
Carbohydrate 15 g	**5** %
Fibre 3 g	**12** %
Sugars 1 g	
Protein 2 g	

Vitamin A	0 %	Vitamin C	0 %
Calcium	2 %	Iron	8 %

Canada

Source: Journal article (96)

Nutrition Information

	Per 100 g
Energy	1837kj / 436 kcal
Fat	11.5g
Of which Saturates	7.0g
Carbohydrate	73.0g
Of which Sugars	31.6g
Fibre	5.2g
Protein	7.7g
Salt	0.5g
Vitamin A	154.96 RE 19%RI

EU

Table prepared by candidate (referring to photographic examples)

Nutrition Information	
Serving Per Package:20 Serving Size: 2 teaspoons (10mL)	
	Per Serving
Energy	90kcal 378 kj
Protein	0g
Fat, total	10g
- Saturated fat	1g
- Trans fat	1g
Carbohydrates	0g
- Sugars	0g
Sodium	0mg

Hong Kong

Table prepared by candidate (referring to photographic examples)

Figure 3 Nutrition labels in different countries

2.6.2 Front-of-Package (FOP) labels

Front-of-Package (FOP) labels provide supplementary nutrition information and are often positioned on the front of containers or packages. FOP labels have been developed by many organizations and companies in the belief that FOP labels can enhance consumer understanding and help consumers identify healthy food without reading the full panel of NIP (77, 78, 97). FOPs are usually presented graphically using logos or pictures such as Figures 4 and 5. A committee of the US Institute of Medicine categorizes current FOPs into three groups (65):

> ***Nutrient-Specific Systems*** – These systems create a shortcut of NIPs by displaying the amount of select nutrients from the NIP or using symbols based on claim criteria. The label may be colored to inform the level of nutrients in a product. Examples of labels in this group are Guideline Daily Amounts (GDAs) labels and UK traffic-light labels as shown in Figure 4 (98).

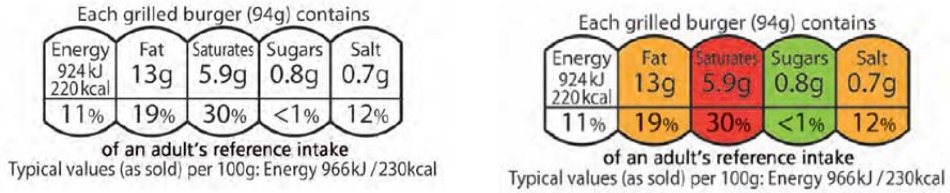

Figure 4 Nutrient-Specific Systems labels

Source: UK Department of Health (98)

> ***Summary Indicator Systems*** – these systems use icons, symbols or scores that summarize overall healthfulness or nutritional quality of a particular food without mentioning any specific nutrient. Overall healthfulness of food can be summarized by using either threshold- or algorithm-based methods. These systems also include nutrient profiling which aim to classify or rank individual foods according to nutrient content (99). Examples of such labels include NuVal® (100) and Great for You® (101) (Figure 5).

Figure 5 Summary Indicator Systems

Source: Nuval website (100) and Walmart's Great for You website (101)

Food Group Information Systems – these systems use symbols that alert consumers to the presence of a food group or food ingredients considered to be the important dietary component. An example is the "whole grain" label.

2.7 Thai nutrition labelling

In general, Thai nutrition labels are not mandatory for all food products unless laws require. Today, four MOPH notifications under the current Food Act are directly relevant to nutrition labelling on food packages:

1) MOPH notification No.182 B.E.2541 (1998) entitled "nutrition labelling"
2) MOPH notification No.219 B.E.2544 (2001) entitled "nutrition labelling (No.2)"
3) MOPH notification No.374 B.E.2559 (2016) entitled "food products required to bear nutrition labelling and energy value, sugar, fat, sodium on the labels of some kinds of foods Guideline Daily Amounts, GDA labelling".

Legislation of nutrition labelling laws and regulations is now a responsibility of the Thai FDA, MOPH. According to current Thai nutrition labelling laws, there are two available forms of nutrition labelling promulgated by the Thai FDA: Nutrition Information Panels (NIPs) and Guideline Daily Amounts (GDAs)

2.7.1 Nutrition Information Panel (NIP)

NIPs were the first format of Thai nutrition labels. Guidelines for NIPs were first announced in 1998. The notification specifies format and nutrient content. NIPs are not mandatory unless food products display health or nutrition claims, or use nutritive values for marketing, or target groups for special use (27). The Thai FDA describes many forms of nutrition labels suitable for different food groups and limited surface areas. These are: Continuous full-form, Short-form (horizontal or vertical), Continuous short-form, and Dual nutrition data display box (27, 102).

Details on Thai NIPs are different to other countries due to different national public health strategies. The full-form format of Thai NIPs contains 15 prescribed nutrients including total energy, energy from fat, total fat, saturated fat, cholesterol, protein, total carbohydrate, dietary fiber, sugar, sodium, vitamin A, vitamin B1, vitamin B2, calcium, and iron as shown in Figure 6. Four listed nutrients (vitamin A, vitamin B1, vitamin B2, iron) are responding to the major nutrient deficiencies noted in the first National Food and Nutrition Plan in 1977 (28).

Nutrition Information
Serving size : 1/3 package (30g)
Serving per package : 2.5

Nutrition Values per serving size
Total Energy 150 kcal (Energy from Fat 70 kcal)

	% RDI*
Total Fat 8 g	12 %
Saturated Fat 2 g	10 %
Cholesterol 0 mg	0 %
Protein 2 g	
Total Carbohydrate 18 g	6 %
Dietary Fiber 1 g	4 %
Sugar 0 g	
Sodium 120 mg	5 %

	% RDI*		
Vitamin A	0 %	Vitamin B1	4 %
Vitamin B2	0 %	Calcium	0 %
Iron	4%		

*Percentage of nutrients for Thai recommended daily intakes for ages of 6 years and up (Thai RDI) are based on the energy demand of 2,000 kcal/day

The energy demand for individuals may be different. The person whose energy demand of 2,000 kcal/day shall receive nutrients as follows:

Total Fat	Less than	65 g
Saturated Fat	Less than	20 g
Cholesterol	Less than	300 mg
Total Carbohydrate		300 mg
Dietary Fiber		2 5 mg
Sodium	Less than	2,400 mg

Energy (kcal) per gram : Fat = 9 : Protein = 4 : Carbohydrate = 4

Figure 6 Standard full-form nutrition information box (Thailand)

Table prepared by candidate (referring to a nutrition label on real snack)

2.7.2 Guideline Daily Amount (GDA)

GDAs are the second form of nutrition labels announced in 2016 (revised from 2011) aiming to improve Thai consumer understanding of nutrient information labels. GDAs are Front-of-Packaging nutrition labels. According to the notification of Ministry of Public Health No.374 "food products required to bear nutrition labelling [will display] … energy value, sugar, fat, sodium on the labels of some kinds of foods [revealing] guideline daily amounts [as] GDA labelling". GDAs are now mandatory in Thailand for most prepackaged foods including snack foods, chocolate, bakery, semi-processed foods (ie noodles, porridge rice), and chilled and frozen ready-to-eat meals (103).

GDA labels in Thailand display key nutrient information (energy, sugar, fat, and sodium) with four boxes as shown in Figure 7 (104).

Nutritive values per package
Consumption should be split into 2.5 times

Energy	Total sugar	Total fat	Sodium
410 kcal	0 g	22 g	310 mg
*21%	*0%	*34%	*13%

*calculated as percentage of recommended dailay intake

Figure 7 Guideline Daily Amounts (GDAs)

Label prepared by candidate (referring to a nutrition label on real snack)

2.8 Consumer decision making and nutrition labels

Consumers make decisions to use labels to assist their purchases or food choices. Consumer characteristics interact with surrounding environments to influence decision making, enhancing or blunting nutrition information. These characteristics include consumer knowledge, attitudes, belief, behaviour, and socio-demographic attributes, interacting with marketing environments and the food products themselves.

2.8.1 Consumer knowledge and skills

Consumer knowledge of nutrition and health predicts understanding of nutrition labels (76, 105, 106). Nutrition labels "often" or "always" influence purchasing of participants with higher nutrition knowledge (107). Higher levels of health knowledge also had a positive influence on receiving information from media sources, which include the use of nutritional labels (108). People who have more nutrition knowledge and follow the principles of Dietary Guidelines are more likely to use nutrition labels (109).

Nutrition labels rarely influenced consumers who had low nutritional knowledge because those consumers considered the information on the label was too technical (107). A high proportion of subjects with low nutrition knowledge were found to be unable to interpret basic information on nutrition labels (110). Nutrition knowledge enables consumers to pay attention to important information on the labels and to ignore marketing ploys (111).

Levels of understanding for information on nutrition labels are also associated with literacy and numeracy skills. These skills are associated with accuracy in estimating and interpreting labels. Persons with high literacy have higher odds of accuracy in estimating serving size (112). Limited nutritional literacy was associated with lower nutrition label usage (113). Poor label comprehension was highly correlated with low-level literacy and numeracy. However, even participants with higher literacy could have difficulties interpreting labels (114).

2.8.2 Consumer attitudes

Attitudes mediate the association between knowledge and label reading, while knowledge and motivations are also involved (115). One study reported that consumer attitudes significantly correlated with nutrition knowledge and use of food labels (116). There are many types of attitude towards food and nutrition labels, food, healthy lifestyle, and health status that impact on consumer use of information on nutrition labels and with label-using behaviours. Positive attitudes towards food labels had strong effects on label reading behaviours (115). Frequent users of nutrition labels are more likely to consider mandatory nutrition labels as beneficial (117). Consumers who perceived benefits and no additional costs engaged in more nutrition-searching behaviour (118).

Understanding or at least believing that they understand the information on food labels influences food label use. If consumers feel that label information is difficult to understand, the probability of using label information is low (119). Moreover, a higher probability of reading nutrition labels was found in those who know how to use labels to select healthy foods, rely on food labels more than their own food knowledge, and think that reading labels does not take more time (118). It has also be reported that education or workshops about nutrition labelling had positive impacts on consumer attitudes and behaviours to the use of nutrition labelling in rural and remote locations (120).

Attitudes about food and healthy eating also impact on nutrition label behaviours. One study found that positive attitudes towards healthy eating are significant predictors of nutrition label use and dietary quality (121). Another study noted that individuals who frequently read nutrition labels tended to have healthy eating and engaged in healthy dietary practices more than individuals who read nutrition labels infrequently (122). It was also found that participants who read nutrition labels consumed significantly more fruits and vegetables (123). In another report people who consume more total fat, saturated fat, and cholesterol were less likely to search for those three nutrients on nutrition labels (118).

Health queries (looking for specific information) and weight control predicted frequent label use (124). Subjects with chronic diseases checked more often for specific nutrients, and used more nutrition information than participants without such conditions (125). Another study reported that individuals with chronic kidney disease would prefer to see nutrients of concern listed on nutrition fact panels (126). Nearly half of nutrition label non-users do not know which motives would encourage then to start reading nutrition labels. In young participants, health problems were mentioned as probable motives to start the practice of reading nutrition labels (127).

Health status relates to nutrition label attitude. However, health status alone may not help consumers use nutrition labels if they do not have enough health awareness. People with diet-related disease tend to control their dietary intake. Participants who are unaware of diet-disease relationships were less likely to use food labels. A study found people who are at risk of high blood pressure or heart disease or cancer have more knowledge about diet-disease relationships and this has a positive effects on their use of nutrition labels (128). Nutrition label information on salt content was significantly related to shoppers' concern about the amount of salt in their diet and the belief that their health could improve by lowering salt intake (129). Some nutrition label users limited their attention to negative nutrients like total fat and the calories. Others reported that the high amount of fat on nutrition labels was the cause of their becoming health conscious and led to changes in their eating behaviour and nutrition label usage (130).

2.8.3 Nutrition label use

Knowledge and attitudes influence consumer label use behaviour. Conversely, nutrition label use increases consumer nutrition knowledge and improves attitudes. The majority of studies on nutrition label use found a positive association with nutrition knowledge (111). Consumers who have more nutrition knowledge tend to use nutrition labels more and also have more nutrition knowledge (131, 132).

Nutrition label use also relies on a set of interrelated processes centered on comprehension. Consumers pay attention to information on a nutrition label, comprehend it, and store the information at least long enough to apply it to a food-related decision (111). Although using nutrition labels is thought to be common in many countries, the actual use of the labels may be much lower (71). One study reported that half of the respondents did not use nutrition labels because they did not understand the terms on the labels (110). Few consumers can correctly identify information on nutrition labels when presented per serving or using industry labelling schemes (133). Consumers who have more knowledge about nutrition labels are more likely to use the labels, no matter how familiar the product (117). Consumers may pay different attention to particular information on nutrition labels such as reading labels for saturated fat and cholesterol more than for protein and calcium (134).

2.9 Socio-demographic factors

Two Thai studies reported that socio-demographic factors (sex, age, and education) were associated with nutrition label use (29, 31). In international literature many studies of consumers and nutrition label use have shown that sex, age, and education are usually influential. Other factors such as income, family size, and employment were less frequently reported and ethnicity, religion, and occupation were rare.

2.9.1 Sex

In general, females use nutrition labels more often than males (109, 135, 136). Females who were primary purchasers, lived with other people, and had more income to spend on food were more likely to use the nutrition information on food packages (137). Also, females with the highest levels of education, still undergoing education, who were physically active and on special diets reported that they were more likely to read nutrition labels (138).

2.9.2 Age

Age has a relationship to nutrition label use. Older nutrition label users were likely to be interested in diet-health relations (118, 136). Aging may increase consumer ability to process information but actually worsen comprehension (134, 139).

2.9.3 Education

Education level associates with nutrition label use and with healthy eating (76). One study noted a direct relationship between nutrition knowledge and education level (107). Educational level is related to the level of literacy and numerical skill as well as health and nutrition knowledge. Low-level literacy and numeracy associates with poor label comprehension. However, some participants with high literacy could also have difficulties interpreting labels (114). One study indicated that at least the college level was associated with a high score in nutrition knowledge (109). Another study found that undergraduate students have more positive attitudes and higher nutrition knowledge than graduate students (115).

2.9.4 Income

Higher income expands food choices and should lead to healthier diets (137). Higher income also means better nutrition label comprehension (140). Participants with lower income were significantly less likely to check nutrient information on nutrition labels (119). However, there are some contradictory results in the literature. Income was found to relate negatively to reading nutrition labels when those with higher incomes have less time to spend reading the labels (141). Several studies have reported that income was not playing a significant role in food label use (136, 142). Money is a factor affecting attitude towards nutrition labels. Consumers placing importance on price are less likely to use nutrition labels in general (141). A South African report noted that increasing the money available for food purchasing increased label usage (137).

2.9.5 Family size

In general, larger household size is associated with an increasing likelihood of using nutrition labels. A study in South Africa found that use of nutrition labels increased as the number of household members increased (137). People living with other people such as with children and married consumers are more likely to search for nutrition labels. Major food shoppers of families were found more likely to be nutrition label users (131).

2.9.6 Location

In one report, rural residents were less likely to use nutrition labels (119), while another study noted that consumers who live in high-income districts of the city seem to read nutrition labels less compared to those living in middle or low-income districts (143). Some studies found that there was no association between urban residence and label use (123).

2.9.7 Employment

Employment status was associated with increasing likelihood of using nutrition labels (141, 144). But in other settings, employed respondents may not have much time to spend on food shopping (138).

2.10 Product involvement factors and marketing environment

Not only individual factors affect nutrition label use but the food product itself and marketing environments may impact on a decision to purchase food and may affect the use of the label. Many studies investigated product involvement factors on nutrition label-using behaviour as a study variable. These reports include purchasing time and taste. The marketing environment including price, packaging, and advertising is often reported to impact on consumer food purchasing. Designs of nutrition labels can also impact on consumer reading behaviour but this will be described in section 2.12.

Time pressure on purchasing is negatively related to label use. If consumers feel under time pressure they are less likely to use nutrition labels at the point of purchase (145). Studies found that on average European consumers spend between 25 seconds (UK) and 47 seconds (Hungary) per product bought in a supermarket (146). People who have more available time for shopping as well as consumers who are more concerned about nutrition and health have been found to be more likely to be classified as a label users (131). Purchasing time was often assumed to explain the increased likelihood of using nutrition labels in unemployed participants. Many studies reported that consumers considered nutrition labels are important when they purchase a new product (137) and they used the labels to compare products when they purchase a food product with health claims for the first time (115). Most consumers may recall the information from previous purchasing or just very briefly confirm the information if they have bought the same product previously (78).

Taste is another factor found in many reports. One study found that food hedonism was negatively associated with label use (147). Another study found that consumers consider healthiness and tastiness to be negatively correlated. Less healthy foods tend to taste better and be more enjoyable during consumption (148, 149). One report found that students preferred unlabeled cookies (150).

Price, packaging, and advertising also impact on consumer decisions but their impact on nutrition label use was rarely investigated. Price is the main motivating factor in consumer purchasing of foods. It is also connected to the consumer income factor. Price was ranked sixth in the list of motivating factors for purchase of prepackaged food products (151). Price was found to be the main barrier to habitual consumption, even for wealthier consumers (152). Packaging, branding, and labelling can significantly alter consumer actual experiences and

sensory perception of food and drink products (153). Food advertising on television was often found to be biased toward foods that are high in fat, sugar, and salt (154). Food choices endorsed on television do not follow nutrition guidelines and encourage nutritional imbalance (155).

2.11 Health behaviour theories

Health behaviour theories are considered as tools to understand and explain consumer behaviour and to develop better health promotion and education about nutrition labels. Knowledge-Attitude-Behaviour (KAB) is the most popular behaviour model which has been often applied to nutrition label studies for many decades. Other behaviour theories such as Health Belief Model (HBM) and Theories of Planned Behaviour (TPB) were rarely applied to nutrition label research.

2.11.1 Knowledge-Attitudes-Behaviour (KAB) model

The KAB model is commonly used in nutrition education research regarding food and nutrition labels to explain the relationship between nutrition education and consumer behaviour (156). KAB models have been proposed to explain the role of knowledge as shown in Figure 8 (157). Knowledge means understanding the basic information about nutrition labels, knowing the important nutrients for health, being able to identify foods that are suitable for health, and food shopping wisely. Attitude and awareness mediate the relationship between knowledge and label reading behaviour (156). The correlations between knowledge-behaviour or between attitude-behaviour are generally positive but small in many reports (158). However, the KAB model by itself seems to be inadequate for understanding or promoting dietary behavioural change (157). The matters related to this model are shown in Figure 8.

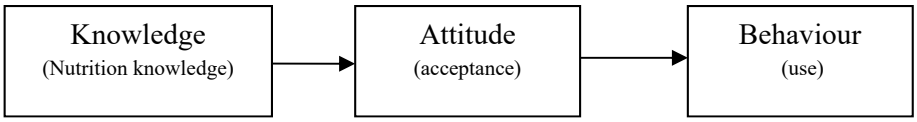

Figure 8 Knowledge-Attitude-Behaviour Model (KAB model)

2.11.2 Health Belief Model (HBM)

The HBM model is the most well-known health model in the field of public health. It states that people's beliefs influence their health-related actions or behaviours (156). It explains the dependence of disease prevention on an individual's perception of susceptibility (159). HBM hypothesizes that health-related actions depend on the simultaneous occurrence of sufficient

health motivation, illness, and recommendation (160). Health Belief Models (Figure 9) describe how consumer behaviour combines with a belief that prevention is possible, leading to action to reduce risks (159, 161).

The HBM has been rarely used in nutrition label research. As one health behavior theory, HBM suggests that label searching behaviour relates to capability to interpret the information. As such, the interpretive difficulty an individual feels in turn affects the probability that he or she will search labels looking for the information (118). Even without formally applying the HBM, some studies of nutrition labelling have led to similar explanations for beliefs encountered in the research. One study of US adults found that participants who were unaware of diet-disease relationships, and were therefore "non-believers", were less likely to use nutrition labels. Those who perceived their weight "about right" were less likely to use nutrition labels compared to those who perceived they are overweight (BMI ≥25 kg/m^2) (119). Another US study showed that adults who believe in the importance of following the principles of dietary guidelines tend to use nutrition labels (109). In a study of African Americans, it was found that belief in the importance of eating a low-fat diet was a strong predictor of nutrition label use (123).

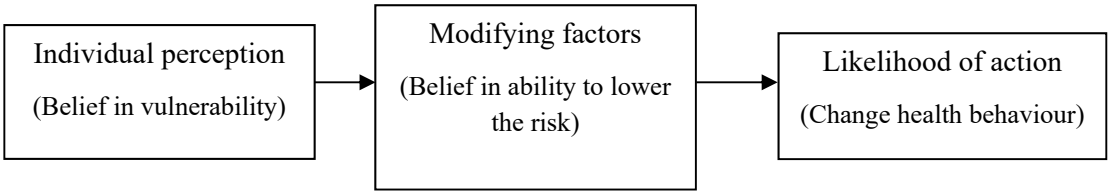

Figure 9 Health Belief Model (HBM)

2.11.3 Other health models

Other health models or theories may be found in nutrition label or dietary behaviour studies such as the Theory of Planned Behaviour (TPB) and the Elaboration Likelihood Model (ELM). These two models have been used to identify key influences on nutrition label reading behaviour. TPB focuses on behavioural intentions derived from attitudes (162) and was used in a study of female college students in Korea to understand motivational factors influencing health and nutrition behaviour (163). In Hong Kong, ELM was used among adolescents to investigate the process of behaviour change, especially attitude and persuasion (164).

2.12 Complexities in using nutrition labels

Many studies have explored non-use of nutrition labels. A systematic review of over 100 papers concluded that consumers are often confused by additional information that goes beyond the questions they had (71). A Malaysia study found that consumers reported avoiding using nutrition labels if they did not understand the technical terms (110). In general, most consumers reported that they were familiar with technical terms but they still did not fully understand the actual meaning. This happens with many elements of nutrition labels such as serving size, calories, and sodium. One US study of the general adult population showed that more than half of participants used "serving size" information often or sometimes, but a majority of participants misinterpreted the meaning of serving size. They also expressed a distrust of the serving size information (165). A four-country study in Europe (UK, France, Germany, and Netherlands) revealed that consumers are familiar with the term "calories" but they do not seem to fully understand how to apply the concept (166). For example, many US diabetics and (in a later study) many Australian consumers believed that higher energy products contain a greater nutrient amount. They thought that such high-energy products were desirable because they provide healthier and more sustained energy (167, 168). In another Australian study, many consumers had difficulty in using labelled sodium information because they did not understand the relationship between salt and sodium. As well, about half the participants were unable to accurately use sodium information to choose low salt options (129).

Misapplication and incorrect calculations are also common errors found in nutrition label comprehension studies. Incorrect responses usually happen with the information on serving size and percent daily value. An interview study of adult community health patients in Tennessee, USA showed that only 37% were able to recognize that the sample contained multiple servings (169). In another US study more than 30% of participants had poor portion-size estimation skills, over- or under-estimating standard servings for a single size (112). A study of internet-using Americans with chronic kidney disease showed that less than one-fourth of respondents were able to correctly determine the calcium content in food based on percent daily value (126). In another Tennessee study of primary care adults only 37% of the patients could calculate the amount of carbohydrate consumed from a 20-ounce bottle of soda labelled 2.5 servings (114). Another community adult study reported from Canada showed that one-third of participants were unable to correctly identify calorie content and percent daily value from nutrition labels (140). A more recent Canadian community study from the same research team showed that few participants could correctly identify total calorie amounts when nutrition labels presented information "per serving", especially if writing was small or blurred. It is also complicated to calculate (133).

Inconsistent and unrealistic suggested "serving size" are also problems that many studies report. For example, Australian consumers find it hard to measure the suggested amount because

serving sizes are not expressed in any common household measurement (87). In a UK study, serving sizes on packages were unrealistic when compared with real eating practices of consumers (130). A US study showed that inconsistent serving sizes allows marketers to reduce the reported calories, fat, sugar, and carbohydrate in a product serving which in turn can influence consumer perception. The authors noted that smaller serving size is prone to be incorrectly perceived as a healthy food product compared to a larger serving size (170).

Consumers also often report that product design and reading time affect nutrition label use. For example, a New Zealand study of Polynesian regular food shoppers (Maoris, Samoans and Tongans) showed they did not have enough time to read nutrition labels (171). Some consumers may need more time than others. One European study involving the UK, Germany, Italy and Netherlands indicated that a small group (20 participants) spent more than 350 seconds compared to an average of 80 seconds to evaluate a labelling format (74). Another review noted that product design with different location of nutrition labels can lead consumers to spend over 30% more time studying labels (172).

2.13 Nutrition labels and health impacts

Nutrition label use was also reported in a UK study as mediating the positive relationship between nutrition knowledge and healthy eating (121) and as partial mediator of the relationship between eating attitude and dietary quality. A US report showed that even people who do not believe in the importance of good nutrition may read labels and have a healthier diet (122). Other studies in Thailand and Europe (40, 173) and literature reviews (131, 174) have found that nutritional label use changes dietary patterns by shifting them to healthier consumption or to reduced consumption of "unhealthy" foods. Two US studies reported that nutrition label use influences eating patterns towards a lower intake of fat and cholesterol, and a higher intake of fruits, vegetables, and fiber compared to non-nutrition label users (109, 175). A more recent US National Health and Nutrition Examination Survey showed that consumers who use serving size information on nutrition labels reported eating 150 kcal less per day than those who were non-label users (176).

Nutrition labels also influence consumer purchasing behaviour increasing the perceived value of the product. Using nutrition labels affects purchasing behaviour because consumers want to avoid the adverse nutrients in food products (131). A Dutch study of female supermarket shoppers reported that they chose products lower in fat than they usually buy after they were instructed to use information from nutrition labels (177). About half of another specially motivated group, chronic kidney disease respondents in the US, reported that they decided not to purchase foods that did not declare the amount of nutrients that were relevant to their conditions (126).

An association between nutrition label use and other health outcomes such as diabetes, kidney disease, and chronic disease has not been found in existing studies though this may be due to limited participant numbers. Only a few studies have attempted to show that nutrition label use was an effective tool for promoting good eating behaviour in patients. A large national US survey included patients with chronic disease who reported they had been advised to use nutrition labels. This group consumed less energy, saturated fat, carbohydrates, and sugar, and more fiber than non-label users (178). Using traffic light nutrition labels also decreases energy intake and on average led to a 1.3 kg loss of weight among Australian participants (179). Nutrition labels have also been used in the USA to educate individuals with chronic kidney disease (126). Now nutrition labels are used to promote healthy eating among patients in many countries, including patients with diabetes, hypertension, and obesity.

2.14 Stakeholder perspectives

After nutrition label policy or legislation was introduced to food producers or manufacturers in many countries, feedback from the producers was largely negative (180-182). In the UK, many food producers have failed to implement the UK government's plan to help reduce obesity by disclosure of energy content in their products. Most food producers have agreed to reformulate their products but some remaining producers have refused to join government plans to help people reduce their sodium intake and to stop using trans-fat in their food products (180). Voluntary use of simplified nutrition labels does not create a strong enough incentive for industry to offer healthier food (183). In Australia, a study showed that government legislation did not help food producers improve the health qualities of their products. There was no significant difference in nutrition quality in Australian breakfast cereal between 2004 and 2010 (181). For the global “south” (outside EU, north USA, and Australia), responses from food and beverage industries have been limited and they usually play a role in influencing legislation and regulation (184).

The accuracy of nutrient declarations on food packages is still doubted by consumers and there is evidence supporting such scepticism. In the USA, a study found inconsistency in the stated energy content of reduced-energy meals obtained from supermarkets. Ten frozen convenience meals were analysed and nutrient values were compared with nutrition information labels provided by the food producers. The actual nutrient values exceeded the vendor disclosure stated value (182). In Australia, serving sizes varied within and between snack food categories (88). Food Standards Australia New Zealand created a free web-based tool with food composition databases to help companies preparing nutrition labels, especially convenient for small companies. But there is still a limitation on the accuracy of nutrient values (185).

Positive responses from food industries have been found in some studies. Nutrition labelling policy induced many food companies to produce more healthful foods. There have been increasing numbers of food products labeled "trans fat-free" and health claims on packaging are found more than in the past (186). In the UK from 2007 to 2009, a study found that private label products were most likely to display nutrition labels (81). In Thailand, for specific food groups required to have nutrition labels, the number of food products with nutrition labelling also had been increased from 2012 to 2016 (32, 187, 188).

2.15 Previous Thai research on nutrition labelling

Research articles about Thai nutrition labelling are sparse in published literature in Thailand and almost absent in international journals. However, there is a useful body of grey literature on this topic produced over the last two decades and summarized here. Twenty reports arose from Master Theses (36, 37, 189-206) and one came from a Bachelor Thesis (207). Overall, four of the Master Theses were available in English. As well there were three additional studies reported by universities (208-210), three Thai FDA reports (29, 188, 211) and five conference posters (31, 32, 187, 212, 213). In addition, there were 13 research articles published in Thai journals in Thai language (214-226). Also since 2009 there have been two unpublished national consumer studies (29, 31) and three large product surveys performed by the Thai FDA (32, 187, 188). Most of these studies were performed with a few hundred participants and frequently reported proportions of nutrition label outcomes (such as knowledge level, reading, and use). Bivariate analyses were unadjusted and used Chi-square, Fisher's Exact test, Pearson correlation coefficient, one-way ANOVA, and Mann Whitney tests. Multiple logistic regressions are not found in these Thai reports and there is no discussion of bias or confounding which could influence the result.

Many studies explored consumer knowledge about nutrition labels. Comparison of results among studies is difficult due to different questions, scoring systems, and classification of understanding. In 2001, one study reported that 71.8% of northern teenager participants (aged 14-21 years, n=300) can give the right answers to nutrition label tests (197). By different questionnaires, 72.9% of Kasetsart University dormitory residents (n=340) and 60% of Chiang Mai teachers (n=250) had nutrition label knowledge at medium level (190, 194). Bangkok consumers have good knowledge and use of nutrition labels and it depended on sex and education level (195). Socio-demographic factors (sex, education, previous high school curriculum, occupations) and nutrition label knowledge were analysed in various sub-populations (such as teachers, dormitory students, Rotarian members, Bangkok residents) and they showed differences in results (37, 190, 192, 194). Health professionals have a good level of food and nutrition label knowledge (37) and are more aware of nutrition labels (198). Senior and junior nursing students had more nutrition label knowledge than freshmen (220).

Knowledge of nutrition labels was reported in positive relationship with using nutrition labels (36). Thai people reported a variety of sources for nutrition label knowledge. These sources include newspaper and magazine articles (200). Television and teachers were also sources of nutrition label knowledge (197). Moreover, four studies developed educational media to promote nutrition label knowledge and they found such an approach can increase participant understanding of nutrition labels (208, 209, 218) and also improve perceptions towards the reading of nutrition labels (224). Understanding was associated with academic area and education level (200). However, consumers noted difficulty understanding the information on NIPs (189) and strongly agreed that Front-of-Package nutrition labels should be harmonized in format, font size, and colours for all food products (213).

Proportions of nutrition label use differed among consumer groups. However, most nutrition label studies focus on usage behaviours for NIP labels. In 2001, a report showed 64.8% of 400 Bangkok consumers read labels on milk products but only 34.3% read nutrition labels (219). In 2003, among university students (n=419), 44% frequently read nutrition labels (200). Another study of a northern area with 100 respondents showed 32.0% of consumers were frequent users of nutrition labels (207). In one woman development group 79% were unaware of GDA (193). Among 199 Public Health College students 43% were aware of nutrition labels at a high level (Komwong et al., 2014). Among Thai FDA volunteer staff, teachers, and students (n=394), 59.3% frequently read nutrition labels before choosing products (216). In Ubon Ratchathani 59.2% of participants (n=130) read nutrition labels before purchasing or eating (225).

Some information has emerged about nutrition label utility in Thailand. For example, 74.3% of university students frequently used the information “energy from fat” (226). Fat, cholesterol, and sugar ranked as the top three label items sought by adult onset diabetes mellitus patients (36). Another study found that 58% of participants in a women development group read nutrition labels when purchasing a product for the first time (193). Using nutrition labels was significantly different among sex (195), age, education, and income (36) but there was no detected difference by BMI status (225). In one report it was noted that consumers were willing to pay higher prices for healthier products, based on sodium content (215). From a business perspective, nutrition labels affected decisions on purchase of healthy beverages (202).

Four studies were performed regarding development of nutrition label displays and guidelines. One study reported reference amounts for Thai nutrition labelling (205). Different nutrition labels (pie chart, tables, GDA with/without traffic light colours) were selected and label components were randomly displayed on packaging samples. The most preferred labelling package was the GDA plus traffic light colours at the right bottom corner (204). Other studies reported on developing and evaluating laboratory performance on nutrition labelling (210, 221).

The Thai FDA began to have national surveys aiming to develop better nutrition labelling after NIPs had been used for 10 years. The first FDA study about NIP labels was performed using short questionnaires with a group of respondents (n=2,000) across Thailand in 2009. It showed that 89% of respondents were aware of the labels, 54% understood the information on the labels, and 63% could apply nutrition knowledge to choose appropriate products (29). It was found that 62% of participants understood information on GDA at a moderate level and understanding was not associated with sex and age (212). After GDA labelling laws were promulgated in 2012 the Thai FDA performed a post-launch national survey and found that 48% were aware of GDAs, 63% of them understood the information, and 52% had the right answers (31). The Thai FDA also had three packaging surveys in 2012, 2013, and 2016. They found that the proportion of nutrition labelled foods increased from 67.6% to 79.2% for NIP and from 12.5% to 35.2% over the period 2012 to 2016. They also found nutrition labelling occurring as mandated in 2016 with 99.8% and 93.8% compliance for NIP and GDA, respectively (32, 187, 188).

2.16 Future nutrition labelling in Thailand

From the past until now, many studies investigated consumer behaviours and associations in relation to nutrition labels. However, most studies about nutrition labelling were performed in developed countries, especially the USA and UK. In Thailand, consumer behaviour studies and background knowledge about nutrition labelling were limited. As well, there was no Thai publication on nutrition labelling in international literature until 2015 when the first paper of this thesis was published (33). Insufficient Thai research and limited supporting documents are often mentioned as barriers when proposing new food labelling regulations at WTO. Many knowledge gaps and unresolved questions were notable in Thai nutrition labelling studies.

Thailand is a developing country where nutrition labels have been displayed on food packages to promote consumer healthy eating for almost 20 years. For the future development of consumer-friendly nutrition labels, there is a need to investigate consumer characteristics and their responses to nutrition labels including motivations, difficulties, and barriers in using information of the labels. The impact of current nutrition labelling on Thai consumer eating choices also needs to be understood.

Up until last year there was an identifiable lack of historical background on Thai food and nutrition labels. The historical knowledge gap was addressed in this thesis (Chapter 3). It was important to document and understand the history leading to the current situation of Thai nutrition labelling and consumer behaviour. This will help develop better national nutritional strategies to address the nutrition transition and its consequences.

CHAPTER 3: HISTORY OF FOOD AND NUTRITION LABELLING IN THAILAND

Chapter 3 presents Paper 1 for the thesis. It is published by *Food Policy* and reviews and interprets historical data noting influences on Thai food and nutrition labelling policy development over the last century. The results summarized information gained from searching literature, government documents, laws, and old rare books covering the period from 1906 until 2015. This Paper provides an historical review of the origin of Thai food laws, food and nutrition labelling, along with the social changes, development of Thai food industries, and impact of international trade on making policies. The Paper also identified future trends and challenges related to food and nutrition labelling in Thailand and many similar emerging economies. Understanding the origin, instrumental factors, and challenges of nutrition label development will benefit policy makers. It also provides a framework that supports future Thai research about food and nutrition labelling.

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Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders

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ABSTRACT

This paper reviews the evolution of Thai food and nutrition label policies and Thailand's international role relating to food product safety and standards. The historical record has been interpreted to identify future trends and challenges related to food labelling. These challenges are arising in Thailand and many similar emerging economies.

Thailand has a good reputation in world food markets and is now becoming a global leader in food production and export. It has become deeply involved with regulations and standards applied by World Trade Organization and Codex Alimentarius while serving its own population with a safe and secure food supply. For consumers considering Thai food products, food labels can provide useful nutrition information and help build trust.

Thais began a century ago with policies and laws to enhance food safety and to protect Thai consumers. During the lengthy journey from national to global standards Thai food labels have evolved and now contribute to international food labelling policies. This contribution comes from the perspective of a leading middle income south-east Asian food producer now trading with high income countries around the world. The story of that journey – a case study for many other countries in a similar situation – has not previously been told.

This article provides information for policy makers dealing with food labelling, embedding trends and tensions for one middle income food exporter in a long history. Information captured here should be helpful for other middle income countries, especially those with limited records. This strategic knowledge will enable better decisions for future policies.

Introduction

Labels have long played a part in promoting food products all around the world. Over the last century, food labels also have become increasingly involved in consumer protection by including information regarding both safety (Marks, 1984) and nutritional content (Taylor and Wilkening, 2008a,b). As countries develop their food systems, food labelling plays an important role because good practices and improved food safety are the usual consequence. A transition to food quality and safety is also proceeding in countries undergoing rapid development from traditional subsistence to modern middle income status. Now many countries around the world face difficulties balancing national nutrition, consumer protection, and international trading agreements. A good example of such a transition is Thailand.

In Thailand, food labels first were used to protect consumers from adulterated imported foods. To ensure food safety and quality, the Thai government, through its Ministry of Public Health (MOPH), assumed responsibility for food labels and related policy amendments. Now food labelling reflects and enhances the trustworthy image of Thai food exports.

More than 100 years ago, the Thai government issued its first regulation for food. It prohibited the sale of contaminated or adulterated food from 1908. The first food labelling requirement came much later in 1941. The evolving Thai system of food labels has since gradually harmonized with international developments

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codified by key United Nations (UN) agencies including the Food and Agricultural Organization (FAO), the World Health Organization (WHO), the Codex Alimentarius, and the World Trade Organization (WTO). The developing food industry, consumer movement, international trade, and health transition are all involved in changes of food label regulations. Thailand now has a good reputation for food production and food labelling has contributed to this reputation.

This paper assembles and interprets historical and contemporary data on food and nutrition labelling policy in Thailand. Such historical analysis has never been reported. By understanding the historical development of food labelling, and concomitant social changes, policy makers will be better positioned to anticipate and shape the future. Government regulators should understand the history of labelling in their own jurisdictions. This knowledge will facilitate development of new labelling policies that respond to prevailing nutrition problems as well as helping design the food labels of the future. As well this information should inform debate on fair trade and consumer protection of other countries in a similar situation to Thailand. Obviously, the information we present will be most relevant to the Southeast Asia region but will also help in many other parts of the world.

Methods

National and international databases and key Thai document collections were searched for information on food labelling. The search ended in May 2015. Data were collected from the Royal Thai Government Gazette e-database, the largest collection of Thai laws, registrations, and notifications. This database was searched in Thai using five keywords with results as follows: 7 documents for 'food label', 4 documents for 'nutrition label', 512 documents for 'label', 330 documents for 'food MOPH notifications' and 44 documents for 'packaged food'. Each of these 897 documents was examined and those with substantive information relevant to food labelling, or to related aspects of food regulation or the food industry, were placed in an annotated computer file (n = 137).

The search for information also extended to published articles and monographs. First the Thai Food and Drug Administration (Thai FDA) e-library was searched in Thai for the term 'food label' and 'nutrition label', yielding 30 relevant articles. Then the international ScienceDirect, Medline, and Scopus databases were searched in English looking for publications with the term 'Thai or Siam' in all fields, and the term 'food or nutrition' and 'label' in the title field. All terms were entered with a wildcard to allow for truncation, yielding 11 unique articles. In 3 of these 11 articles the reference to Thailand involved no more than one or two sentences and the other eight were not relevant. Finally, to complete a thorough review of information bearing on food labelling, 19 rare old documents in Thai were found in the Kasetsart University Knowledge repository e-database; as well in the Thai government Department of Science Service digital archive the DSS bulletin was scanned (100 documents) and three issues contained relevant information.

The screening described above resulted in a total of 189 (137 + 30 + 19 + 3) documents available for the next stage of analysis. Each was then read fully and some documents were found to duplicate information or contained excessive detail. Eventually 39 of these documents or articles were actually used in this report along with other references that were identified through cross-citations. All these are listed with the references.

All the significant laws and documents found relevant to Thai food labels were dated between 1908 and 2014. For this report, the information gathered on food and nutrition labelling covering the last century is organized into six sections. These include the start of Thai food industry and its regulation, early experiences of labelling, modern food labelling, nutrition labelling, Thai nutrition label challenges, and international tensions.

Results

Beginning of food industry and its regulation in Thailand (1906–1944)

The first phase of food regulation in the Kingdom of Siam (previous name of Thailand) responded to imported low quality or adulterated foods. Such foods were widespread at the start of the 20th century. A report about spoiled tinned food had appeared in the Journal of the Siam Society as early as 1906. It noted that food producers were not required to stamp the canning date on each tin. Old stocks that should have been destroyed were sold to the small traders (Highet et al., 1906). In 1908, new regulations in many fields were introduced as part of a modern penal code for the Kingdom of Siam (Thai FDA, 2009). The new law does not mention food labels or canning dates but use of false brands or names on products was specified as infractions of the code (Royal Thai Government Gazette, 1908).

In the late 1910s, skimmed milk was considered to be a food lacking in nutritive value because butterfat, carrier of vitamin A, was removed (Howard, 2013). Many Thai physicians agreed that skimmed milk could not give infants enough nutrients and might cause sickness. The Skimmed Milk Act in 1927 controlled imported milk (Royal Thai Government Gazette, 1927). At this point, the Thai government developed a food quality analysis unit to measure the mineral composition and quality of milk. It was located in the existing Government Laboratory in Bangkok (*Salayaekthatu*) that was responsible for geological analyses (Ministry of Industry, 1953). The Skimmed Milk Act 1927 was the first attempt to protect consumers from fake foods. It led to development of laboratory expertise and food science needed to investigate the composition of foods and validate the labels.

After World War 2 Thailand became an early member of the UN. It joined the FAO in 1947 and began to industrialize. For the food industry a Department of Science (DOS) evolved incorporating the Government Laboratory. Opportunities grew for international knowledge exchange. For example, FAO sent a specialist to Thailand to work on food and nutrition with the DOS and the MOPH in 1955. A UN scholarship was given to a government scientist to visit Australia to study food processing in 1957 and another Thai scientist was sent to study food canning and preservation in Denmark in 1964 (Bhumiratana, 1966a,b; Ministry of Industry, 1955a,b). Thai food industries responded well and modern food science and technology appeared quickly in the 20 years after World War 2.

Food preservation industries became prominent in Thailand during the 1950s. At first, the Thai government developed a pilot food factory, the Preserved Foods Organization (PFO) established in 1955, managed by the Ministry of Defence. The PFO aimed to produce instant or ready-to-eat foods that could be used during a civil or military emergency (Royal Thai Government Gazette, 1955). As well knowledge about combat rations was obtained from US Armed Forces. The first prototypes produced by PFO were canned rice and food dishes exhibited at the first Thai Trade Fair (1962). Three years later, the PFO developed dehydrated combat rations (instant rice and dried banana in tin foil) for military use (Bhumiratana, 1966a). As a knowledge hub, PFO was an important influence on food laws in later decades.

The Thai canned foods industry arose in the 1950s and was the first food industry component to receive strong government financial and technical support. The aim was to stimulate consumer demand and to reduce food imports when food shortages appeared

after World War 2 (Royal Thai Government Gazette, 1956). The first generation of Thai canned foods were produced by small enterprises with simple production practices (Ministry of Industry, 1975), such as canned pickled mustard greens in 1950 (The Peace Canning (1985) Co. Ltd., 2010) Much later, large canned food companies introduced modern production systems. This led to internationally famous exports including Thai pineapples in 1967 (Siam Agro-Food Industry Public Company Limited, 2013). This expertise with canned foods and tropical fruits continues up to the present day.

Early Thai food labelling

The Food Quality Control Act 1941 was the first comprehensive Thai food law and it defined the word "label" to be any statement or picture or imprinting on food, box, package, or container. Food products with labels that misled consumers about quality, quantity, or specific characteristics were classified as fake food. A Thai food label with the name and address of the place of business was required when food was mixed with a number of ingredients or was sold with a special name (Royal Thai Government Gazette, 1941). The law protected consumers from fake foods but there was no overall guidance for labelling details.

One year later, in 1942, foods which included colourants were the first group specified to require food labelling. Colourant-added-products (1) shall have a Thai label and if the label also displays in a second language, it shall not have a different meaning, (2) specified colourants shall be declared. As well, milk had to declare the 'type of food' and 'place of production' for many types of products such as condensed milk, milk powder, and colostrum (Royal Thai Government Gazette, 1942a,b). Non-declaration could lead to court proceedings. However, government capacity was limited and the initial focus was limited to colourants and milk products (Deputy Director General of Department of Science, 1942).

The Food Quality Control Act 1941 consolidated in the years through to 1959 and new food controls soon appeared. Low quality canned food (both Thai and imported) had become widespread in Thailand after World War 2 and the existing laws could not make this food safe. As well, an increasing number of bad quality canned foods displayed fake labels. For example, canned rambutan products were labelled with a photo of lychees; or food producers tried to conceal their place of production by using English language labels to make consumers think it was an imported product. Some canned foods contained preservatives that were not declared. Canned foods became an important safety issue as reported in newspapers of the period (Bhumiratana, 1964, 1966b; The Thai Home Economics Association, 1965).

Many government groups met together for Thailand's 11th PFO conference in 1962 to discuss the hot topic "How can we control [the quality of] processed food industries?" Staff from PFO, Ministry of Industry (MOI), and MOPH agreed that Thailand should amend food laws, especially for canned foods. They agreed that Thai food labels should name the food type and ingredients in food products (Bhumiratana, 1964). Two years later, in 1964, Notification No. 6 amended the Food Quality Control Act (1941, 1959) by requiring labels to present the truth. The type and name of food, place of production, quantity, and manufacturing date were required on the label (Royal Thai Government Gazette, 1963b).

At this point, international standards began to appear and Thailand often adopted them. The Director of Department of Science, Prof. Yos Bunnag, was on the committee drafting the Food Quality Control Act 1964 and he had participated in the Codex since the 1st Codex Alimentarius Commission (CAC) in 1963 (Pongsapitch, 2013; Royal Thai Government Gazette, 1963a). Thailand wanted to export food products, so it had to adopt the international standard of the Codex for safe food products, reducing trading barriers among countries (Thai FDA, 2000). This was the beginning of international food regulations and standards that Thailand adopted to use in later food laws.

The Food Quality Control Act 1959 had limited powers over food producers so a new Food Quality Control Act 1964 was promulgated (Bhumiratana, 1964). Food products with labels that deceive about quality, quantity, other special characteristics, place of production, or country-of-origin were classified as fake foods. The penalty for fake foods was imprisonment up to ten years or a fine not exceeding 20,000 Thai Baht (approximately US$600), or both. Accredited staff had authority to seize or destroy fake foods (Royal Thai Government Gazette, 1964a).

In 1964, the MOPH food label Notification No. 6 was the first label guided by the general provision of CAC. Food labels had to declare name, food registration number, net quantity and volume, and name and place of manufacture. The notification also covered declaration of any usage of preservatives or additives (including colourants, flavours, and antioxidants) with a specific statement and specified font size (Royal Thai Government Gazette, 1964b).

Food labelling in modern Thailand (1979-)

The Consumer Protection Act 1979, and the Food Act 1979 which required product labelling without deception, were part of the consumer movement that swept the world at that time (Potipara, 2012). The Thai Food and Drug Administration (Thai FDA), created in 1974, was tasked to enforce these laws. The Food Act 1979 is the central law governing the food industry in Thailand today. It defines "food" as "edible items and those which sustain life", including: (A) "substances eaten, drunk, sucked, or gotten into the body by mouth or other means ... not including medicine, psychotropic substances or narcotics ..."; (B) "substances for use as ingredients in production of food including additives, colouring, and flavouring". The Act defines "label" as any symbols, pictures, printings or statements on food packages (Royal Thai Government Gazette, 1979a).

MOPH guidance in Thailand in 1979 indicated that food labels should display the name and type of food, food recipe registration number, name and location of manufacturer, manufacture date, quantity, and the ingredient list. Labels must mention any food preservatives, colourants, additives, and chemicals that were added. The label needs to be obvious and present the truth (Royal Thai Government Gazette, 1979b).

Approved Thai FDA food labels for display on packages first began for "controlled" (Category 1) or "prescribed" (Category 2 and 3) foods in 1979 (Fig. 1) (Royal Thai Government Gazette, 1979b). Foods that must be labelled include products likely to cause adverse health effects if the quality is poor (Thai FDA, 1979). The Thai FDA "approval symbol" then came into use in 1985 showing consumers that the food labels had been approved by the MOPH (Fig. 2) (Royal Thai Government Gazette, 1985).

Further changes arose after Thailand became a WTO founding member in 1995 (World Trade Organization, 2014). The emphasis moved to post-marketing monitoring of food safety (Good Manufacturing Practice or GMP) and food quality (Thai FDA, 2000). In 2000, to support the free-trade system, "controlled" and "other foods prescribed by the Minister" became the only food groups that required label approval before sale (Royal Thai Government Gazette, 2000). The new Thai FDA approval symbol incorporated a thirteen digit food serial number. These numbers allow consumers to trace the food to its point of production (Fig. 2).

Some modifications were a result of cumulative small changes since 1979. Thus "net quantities" have been clarified and measurements are now metric (e.g. gram and millilitre). In 1981 "net quantity" evolved into two words – "net weight" (solids) and "net volume" (liquids). "Drained weight" quantifies chunky

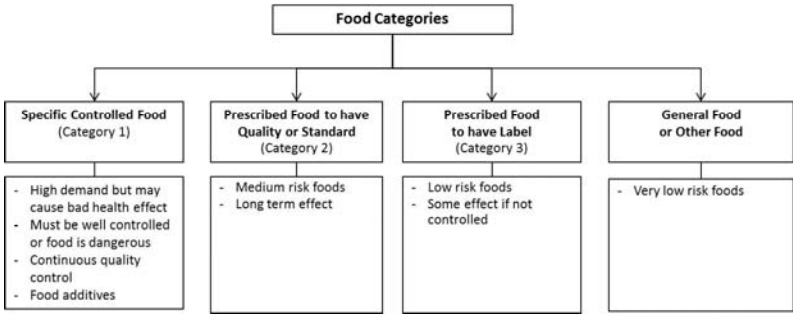

Fig. 1. Food categories by Thai FDA regulations (Thai FDA, 1979).

Fig. 2. Thai FDA label before and after 2000.

foods or foods packed in liquid, excluding foods which cannot be isolated from liquid. Since 1982, Thailand had required more comprehensive declarations with percentage of weight expressed in descending order of magnitude. Thailand was ahead of the Codex for a Quantitative Ingredients Declaration (QUID) (Royal Thai Government Gazette, 1979b, 1981, 1982; The International Association of Consumer Food Organizations, 2005).

Before the advent of the current 2014 rules regarding manufacturing date and expiration date, guidelines relating to these two dates had often been amended. Also, at first (1979), names and addresses of producers were simply expressed on the labels specifying the place of manufacture or the place of re-packaging. Finally, after many changes, in 2014 specific terminology was adopted including "Manufactured by", "Repacked by", "Headquarters", or "imported by" (Royal Thai Government Gazette, 1979b, 2014).

Visibility and legibility of Thai food labels have evolved considerably. From 1979, the font size of certain key words such as "type of food" was fixed at not less than 5 mm, equivalent to Times New Roman 14 pt on a modern printer. Text colour should contrast to the background and font sizes should be appropriate for the label surface area. Labels should be placed on visible locations, and should be clear and easy to read. In 2014, a particular font size was indicated for specified text expressions. One millimetre is minimum font size required for smaller (<100 sq cm) package area (Royal Thai Government Gazette, 1979b, 2014).

One development yet to evolve in Thailand was the Principle Display Panel (PDP). In the USA, where PDPs were first developed, they were considered to be easily visible with a legible name, food registration number, place and address of manufacture, net weight, manufacturing date and expiration date. However, in Thailand PDP did not become the standard for labelling (Royal Thai Government Gazette, 1981, 1982, 2000).

Rules for food additives and preservatives continue to evolve. When the Food Act 1979 became law, manufacturers had to mention "utilizing preservative", "colouring" or "flavouring". In 1985, further division was required into "Natural flavour", "Synthetic flavour", and "Artificial flavour" – categories still used today. Since 2000, flavour enhancers and food sweeteners must be on the label. Since 2014, the food additives group has to include the corresponding number for the International Numbering System (INS) (Royal Thai Government Gazette, 1979b, 1985, 2000, 2014).

Another important change for labelling came in 2014 and is still in force (Notification No. 367). All pre-packaged foods (except fresh, kiosk and wholesale catering foods) now must have labels (Royal Thai Government Gazette, 2014). Allergen information labels are also now required for the first-time; this followed a recent study showing one-third of Thai commercial food products contained undeclared allergens greater than 10 ppm (Surojanametakul et al., 2012).

Nutrition labelling in modern Thailand (1979-)

Thailand's first nutrition label law was promulgated in 1998, nineteen years after the first food label law. Nutrition labelling laws were dependent on scientific discovery and this followed World War 2 and the collaborative work with foreign nutritionists (Kachondham et al., 1992). Many new scientific findings about diet and health led to Thai guidelines, and food and nutrient databases were created to improve Thai consumer knowledge.

Nutrition labels on foods were part of the national strategy to improve nutritional status of Thai people and followed after the first International Conference on Nutrition (ICN) was held in Rome in 1992 (Kongchuntuk and Intaraluk, 1999). At that conference, all countries agreed to make a World Declaration and Plan of Action for Nutrition. Nutrition labelling was part of a communication strategy to prevent diet-related non-communicable disease attributable in part to dietary and life style changes and urbanization. To harmonize labels among countries, each followed the international standards of the CAC (FAO/WHO, 1992). In the early 1990s, when Thailand was trying to grapple with serious problems of simultaneous under- and over-nutrition, the government adopted nutrition labels as one strategy for the 7th National Economic and Social Development Plan (1992–1996) (Kongchuntuk, 1996).

In 1990, the US Congress passed the Nutrition Labeling and Education Act (NLEA) (Taylor and Wilkening, 2008a), creating a problem for Thai food exporters because they had not previously had to display nutrition labels. In 1992, the Institute of Nutrition at Mahidol University (INMU) held a nutrition label workshop to help compliance with US food labelling laws. Beginning in 1993, chemical analyses of Thai foods involved cooperation between Thai food experts and food analysts (Pitsanupoom, 2001).

The format of the Thai nutrition label evolved in response to prevalent nutritional problems and was based on national priorities. A special project to develop Thai nutrition labels began in 1994 (Kongchuntuk, 1996) using the Codex guideline on nutrition labelling that had been available since 1985 (Codex Committee on Food Labelling, 2013). Thai FDA was in charge and cooperated with many national organizations including the INMU, as well as the MOPH Bureau of Nutrition, the MOI Office of the National Codex Alimentarius Committee, and the Federation of Thai Industries (Kongchuntuk and Intaraluk, 1999).

Recommended Daily Allowances for Healthy Thais (RDAs), created by MOPH in 1989, were not suitable for nutrition labelling because there are too many values dependent on age and sex

(Royal Thai Government Gazette, 1998; Thai FDA, 1995). Accordingly, the Thai Recommended Daily Intake (Thai RDI) was established in 1995 to be a set of mean values for healthy Thai people above 6 years old. These values were created by choosing the highest nutrient value among Thai RDA, US Daily Values (DV), US Daily Reference Values (DRV), US Reference Daily Intakes (RDI), and Codex Nutrient Reference Values (NRV) (Kongchuntuk, 1996). Eventually, the Thai RDI specified 2000 kcal total energy, 65 g total fat, 300 g total carbohydrate, 2400 mg sodium and other nutrient values as standards (Thai FDA, 1995). For reference serving size, values came from consumer consumption surveys and from information provided by food producers (Royal Thai Government Gazette, 1998).

According to the Codex guideline, each country may require declaration of specific vitamins and minerals on nutrition labels (Codex Committee on Food Labelling, 2013). For Thailand, declarations of vitamin A, vitamin B1, vitamin B2, Calcium, and Iron are all mandatory under Thai nutrition label laws (Royal Thai Government Gazette, 1998). Those vitamins and minerals reflect the major nutrition problems noted in Thailand's first Thai National Food and Nutrition Plan (NFNP) (1977–1981) (Kachondham et al., 1992). Vitamins and minerals required on Thai nutrition labels may differ from other countries.

As noted at the start of this section, Thailand first developed a Nutrition Information Panel (NIP) (Fig. 3) in 1998. In the beginning, foods making health or nutrition claims, foods for special diets, and foods using nutrition for marketing purposes were subjected to mandatory nutrition labels (Royal Thai Government Gazette, 1998). Thai nutrition labels have followed the Codex principles including declaration of nutrients, and nutrient calculation of the information (Codex Committee on Food Labelling, 2013). The appearance of the box in Thai nutrition labels was rather similar to USA nutrition labels. At that time, USA nutrition labels were leading for clarity and many countries were influenced to produce similar labels (Kongchuntuk, 1996). The full-format of a Thai nutrient data display box includes 15 items, but a short-form data display box can be used when some of the 15 nutrients are absent (Royal Thai Government Gazette, 1998).

Since 1998, the Thai government had paid great attention to nutrition labels increasing consumer's knowledge. Nutrition labels appeared in mass circulation magazines and newspapers such as Thairath, Matichon, and Folkdoctor magazine as well as on television. Videos, brochures, and magnets were distributed to high schools in Thailand (Thai FDA, 2001). The book "10 steps to nutrition labels" was provided to food producers in 1999 (Kongchuntuk and Intaraluk, 1999). Some newspapers or magazines ran a quiz competition based on the information imparted and this created some enthusiasm in younger age groups. However, in 2007, INMU surveyed 1330 consumers and it showed that only 20% understood all the information on a NIP (Puwastien, 2008).

Challenges for Thai nutrition labelling: traffic lights and GDAs

Thailand faces several unresolved issues regarding nutrition labelling. Over the last decade, many groups have advocated traffic light nutrition labels. Others oppose them because of lack of agreement on the "colour" of specific foods or on typical amounts ingested. Unfortunately, many less educated consumers also found NIPs were hard to comprehend. In 2006, the WTO Technical Barriers to Trade agreement (G/TBT/N/THA/215) was invoked to oppose a traffic light system in Thailand (Thai FDA, 2006; WTO, 2007). Investigating further, in 2007, Thai researchers explored a star system (1–5 stars), multiple traffic lights, and various nutrient models. This work was done with 450 Thai participants. The traffic light was favoured by participants as the most comprehensible and appropriate model (Sirichakwal, 2007).

Nutrition Information

Serving size : 1/3 package (30g)
Serving per package : 2.5

Nutrition Values per serving size
Total Energy 150 kcal (Energy from Fat 70 kcal)

	% RDI*
Total Fat 8 g	12 %
Saturated Fat 2 g	10 %
Cholesterol 0 mg	0 %
Protein 2 g	
Total Carbohydrate 18 g	6 %
Dietary Fiber 1 g	4 %
Sugar 0 g	
Sodium 120 mg	5 %

% RDI*			
Vitamin A	0 %	Vitamin B1	4 %
Vitamin B2	0 %	Calcium	0 %
Iron	4%		

*Percentage of nutrients for Thai recommended daily intakes for ages of 6 years and up (Thai RDI) are based on the energy demand of 2,000 kcal/day

The energy demand for individuals may be different. The person whose energy demand of 2,000 kcal/day shall receive nutrients as follows:

Total Fat	Less than	65 g
Saturated Fat	Less than	20 g
Cholesterol	Less than	300 mg
Total Carbohydrate		300 mg
Dietary Fiber		2 5 mg
Sodium	Less than	2,400 mg

Energy (kcal) per gram : Fat = 9 : Protein = 4 : Carbohydrate = 4

Fig. 3. Nutrition Information Panel (NIP) translated from Thai label on a real snack.

Although many consumer organizations tried to push traffic light nutrition labels, they were abandoned as a nutrition information tool in Thailand. An additional Thai FDA study of other systems in 2009 showed Guideline Daily Amounts (GDA) (Fig. 4) was a good solution (Hokiarti, 2012).

However, GDA labels were not accepted by all. In 2010, the National Health Assembly (NHA) and the Thai cabinet agreed to manage the emerging problem of obesity in Thailand (Banwell et al., 2009). They proposed that the National Health Commission office (NHCO) and the Thai National Food Commission (TNFC) should support traffic light symbols on foods containing fat, sugar,

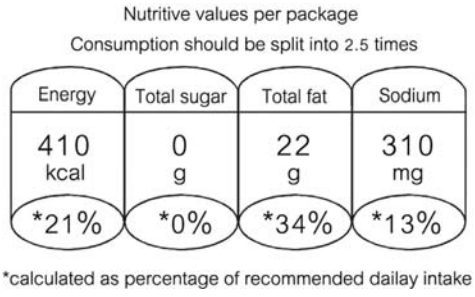

Fig. 4. Guideline Daily Amounts (GDA) translated from Thai GDA label on a real snack.

or sodium (National Health Assembly, 2009). In 2011, eight Thai health organizations and many parents also signed a petition to the prime minister and the minister of MOPH asking for a traffic light label policy. But the Federation of Thai Industries argued that such traffic lights may induce consumers to eat too much "green foods" (Matichon newspaper online, 23 March 2011). Finally, the GDA label rather than the traffic light system was announced by a Thai FDA Notification of Labelling of Certain Ready-To-Eat Food (No. 2) in 2011 and it became effective on 24 August 2012 (Royal Thai Government Gazette, 2011).

Since 2011, GDA labels have been promoted by many campaigns to support consumer good eating and health. There have been GDA label brochures prepared by Thai FDA. As well, the GDA labels have been promoted by Thai FDA road shows at hypermarkets (Tesco Lotus) (Thairath newspaper (online), 21 April 2012) and the "Rai poong" project (Network of Fatless Belly Thais) (Chavasit et al., 2013). A Low Salt Thailand project is also underway (Supornsilaphachaii, 2013). As well knowledge is being transmitted through "Oryor noi" Youth FDA volunteer project (Hokiarti et al., 2012) and the "DekThaiDD" project developed by Nestle (Healthy Thai Kids project).

Because mandatory GDA labels may help consumers understand nutrition better, the Thai FDA designed these labels to cover all foods containing high sugar, fat, and salt. At first, five groups of snack foods were selected as pioneers for GDA labelling. There included fried or baked potato chips, fried or baked popcorn, rice crisps or extruded snack, crackers or biscuits, and filling wafers (Royal Thai Government Gazette, 2011). With good feedback from food producers, about 75% of targeted snack foods quickly developed GDA labels for their food packages within one year after the law became effective (Kumsri et al., 2013).

The Thai FDA conducted consumer surveys and published a summary of results at the 7th Thailand Congress of Nutrition, claiming that about 63% of those studies revealed that the participants had correctly understood information on the GDA labels (Yodtheun et al., 2013). Accordingly, the GDA policy remains in force for the five groups of snack foods and (in mid-2015) expansion to other foods is under consideration. It is expected to become mandatory for other food groups in Thailand including all snack foods (including peas and nuts, seaweed, and fish snacks), chocolate in all its forms, bakery products, semi-processed foods, and chilled and frozen ready-to-eat meals (Ministry of Public Health, 2013).

The Thai FDA plans to change labels soon. The changes include a lower value for the recommended daily sodium intake (from 2400 to 2000 mg). As well, information about food serving size will expand to include a greater variety of foods such as seaweed products. Furthermore, a trans-fat declaration will be included on future Thai nutrition labels (Parinyasiri, 2013). Thai FDA has also indicated plans to expand food labels by adding more about nutrient function claims (International Life Sciences Institute (ILSI) Southeast Asia Region, 2014).

International tensions for food and nutrition labelling

Regional agreements and food trade

Food is an important component of global trade and has been a prominent part of trade agreements. Over the last three decades, regional trade agreements have appeared all over the world including North and South America, the Andean Community, the Caribbean, Eurasia, East Africa, and Asia. In South East Asia, ASEAN created a Free Trade Area (AFTA) over twenty years ago and aimed for economic integration by 2015. To achieve this, it will be necessary to agree on labels for traded food. But this complex work has not been completed partly because it involves agreement among countries ranging from low income to high income. The challenge confronting AFTA is an example of the food agreements that must be made in many other parts of the world as regional economic integration proceeds.

Harmonizing labels in Southeast Asia

Harmonizing food and nutrition labelling in Southeast Asia requires region-wide acceptance of international standards that are yet to be agreed. It will reduce trade barriers and consumer confusion but will involve tedious and prolonged negotiations. Many bureaucratic barriers persist among Southeast Asia countries including differences in scope of label regulation, variation of nutrient standards, and non-uniformity of nutrition labels. Issues surrounding labelling of processed foods have been discussed many times and are well documented by the recent report from the 8th Seminar on Nutrition Labelling, Claims and Communication Strategies (International Life Sciences Institute (ILSI) Southeast Asia Region, 2014).

Thailand has developed regulations over a long period and its rules regarding claims and Nutrition Information Panels are similar to Indonesia, the Philippines and Singapore. Vietnam has less experience and focuses regulations on milk product for children. Gradually, as each ASEAN country develops its own food and nutrition label standards, inter-country differences become apparent and constitute potential non-tariff barriers.

At present, each country has different nutrient reference values and rules regarding nutrition and health claims. For example, nutrient content claims for enrichment products are allowed in Malaysia (Gautier, 2010). Reference values involve Recommended Daily Intake (RDI) for Thailand, and Recommended Energy and Nutrient Intake (RENI) for the Philippines. Although Southeast Asia Recommended Dietary Allowances (SEA-RDAs) have been established, they are not yet integrated with Codex guidelines and not yet used for uniform labelling (Barba and Cabrera, 2008; Tee and Florentino, 2005).

All Southeast Asian countries follow Codex guidelines but have different ways of expressing nutrient content. Some nutrition labels list only a few nutrients, others show 15 nutrients or more (Tee et al., 2002). Labelling of core nutrients also differ. Energy, fat, protein and carbohydrates are the four core nutrients listed in Malaysia, the Philippines, and Singapore whereas Indonesia also lists sodium as the fifth core nutrient (Gautier, 2010). If food products are sold across Southeast Asian countries with source country nutrition labels consumers will be even more confused than they are dealing with labels produced by their own country.

National and international food label regulations

Complaints to WTO of Technical Barriers to Trade (TBT) show how labelling for consumer protection can be perceived as a trade barrier. Every country has a legal obligation to comply with WTO rules but this can conflict with sovereign responsibility and national public health laws (Albert, 2009). Frequent examples include conflicts related to nutrition labelling, ingredient list labelling, and country-of-origin labelling. Many TBT questions relate to definitions (e.g. organic foods), product categories (e.g. snack foods), and proof of claims (e.g. transgenic foods). This is well summarized in recent reports from the USA (United States Trade Representative, 2013, 2014).

The great variety of TBT complaints about food labelling regulations reveal the current tensions arising from food trade. Labelling that warns consumers about risks associated with the products were the source of frequent complaints. For example, Chile, Ecuador, and Peru tried to mandate front-of-package labelling for products with a high content of sugar, fat, or salt. The USA objected to such nutrition "stop sign" labels because they discourage consumption even if the product is not harmful when consumed in moderation (Grocery Manufacturers Association, 2014). Also, the

European Union and Taiwan required labelling for transgenic foods but this led to TBT complaints due to a negative impact on trade that is not science based. When scientific evidence supporting labels is insufficient countries have revised them if they have the capacity to gather the necessary data. But in TBT complaints, developing countries are always disadvantaged due to lack of the necessary scientific expertise and resources (Anonymous, 2000). This disadvantage in obvious for TBT disputes involving South East Asia. Thailand can get entangled in first world-third world disputes as it has considerable expertise in food sciences and is also a major global food trader.

Concerns were often raised by many stakeholders whenever food regulation mandates labelling that reveals some attribute of food that would decrease consumption of the product. For example, Thailand was the first country to propose multiple traffic light nutrition labelling for snack foods in 2006. Some said it would cause confusion and mislead consumers. Finally, reflecting the interest of the food industry, Thailand later opted to implement a GDA system of labelling (Chavasit et al., 2013; Friel et al., 2013; Royal Thai Government Gazette, 2011; Thai FDA, 2006). In January 2013, Chile proposed a stop sign variant for foods "high in" fat, sugar, calories, or salt. Eleven countries including the USA raised concerns that the regulation was unclear, not scientific, and unnecessary to communicate the nutrient content of product. Chile continues to propose stop sign guided labels (Grocery Manufacturers Association, 2014; United States Trade Representative, 2014). After two years dispute, stop sign labels were signed into law by the Chilean President on April 2015 but WTO still considers the matter (Ramirez and Katial, 2015).

Beyond the Codex and the WTO, there are additional issues related to labels that can lead to disputes. For example, the USA is worried about the EU implementing "place of farming" labelling. The USA complained because there is no international guideline and it is difficult to comply for foods with multiple ingredients. Conversely, the USA also had country-of-origin labelling applied to imported beef and pork but these labels were rejected by WTO because of unfair adverse effects on imported meats from Canada and Mexico (Locke, 2015). Also, there have been complaints that Indian food labelling for "date of production" departs from the Codex Standard. And while Ecuador, Peru, Taiwan, and Russia are calling for "biotechnology labelling" others counter that biotech (transgenic) foods need not be treated differently (Codex Alimentarius, 2011). Warnings to "avoid excessive consumption" are criticized because they create fear in consumers (United States Trade Representative, 2014).

Conclusion

Thai food labels have evolved for over 100 years to improve the quality and safety of food products. But the labels did not indicate nutrient content and daily requirements until the 1990s. These "nutrition labels" follow international trends to promote consumer health. Thai nutrition label policy follows the international Codex Alimentarius guidelines. A good impact on dietary behaviour, and eventually on health and nutrition, remains the elusive goal.

Thai food label regulation has changed in parallel with social change and economic development for the past century, while the country underwent a transition from a traditional subsistence agricultural society to a modern manufacturing middle income state. Within Thailand, sovereign power to draft national regulations for food and nutrition labels to protect consumers is now constrained by international trading policies and standards that have intruded. Strong consumer sentiment influenced food labelling 40 years ago but now international "fair trade" is a higher priority.

Managing different stakeholders has become a prominent issue. Thai food label policies now must find a balance among domestic consumer protection, nutrition promotion, abolition of international trading barriers, and adherence to international rules. These tasks also contribute to a national goal to make Thailand a kitchen to the world. This ambitious goal must be balanced by the ongoing commitment to optimize nutrition of the Thai population.

The evolution of the Thai food industry and rules that govern domestic and international trade have interacted with economic development in complex ways documented here and beginning a century ago. The experience of Thailand, which we could capture due to the good record systems, has useful information for many other countries, especially those with limited or confusing historical records. The Thai experience overlaps that of many other countries making similar transitions. Issues confronting the Thai food trade almost certainly affect food trade in other middle income countries with similarly strong traditions.

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CHAPTER 4: THAI CONSUMER MOTIVATIONS FOR USING NUTRITION LABELS

Chapter 4 presents Paper 2 in the thesis. It is published by *Global Journal of Health Science* and investigated factors influencing Thai consumer decision making about the use of nutrition labels. Interviews were conducted face-to-face with 34 participants aged 20 to 45 years in two socio-demographic extremes in Thailand – "urban Bangkok" (university educated consumers) and "provincial Ranong" (non-university educated consumers). Semi-structured in-depth interviews combined with a Knowledge-Attitude-Behaviour and Health Belief Model helped explain consumer knowledge, attitudes, behaviours, and beliefs towards nutrition label use. Results in this Paper describe four different groups of nutrition label users in Thailand. It also examines the impact of health beliefs and motivations on the likelihood of using nutrition labels as consumers. Results reported here contribute to labelling improvement and more effective nutrition education strategies and promotion.

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"I rarely read the label": Factors that Influence Thai Consumer Responses to Nutrition Labels

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Abstract

Background: This qualitative study employed the Knowledge-Attitude-Behaviour (KAB) model and Health Belief Model (HBM) to investigate factors influencing Thai consumer decision making about use of nutrition labels. Labels include both Nutrition Information Panels (1998-) and Guideline Daily Amounts labels (2011-).

Method: In-depth interviews were conducted with 34 participants representing two socio-demographic extremes in Thailand – "urban Bangkok" (university educated consumers) and "provincial Ranong" (non-university educated consumers). An integrated KAB-HBM model was used to devise in-depth interviews for a qualitative study using 20 open-ended questions and samples of food package labels. Additional questions arose from the interviews and they lasted 30-45 minutes and were video recorded. The analysis identified recurring themes using Atlas.ti software.

Results: Most participants (n=25) were aware of nutrition labels but a much smaller number (n=10) used and derived any benefit from them. Nutrition label users were classified into 4 groups: A) competent user; B) confused user; C) aware non-user; D) unaware non-user. Better educated participants were better at understanding nutrition labels but not more likely to use labels. Belief that nutrition influences health increased likelihood of using nutrition labels to make decisions about food. Being well-educated and motivated by health concerns increased likelihood of attention to nutrition labels.

Conclusion: Results are discussed with a view to increasing the use of nutrition labels by Thai consumers. Our findings, drawing on a combination of the KAB and HBM models, can contribute to strategies motivating consumers to use nutrition labels and can provide useful insights for developing promotional strategies.

Keywords: Thailand, nutrition label, qualitative study, consumer, behaviour, community health

1. Introduction

A sound understanding of nutrition labels can contribute to healthy food consumption and improve consumer health status (Jasti & Kovacs, 2010; Post, Mainous Iii, Diaz, Matheson, & Everett, 2010; Storcksdieck Genannt Bonsmann & Wills, 2012). In an effort to boost community health, the Thai Ministry of Public Health (MOPH) introduced a Nutrition Information Panel (NIP) in 1998 on specific prepackaged foods. Despite these efforts the prevalence of overweight and diet-related disease has grown among Thai adults as has the national trend towards unhealthy diets. Obesity prevalence in Thai adults (35-59 years old) had steadily increased from 1991 to 2009 (Wibulpolprasert, Sirilak, Ekachampaka, & Wattanamano, 2011). More than four fifths of adults consume insufficient amounts of vegetables and fruit (Institute for Population and Social Research - Mahidol University, 2011). Furthermore, diet-related conditions such as cardiovascular disease will have a significant impact on Thai health into the future (Zhao et al., 2014).

Reacting to concerns about over-nutrition and Non Communicable Diseases (NCDs) the MOPH took further steps by designing a more comprehensible version of the nutrition label (Royal Thai Government Gazette, 2011). The Guideline Daily Amounts (GDA) nutrition label was introduced in 2011 for four categories of risk-related food types–energy, sugar, fat, and sodium. This "Hwan-Man-Khem label" (sugar-fat-salt label) is now compulsory on the front of packages of five groups of popular processed snack foods - fried or baked potato chips, fried or baked popcorn, rice crisps or extruded snack, crackers or biscuits, and filling wafers. Currently, Thai snack foods display both NIP and GDA on their packages.

Despite these efforts, food labelling is a relatively under-researched topic in the Thai context. Since 2009, only two quantitative surveys have been conducted with Thai consumers. The first found 89% of respondents were aware of nutrition labels, 54.4%, understood them and 62.8% used the information on them (Parinyasiri, 2010). One year after GDA labels were added to the five snack foods listed above, the Thai Food and Drug Administration (Thai FDA) reported that an average of 48.1% of respondents were aware of GDA labels, 63.3% understood them, and 52.4% were able to apply information from GDA when choosing products (Yodtheun, Juntarasuthi, Rochanawanitchakarn, Ratanatikaumporn, & Panprayun, 2013). These studies demonstrated that consumers' awareness and use of labels is comparatively low but they did not address the reasons for this. Little is known about Thai consumers' decision making processes related to using labels nor their responses when shown real packaged foods.

For labels to be effective, consumers need to be aware of, understand, and make use of them. Our study sought an in-depth understanding of Thai consumers' responses to actual nutrition labels on existing food products so that strategies to improve the use of labels could be developed. It aimed to contribute to better health promotion strategies both in Thailand and in other South East Asian countries that are undergoing a nutrition and health transition related to a rapidly westernizing diet and rising NCDs.

2. Methods

2.1 Participants

The study was conducted in two areas: urban Bangkok and provincial Ranong. Bangkok residents were recruited by phone from members of the Thai Cohort Study (TCS) (Sleigh, Seubsman, Bain, & the Thai Cohort Study Team, 2008; Seubsman, Yiengprugsawan, Sleigh, & the Thai Cohort Study team, 2012), a large national cohort of students from Sukhothai Thammathirat Open University under study since 2005 for the health-risk transition. Ranong residents were recruited inside the only supermarket (Tesco Lotus) in that province, but only if they did not have a university education. The aim was to include participants with a range of educational and health knowledges in the age-groups likely to benefit from future nutrition labelling (20-45 years).

2.2 Interviews

Health-related behaviour has long been studied using conceptual models (Egger, Spark, & Lawson, 1992; Contento, 2010) such as the Knowledge-Attitude-Behaviour (KAB) Model in which knowledge mediates attitudes and behavioural change. Also useful is the Health Belief Model (HBM) which considers vulnerability combined with belief that prevention is possible, leading to action to reduce risk. These two well established models of health behaviour were integrated and adapted to qualitatively explore the influence of nutrition labelling on nutrition-related health behaviour.

The interview protocol was based on the integrated KAB-HBM model of health behaviour and from similar international qualitative research on nutrition labelling (Marietta, Welshimer, & Andersons, 1999; Maubach & Hoek, 2010; Wahlich, Gardner, & McGowan, 2012; McLean & Hoek, 2014). Interviews were conducted face-to-face by the lead author in Thai using a semi-structured schedule of questions. Each participant was given examples of real food packages with both NIP and GDA labels and was asked to explain the information on the labels and their reaction to them. An open-ended approach adapted from grounded theory (Glaser & Strauss, 2009) was used in interviews. Each interview lasted around 30-45 minutes and was audio and video recorded with participants' consent. The number of interviews conducted was guided by the principle of saturation, or the notion that little new information was being gained in additional interviews. Once this occurred in each setting we refrained from collecting more interviews. This study's protocol was approved by the Australian National University Human Research Ethics Committee (Protocol 2013/148).

2.3 Data Analysis

The audio content was transcribed verbatim into Thai text and cross-referenced with the video recording to help validate the verbal transcript with body language. The transcripts were read repeatedly to determine appropriate code words that reflected the overall research questions and the components of the two models (KAB, HBM) that guided the research as well as new or emergent ideas expressed in the interviews. The code list was approved by team members before the textual data was uploaded to Atlas.ti software which was used to apply codes words to the text and identify reoccurring themes. The results of the preliminary analysis were transcribed into English and discussed with the research team to refine themes before writing up final conclusions. Direct quotations have been edited to improve their readability.

3. Results

Equal numbers of male and female participants (n=34) aged between 20 and 45 years were recruited. University educated (UE) Bangkok participants were expected to have been exposed to more nutrition information via advertising than those living in Ranong, non-university educated (NUE) participants. Slightly more Ranong

(n=20) than Bangkok participants (n=14) were recruited as some Ranong participants did not know enough about food labels to discuss the topic in detail.

3.1 Using Nutrition Labels

Most participants were aware of NIP labels (n=25) but less than half of them (n=10) used the labels and derived any benefit from them. In contrast, 6 participants reported that they have seen GDA, although only one person knew the Thai term "Hwan-Man-Khem label" for GDA, and none were familiar with the English term "GDA". Finally, we grouped participants by their behavioural responses to NIP (Table 1) to gain a deeper understanding of barriers impacting on the utility of labels.

Table 1. Groups of nutrition label users

Group	Users' characteristics	n
A	Competent users who were aware of nutrition labels, had correctly used them, and received benefit in everyday life	10
B	Confused users who were aware of nutrition labels, had used them, but had difficulty interpreting	9
C	Aware non-users who did not use nutrition labels	6
D	Unaware non-users who had not used nutrition labels nor received any benefit from them	9

Participants in Group A were predominantly university educated (n=8/10) and were aware of, and had correctly used, both types of nutrition labels in their everyday life. They were likely to be concerned about diet and health. For example, a well-educated, middle-aged woman in Group A was influenced enough by the cholesterol content of a pre-packaged food to alter her behaviour.

In the last few days, I went to purchase frozen food [pasta with Carbonara sauce]. When I read the label, I changed my mind [because it contained high cholesterol].

This group also contained participants without a university education who used labels because they were motivated by health concerns.

In contrast, Group B participants were aware of and had used nutrition labels but they had difficulties in interpreting them and applying the information correctly. In the interviews some participants confused the nutrition labels with other food labels or made comments like "I have read it but I did not understand it". This woman demonstrated confusion, common amongst participants, between ingredient lists and nutrition information. Nutrition labels do not list ingredients but she thought as follows:

It is this ingredient [list] label. … I have read it before. If it displayed flavour enhancer, I will not let my child eat it. (NUE, male, age 34)

Group C participants, which included both university educated and non-university educated participants, were aware of nutrition labels but did not read them for a variety of reasons including that the font is too small, or they did not see any reason for using them. They often stated that "I rarely read the labels". One university educated man explained:

I never use them. I have seen them but did not think to use them. (UE, male, age 41)

Group D contained participants who were unaware of, had not used, nor received any benefit from nutrition labels. Their reasons for not reading or using labels included that the labels contained "too much information". They also said things like: "I don't understand" or they indicated that their food preferences were more important than health consideration. As this person said "I prefer a tasty product". This 37 year old Ranong man who did not have a university education provided an interrelated set of reasons that included his own level of knowledge and lack of education which contributed to his lack of "attention":

I think that I cannot read the label because I don't understand deeply. … I didn't study [enough about it]. I looked over it and didn't pay attention to it.

3.2 Knowledge

3.2.1 Dimensions of Knowledge Affecting Awareness of Nutrition Labels

As we have already illustrated, general levels of education as well as specific nutrition knowledge contribute to participants' ability to use nutrition labels. All university educated participants were aware of NIP while those without a university education were less likely to be aware of labels. Education level is associated with literacy and numeracy skills, as well as nutrition knowledge. Highly literate participants were able to develop their skills in using nutrition labels through frequent application in everyday life. For example, this university educated

woman even demonstrated her familiarity with the history of labels when shown a package during the interview.

I see that [NIP] is available. I saw it when I turned [package] over and then I read it.… I think it [first] began to appear on dietary supplements, and then they appeared on general foods.

This highly educated man provides another example of a participant who had learned to use nutrition labels through repeated use.

I know [nutrition labels] by myself. Nobody told me. Just reading and keep reading. (UE, male, age 36)

Generally though, consumers did not engage with labels due to lack of education and nutrition knowledge which affected their understanding of, and confidence in, interpreting and using information on nutrition labels. Non-university educated participants had more difficulty in identifying the nutrition labels on real packages during the interview because they could not understand the information provided. One 32 year old non-university educated woman exemplified the many problems that people have with labels. As she so clearly illustrates, consumers not only need to understand the terminology used they also require an understanding of how label information connects to general health concepts and their own particular health needs.

I don't understand really. I don't understand and I have never learned [about nutrition labels]. I don't have knowledge regarding what total fat is. What is saturated fat? Cholesterol? Protein? Mineral? Dietary fiber? All this information [on nutrition labels]? I don't know how they benefit my body. Which is an advantage? Which is a harm? I really don't know.

3.2.2 Sources of Nutrition Label Knowledge

Participants had not received any education about nutrition labels at school or university. Instead, they gained some awareness from watching television but it was not enough to develop their knowledge or influence their use of labels as one man explained:

I know [nutrition labels] from advertisements and television media. ... I saw them but I did not pay attention. ... I saw them and I did not understand. What is percentage? I don't understand about percentage. (NUE, male, age 40)

However, participants who learned about labels via the internet tended to understand them better. The internet provides more interactivity than television allowing consumers to improve their understanding of labels over time although internet information is not always accurate and can lead to misinformation. Two participants were well-educated and familiar with the internet because they worked with computers.

I got [information about health and eating] from a website. ... The [website] said that ... information [on NIP] did not show calories per package but it actually showed calories per serving. (UE, female, age 37)

I got it [health and diet knowledge] from the internet. I often search health topics when I have free time. (NUE, female, age 37)

Other sources of information included books, health club memberships, and workshops. Many participants also reported that their workplaces provided annual health check-ups, and workshops on healthy eating but only one mentioned learning about nutrition labels.

I have known about [nutrition labels] from a public health workshop. ... My previous office sent me to learn from the public health service. ... They might want me to use it for public relation purpose [my career] and for myself." (UE, female, age 30)

3.3 Attitudes and Beliefs: Motivation vs Likelihood of Using Nutrition Labels

Negative results from an annual health checkup and medical diagnosis were often a "turning point" that changed a participant's attitude to their eating habits, which then led them to consult nutrition labels. Annual health checkups sometimes revealed problems such as high blood cholesterol, high blood sugar, and high blood pressure, which led to a recommendation from a physician to eat healthier diets. Being diagnosed with such a problem encouraged participants to use nutrition labels. For example, this nutrition label user changed his diet due to a high blood cholesterol result.

Three years before, I ate normally. I ate deep-fried food and squid. My turning point was a health check-up. Before this, my age was not too high so I did not mind [about food choice]. I was not a fat guy. After health check-up, I found that my blood cholesterol was too high. (UE, male, age 36)

Some participants also modified their attitudes and eating behaviours without a medical diagnosis when they believed that they were at risk of a diet-related health issue such as increasing age, weight gain, changing appearance, and slow body metabolism.

Recently, I begin to control my weight. After I got pregnant, my weight did not decrease even though I ate the same. ... For me, it is important because if I get diabetes, many bad effects will come to me. (UE, female, age 29,

BMI 24.84)

I look for sodium. Have I got too much [sodium]? Sometime I wonder if I've got disease [hypertension]… I try to find the cause of symptoms by reading labels and to cut out something bad for me. (NUE, female, age 37)

Other people's experiences or a family member's illness also motivated participants to change their eating behaviour. These examples show that some participants had quite high levels of awareness of diet-related health risks.

I enjoyed eating and never mind about sodium. … After my friend [who graduated in nutrition] told me, I have begun to look at [nutrition] labels. (UE, female, age 29)

Because I am afraid of illness and obesity. … They [public health service mobile unit] came to set up a booth. They have a blood check-up service, blood pressure measurement, and also giving hospital brochure. … Many food sellers went to get a check-up. Most of them have diabetes and high blood pressure. (NUE, male, age 40)

3.4 Behaviours: Consumers Choose not to Read Nutrition Labels

Some participants, like this well-educated woman did not see any need to read nutrition labels in general.

I rarely read [nutrition labels]. I think it depends on my interest. I have seen advertisements about recommended intakes of sugar and salt. I know all of that but I did not much mind it. (UE, female, 40)

This man acknowledged that nutrition labels are useful but he did not want to use them because he did not have a severe health problem.

Now, I just know it is really useful. It is useful for a person who is unhealthy. It is a way for controlling [health status]. (NUE, male, age 37)

Once participants were familiar with a food they no longer read the label which meant that they were unaware if a product changed its nutrient content.

If it is a new product, I will read the food labels only the first time [purchasing] because they do not change anything. (UE, male, age 41)

Other considerations were sometimes more important. This young non-university educated woman said "I read only the price tag and my favourite flavour". Another woman reported that she mostly bought foods that she liked saying; "I had tasted a flavour and [it was] delicious, I never read the nutrition labels"

4. Discussion

Overall, more participants were aware of NIP (n=25/34) than GDA (n=6/34) indicating that the placement of food labels is important. Those with higher levels of education or with a relevant health condition were more likely to use nutrition labels. People's low levels of literacy, numeracy and nutrition knowledge often limited their ability to correctly use nutrition labels due to complexity of information provided. Some participants chose not to use them because they did not have health problems or they put other considerations first.

Thus far, only two national studies of nutrition label use by Thai consumers have been conducted (Parinyasiri, 2010; Yodtheun, Juntarasuthi, Rochanawanitchakarn, Ratanatikaumporn, & Panprayun, 2013). In one study, the Thai FDA reported that 62.8% of respondents in their survey used NIP (Parinyasiri, 2010). This study reported 54.4% of respondents understood NIP but a later Nielsen global study found that only 27% of Thai consumers understand most information on NIP (Nielsen Consumer Research, 2012). However, it should be noted that these differences could be due the different wording used in the questionnaires. The proportion of Thai consumers who used NIP was higher than in Malaysia (46.4%) (Norazmir, Norazlanshah, Naqieyah, & Anuar, 2012) and the USA (61.6%) in 2010 (Ollberding, Wolf, & Contento, 2010).

In the only published study of Thai consumers' responses to GDA, it was found that 52.4% of respondents were able to apply information from GDA when choosing food products. (Yodtheun, Juntarasuthi, Rochanawanitchakarn, Ratanatikaumporn, & Panprayun, 2013) Respondents were not asked if they actually used GDA which suggests that usage may be lower than this figure implies. Nevertheless, it appears that Thai use of GDA may be higher than elsewhere. The proportions of the population who actually use GDA across 6 European countries were 16.8%: with UK respondents most likely to use it (27%) and French respondents least likely to (8.8%) (Klaus, Laura, Josephine, Stefan Storcksdieck genannt, & Liliya, 2010). Once again these differences may reflect different survey approaches.

However, these earlier Thai studies offer only limited insights into the reasons why consumers are not readily adopting nutrition labels. Our use of in-depth interviews has allowed us to investigate consumers' attitudes and practices more deeply than the usual design employed in other studies (Misra, 2007; Wiles, Paterson, & Meaker, 2009). The Malaysian survey asked about reasons for not using nutrition labels and showed 32.4% reported they do not understand terms on the package (Norazmir, Norazlanshah, Naqieyah, & Anuar, 2012). The use of closed

questions did not give consumers an opportunity to explain their attitudes in depth and it did not reveal that there are consumers, like our group B participants, who misunderstood or misused labels. Our approach has revealed that some people had positive attitudes to nutrition labels and commonly read them but incorrectly applied this information to their food choices. We found that consumers were often confused when shown real food labels and that others just did not want to use them even though they were knowledgeable about them.

Combining the KAB and HBM models to analyze consumers' actions reveals that use of nutrition labels requires both adequate knowledge and a corresponding belief in healthy eating. Attitudes are often motivated by a personal health issue, as explained by HBM. In line with another study (Guthrie, Fox, Cleveland, & Welsh, 1995) we found that consumers were more likely to use nutrition labels when they perceived a personal susceptibility to a diet-health problem. We therefore propose that this mixed model (Figure 1) better explains consumer responses to nutrition labels and that this understanding will contribute to more effective promotional strategies.

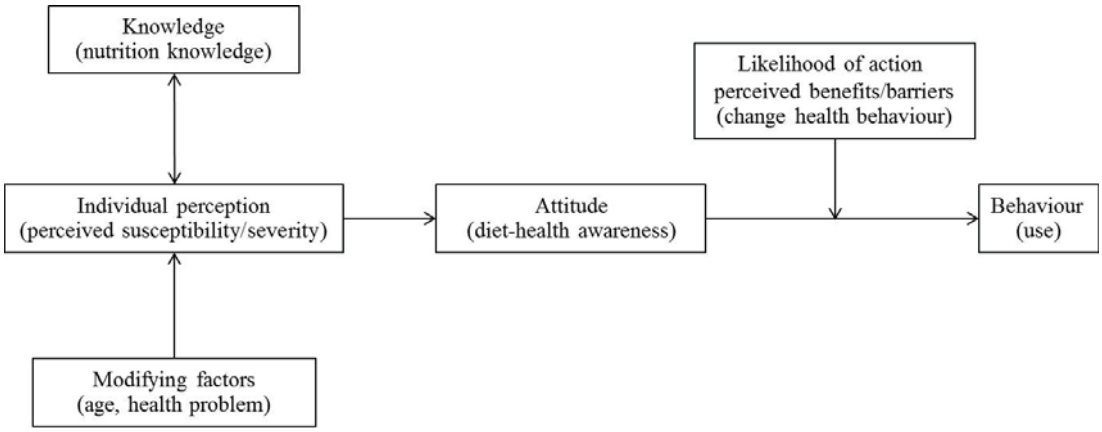

Figure 1. Knowledge-Attitude-Behaviour and Health Belief mixed model (KAB-HBM)

Most of the existing qualitative studies of nutrition labels have investigated consumers' understanding and interpretation of label information but few have explored their motivation. One study, with similar results to ours found that participants' nutrition label use and food choices were related to concerns about specific diet-related disease, general health, and physical appearance (Wahlich, Gardner, & McGowan, 2012). Our study provides additional understanding of the level of health concern which affected the likelihood of people using labels. Participants who received a diagnosis of a serious health condition from their annual health checkup began to use labels and improve their diets. Perceived susceptibility to a diet-health problem or an experience of other peoples' illnesses also encouraged label use.

Our results suggest that teaching consumers, such as the label-aware non-users (Group C), to interpret nutrition labels without changing their perceptions about eating and health concerns will not motivate them to use nutrition labels regularly. Therefore media and health promotion advertisements should also focus on changing consumer attitudes and on awakening consumer awareness of the connections between health and diet. Sources of information about interpreting nutrition labels may be provided in pamphlets, books, and also in workshops and existing sources of health information. Another avenue would be to disseminate additional nutrition and label knowledge to people who are already concerned with diet and health through groups such as those run in hospitals or special clubs for people with diabetes, hypertension, and metabolic syndrome. We also found that the location and size of GDA labels do not attract consumer attention. So in the short term advertisements (on TV or internet) about GDA should indicate where the label is located to improve consumer awareness. Over the longer term, consideration should be given to improving the position of labels to make them more prominent.

This type of research is not intended to be directly generalizable to the entire community; instead it provides an in-depth understanding of people's perceptions and practices in Thailand, which may be more widely applicable in South East Asia or other regions undergoing a rapid increase in processed, packaged food consumption. We have documented participant responses to labels on snack foods because they are the only Thai food products that are required by law to have NIP and GDP labels. However, participants' experiences with nutrition labels may also come from other foods and they may react differently to labels on more essential foods.

This study contributes to existing research on label use in Thailand by providing deeper insights into people's attitudes and it helps explain why they behave in particular ways. Categorizing nutrition label users into two

groups (users and non-users) as is common in survey research does not reflect the more complex ways people respond to nutrition labels. In addition, our findings reveal that there are consumers who do not understand labels correctly even though they read them and are therefore likely to miss out on associated health benefits or may even suffer negative health consequences. This research can inform the development of future survey research in Thailand that will provide more generalizable results and the development of health promotion strategies about labels for general consumers.

5. Conclusions

The level of education among participants informed their use of nutrition labels. Also, awareness of GDA was very low. Only one-third of participants actually benefited from nutrition labels. Our results indicate that Thai consumers need additional motivation and encouragement to make better use of nutrition labels. Different groups of label users would benefit from programs or interventions that targeted their level of awareness or knowledge. Consumers' attitudes are the key to improving their likelihood of using nutrition labels. To promote nutrition label use in the general public, the combined KAB and HBM models could be used to design short messages and heart-warming stories to motivate consumers.

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CHAPTER 5: THAI CONSUMER DIFFICULTIES AND BARRIERS UNDERSTANDING INFORMATION ON NUTRITION LABELS

Chapter 5 presents Paper 3 in the thesis. It is published by *Journal of Safety and Health (STOU)* and investigated consumer difficulties and barriers in interpreting the information on nutrition labels. Semi-structured in-depth interviews with open-ended questions were performed with 34 participants in two areas of Thailand – "urban Bangkok" (university educated consumers) and "provincial Ranong" (non-university educated consumers) – capturing a wide array of potential difficulties and barriers in interpreting nutrition labels. All participants were given real snack packages and asked to describe terms or phases on nutrition labels. They were asked to compare food choices and were encouraged to talk about their practical experience and actual difficulties in using nutrition labels. Consumer suggestions to improve nutrition labels were also noted in this paper. Results reported here help label makers understand what consumers want and how to create more consumer-friendly nutrition labels.

วารสารความปลอดภัยและสุขภาพ
ปีที่ 8 ฉบับที่ 28 ประจำเดือนเมษายน-มิถุนายน 2558

การวิจัยเชิงคุณภาพความยากลำบากและอุปสรรคต่อการเข้าใจข้อมูลฉลากโภชนาการในกลุ่มผู้บริโภคไทย

Thai Consumer Difficulties and Barriers in Understanding Nutrition Labels : A Qualitative Study

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บทคัดย่อ

วัตถุประสงค์การวิจัย

การปรับปรุงฉลากโภชนาการไทยเป็นไปได้จำกัดเนื่องจากการวิจัยความเข้าใจของผู้บริโภคไทยต่อข้อมูลฉลากโภชนาการยังมีไม่เพียงพอ งานวิจัยนี้มุ่งศึกษาความยากลำบากและอุปสรรคต่อการเข้าใจข้อมูลฉลากโภชนาการบนผลิตภัณฑ์อาหารทั้งตารางโภชนาการและแบบจีดีเอ

วิธีดำเนินการวิจัย

ทำการสัมภาษณ์เชิงลึกผู้บริโภค 34 คน ที่มีลักษณะทางสังคมและประชากรที่แตกต่างกัน ได้แก่ ระดับมหาวิทยาลัยในจังหวัดกรุงเทพฯ และต่ำกว่าระดับมหาวิทยาลัยในจังหวัดระนอง โดยบันทึกการสัมภาษณ์ทั้งแบบเสียงและวิดีโอเพื่อเก็บคำพูดท่าทาง บทสนทนาจะถูกนำไปวิเคราะห์โดยโปรแกรมเพื่อจำแนกความถี่ของคำ ข้อความ เหตุการณ์ร่วมหรือแตกต่างกัน

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ผลการวิจัย

งานวิจัยนี้พบความยากลำบากต่อการเข้าใจฉลากโภชนาการมี 4 สาเหตุหลักคือ การรับรู้น้อยเกินไป เคลือบแคลงความถูกต้องข้อมูล ความสามารถเชิงภาษาและตัวเลขน้อยเกินไป และความรู้ทางโภชนาการไม่เพียงพอ และอุปสรรคต่อการเข้าใจฉลากโภชนาการมี 5 ลักษณะคือ ความสับสนต่อฉลาก การซ้ำของคำศัพท์ ตัวอักษรขนาดเล็ก ตำแหน่งฉลากไม่เด่นชัด คำศัพท์เฉพาะทาง แม้จะเป็นปัญหาแต่การมีอยู่ของฉลากโภชนาการสามารถเพิ่มความน่าเชื่อถือของผลิตภัณฑ์ต่อผู้บริโภคได้

สรุปและข้อเสนอแนะการวิจัย

งานวิจัยนี้ได้เสนอแนะแนวทางปรับปรุงฉลากทั้งแบบตารางและจีดีเอ เพื่อการออกแบบฉลากที่ดีขึ้น ระบุแนวทางการส่งเสริมความรู้ด้านโภชนาการ เพื่อส่งเสริมผู้บริโภคสามารถเข้าใจข้อมูลฉลากโภชนาการได้ดียิ่งขึ้น

คำสำคัญ : ประเทศไทย/ฉลากโภชนาการ/ความเข้าใจ/ผู้บริโภค/ความยากลำบาก

Abstract

Background

Systematic review of nutrition labels in Thailand has not yet been attempted and there is a little information on Thai consumer understanding of existing labels. To fill this gap, we investigated Thai consumers and real food packages, identifying the difficulties and barriers consumers have with both Nutrition Information Panels (NIP) and Guideline Daily Amounts (GDA) labels.

Materials and Methods

The study employed samples of real food packages and in-depth interviews of 34 participants aged 20-45 years including urban (Bangkok) university educated consumers, and rural (Ranong) non-university educated consumers representing a wide range of socio-demographic groups. Interviews were audio and video recorded to collect verbal and non-verbal information. A qualitative data analysis program was used to help in the analysis of transcripts by searching for repeated words and codes to build themes and meanings.

Results

We identified four difficulties consumers have with nutrition labels (low awareness, suspected truthfulness of information, low literacy and numeracy, and insufficient nutrition knowledge), and five barriers (confusing labels, small font size, use of technical terms, repeated words, unobtrusive location). These problems impeded consumer use of nutrition labels. However existing nutrition labels can increase trust in a food product.

Conclusions

To improve consumer understanding of labels we suggest practical ways to amend NIP or GDA and recommend nutrition education strategies to enhance consumer knowledge. Results of this study should contribute to the design of nutrition labels that are easier for consumers to use.

Keywords : Thailand/Nutrition label/Understanding/Consumer/Difficulty

Introduction

Nutrition labels are part of an array of strategies to support healthy food choices as diet-related diseases emerge in developed and developing nations (Campos, Doxey, & Hammond, 2011). In Thailand, two types of nutrition labels appear on Thai snack packages: Nutrition Information Panels (NIP) and Guideline Daily Amounts (GDA). NIPs display a detailed list of nutrients, vitamins, and minerals on the back of packages whereas GDA is a simplified nutrition label including only four core nutrients (energy, sugar, fat, and sodium) on the front of package (Royal Thai Government Gazette, 1998, 2011). They have been developed in response to the non-communicable diseases (NCD) epidemic to provide information to consumers to assist them choose healthier foods.

Diet-related diseases are particularly important in South East Asia at present because of the rapid transition from traditional to

westernized diets which include more processed and packaged foods, associated with body size and chronic diseases (Kelly et al., 2010; Lipoeto, Geok Lin, & Angeles-Agdeppa, 2013). The Thai national examination survey in 2009 shows that average Body Mass Index (BMI) significantly increased in both men and women (aged 20 and over) when compared to 1991 (Aekplakorn et al., 2014). About twenty percent (19.1%) of children aged 2 to 14 consumed snack foods everyday while the proportion of adults age 15 to 59 years frequently eating snack foods (more than 4 times a week) increased from 3.4 to 7.9% (Ministry of Public Health, 2011).

Nutrition labels are considered to be a tool that shoppers can use to help choose healthy foods but they often experience difficulties in interpreting and understanding the labels. Studies find that consumers say they understand food labels although evaluation tests show that their comprehension is not as good as they think (Sharf et al., 2012). Others found that participants are not confident in their ability to read and understand nutrition labels (Zweig & Pilliar, 2012). In general, consumers have insufficient nutritional literacy and numeracy skills to interpret labels and consider them to be bothersome and difficult to understand (Cowburn & Stockley, 2005; Kim & Kim, 2009; Rothman et al., 2006). In 2012, a global Nielson survey revealed more than half the world's consumers had difficulty understanding nutrition labels with levels of confusion being highest in Asia Pacic countries (Nielsen consumer research, 2012).

There is a shortage of data on consumers' responses to nutrition labels in Thailand. The first local study on the topic in 2009 reported that 54.4% of respondents understood NIP (Parinyasiri, 2010). After GDA was launched, another study reported 45.8% of trained participants had a high level of understanding of the labels (Hokiarti, Siriwong, & Chulakarangka, 2012). A Thai national survey also showed 63.3% of participants understood GDA but that fewer (52.4%) were able to use the labels to choose food products (Yodtheun, Juntarasuthi, Rochanawanitchakarn, Ratanatikaumporn, & Panprayun, 2013). However, these studies did not investigate the problems and barriers consumers have with nutrition labels in any detail.

Many studies have recommended that nutrition labels be changed to improve consumers' comprehension. These studies have mainly focused on two important components of nutrition labels: design and content. Design-focused research has used eye-tracking techniques to monitor consumers' visual attention. As a result these studies recommend that visual clutter around nutrition labels should be reduced and the labels should be larger and located on the center of the package (Ares et al., 2013; Graham, Orquin, & Visschers, 2012). Most studies evaluated consumers' understanding of labels by testing them (De la Cruz-Gongora et al., 2012; Sharf et al., 2012) or asking consumers to score their level of understanding using a close-ended questionnaire (Aygen, 2012; Jacobs, de Beer, & Larney, 2011). These approaches reflect researcher pre-conceptions about problems with labels and miss the opportunity to gather data on consumer views of difficulties.

The qualitative study reported here was designed to fill this gap by identifying the difficulties and barriers consumers have in understanding the two types of nutrition labels used in Thailand: the Nutrition Information Panel (NIP) and the Guideline Daily Amounts (GDA). We analysed our results to provide recommendations for improving the use of nutrition labels by Thai consumers. These results have implications for the food industry, nutritionists, nutrition educators, related policy makers, and the general population.

Methods

Study design

Semi-structured interviews were conducted in May-July 2013 with 34 participants aged between 20 to 45 years who were almost evenly distributed over two areas, urban Bangkok and regional Ranong. These areas have contrasting socio-economic and education backgrounds (university and non-university educated) representing a wide array of potential barriers in interpreting food labels. We expected that highly educated people living in a capital city would have more opportunities to access information of nutrition labels via many types of multimedia than regional area.

Equal numbers of men and women were recruited for interview as both undertake food shopping and therefore may read labels. Bangkok participants were recruited from an ongoing Thai Cohort Study (TCS) established in 2005 to observe the health-risk transition underway in Thailand. At the time of recruitment TCS members were students enrolled at Sukhothai Thammatirat Open University (Seubsman, Yiengprugsawan, Sleigh, & the Thai Cohort Study team, 2012; Sleigh, Seubsman, Bain, & the Thai Cohort Study Team, 2008). The TCS provided an opportunity to locate and recruit educated Bangkok residents into the study. Fourteen TCS members were invited by phone to join the study. The random sample was balanced for sex and age group. The Bangkok interviews were held at an agreed venue and time to maximize participants' convenience. Ranong participants entering or exiting a Tesco Lotus store were invited to take part in the study. Individual customers were screened to exclude those who had a university education.

The overall aim was to recruit participants from a range of educational and socio-economic backgrounds and with different exposures to food advertising to cover the variety of experiences people might have in interpreting and understanding nutrition labels. Recruitment in both Bangkok and Ranong continued until data saturation was reached and little new information was gained by continued interviewing.

All participants were given an information sheet in the Thai language, asked to sign a consent form guaranteeing their privacy, and agree to both an audio and video recording. Each interview lasted around 30-45 minutes. This study protocol was approved by the Australian National University Human Research Ethics Committee (Protocol 2013/148).

Interviews

Interviews were conducted in the Thai language by a native speaker and began with questions about participant eating behaviour and frequency of using labels when purchasing foods. We provided an example of an actual pack of snack food containing more than one serving size and asked participants to identify the nutrition label, and then explain it. Then, two small snack food packages were shown to participants to test their ability to use nutrition labels to help them choose a product. These packs were equivalent to one serving size making it easier for consumers to compare the nutrient contents without having to take recommended serving size into account.

In general, food manufacturers displayed nutrition labels using different fonts and sizes. We gave participants four snack packages and asked them to discuss their preferences between the packs, difficulties in using them and any suggestions to improve nutrition labels. We also encouraged them to talk about their practical use of nutrition labels and difficulties they had.

Analysis

All interviews were transcribed into Thai language verbatim from the audio-recording and

information collected by video recording was used to conrm the verbal transcript and non-verbal cues. We also collected socio-demographic details (sex, career, household size, weight, and height). Throughout the study, we maintained an open-ended approach loosely adapted from grounded theory (Glaser & Strauss, 2009) to more deeply to investigate the barriers to interpretation. Atlas.ti software was used to manage the textual material and to easily search across data set for repeated meanings, words, and themes. Notable examples of quotations were transcribed into English and discussed with the research team before writing up final results.

Results

Study participants

Of all the provinces of Thailand, Ranong, where we selected a group of non-university education participants, is the most socially and economically different from Bangkok. It has the smallest population, few high schools, and only one large-size supermarket. To reach data saturation, more Ranong participants were recruited because they had more had difficulties in discussing nutrition labels than those from Bangkok. Overall, thirty-four participants were interviewed - 14 from Bangkok and 20 from Ranong. (Table 1)

Table 1 Participant characteristics

Participants (n=34)	
Average BMI (S.D.)	24.0 (3.7)
Age in years (S.D.)	22.8 (6.7)
Age group (%)	
20-35 years	50
36-45 years	50
Sex (%)	
Male	50
Education (%)	
Lower than university educated	59
University educated or higher	41
Career (%)	
Officer/ public servant	24
Employee /elementary worker (non-physical)	26
Professional	9
Police/soldier	6
Merchant	15
Agricultural	3
Not work/ housemaid	18

Consumer difficulties with nutrition labels

Low awareness of GDA labels

A majority of participants reported that they have not seen or were not aware of the term "GDA" or even the equivalent Thai name "Hwan-Man-Khem" before participating in this study. However, when we asked participants to compare products by using any information on package, they prefer to use GDA than NIP because they are less complex and are easier to read because of a larger font size.

It [GDA] does not show on every snack, does it? I don't know. I found back-nutrition label [NIP] on every snack pack but I have only just heard of front-label [GDA]. (male, Bangkok, aged 36)

Back-label [NIP] shows good details but front-label [GDA] is easy-to-understand information. (female, Bangkok, aged 30)

However, people who read labels often use NIP first to read because it looks obviously and is used on every package.

[I often used] back-nutrition labels. [Why?] Are front-nutrition labels more widespread? I have not seen it. (female, Bangkok, aged 41)

Suspected truthfulness of information

Participants in general did not understand the process of generating and regulating nutrition labels but most of them believed that food products get government approval. Factors can reduce trust in labels including questions about the truthfulness of information. Participants also made comments like "Information on the submitted document may be different from real products" or "[they] may declare a value less than the real [value]" or "[they] display zero sugar but I taste it [as] sweet".

If I know some organizations approve the accuracy of information on nutrition label, I will give 100% trust. I think [such endorsement] may available but I am not sure. (female, Bangkok, aged 37)

Some participants were more likely to trust products that displayed nutrition labels than non-labeled products irrespective of the content of the labels. Nutrition labels were seen by consumers as a type of product disclosure information that influenced their buying decision. Both Bangkok and Ranong participants were interested about product disclosure.

The level of prominence given to nutrition labels can reflect something. ... It says how much the food producer cares for their customers. ... If they care, they will be pleased to disclose information to consumers and let us decide by ourselves, and it suggests they can be trusted. [Those] who avoid being noticed [are] suspicious. (female, Bangkok, aged 40)

I do not trust products without a nutrition label. ... Whether it [nutrient value] is truthful or not but at least they try to show a nutrition label to me. (female, Ranong, aged 37)

Misinterpretation due to low literacy and numeracy

Frequently problems occurred when participants interpreted "serving size" and "RDI". The statement "serving size: 1/3 package (30 g), servings per package: 2.5" that is displayed on existing large packs (more than 1 serving) of snack food was shown to participants (Figure 1). Many participants reported that they did not understand this statement and it was often misinterpreted by non-university educated participants because the written statements were examined first which influenced the interpretation of the quantitative information.

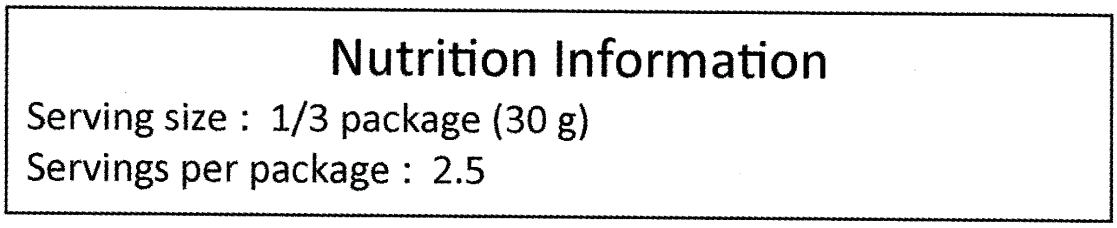

Figure 1 Serving size and servings per package on Nutrition Information Panel (NIP)

For example, the statement "1/3 package (30 g)" was misinterpreted in two ways; 1) the entire package contain 30 g of snack. "One package contain 30 gram, then one-third is equal to 10 grams" or 2) one-third of others such as "filled 1/3 of package". A Bangkok woman wanted more clarity about the meaning of statement.

I should have only 1/3 of package. I never read this before. Umm. I want to know that 1/3 is for one day or other meaning. (female, Bangkok, aged 29)

Also for "serving per package: 2.5", some participants reported that it should type 'unit' after number 2.5. Some other participants may misunderstand that 2.5 means "2 and half days" or "2.5 times in one day".

I don't understand. What? [if it was 3 instead, you will get better understand?] ... Equal 3. What is 3? Isn't it? It does not show that 3 package or 3 calories. ... [It] stand-alone without any unit. (male, Bangkok, aged 26)

Participants often reported difficulties when they interpreted "%" on NIP. Many participants thought %RDI meant what are the nutrients in the food product or how high or low are nutrients from the food ingredients rather than how high or low are nutrient compared to recommended daily intake.

[Difficulties] mostly happened with '%' such as 4%, 5%, and others like this. If they are children, [I think] they will understand only it contains vitamin, protein, and fat but not for actual amount of nutrients. (female, Ranong, aged 28)

This entire package contain 12% of fat. (male, Ranong, aged 34)

Participants may think that it is the recommend amount they should eat 'not exceed' rather than nutrient-containing declaration of product.

[The %RDI value of fat] is 12% and it comes from 100, does it not? From 100, we should have not more than 12. (male, Bangkok, aged 41)

Lack of diet-health relationship knowledge

Lack of nutrition knowledge in some participants contributed to their misuse of labels. Even if participants can compare the value of nutrients, they may not be able to apply this information to their own health situation.

I will choose this snack. I select by energy value because this contains higher levels. ... It is better because it contains more potatoes. ... It gives us energy. (male, Ranong, aged 37)

How I can say? I think these [nutrition] labels tell only benefits. It does not show bad things. I want something said how much we consume and then [adverse] effect to our health. (female, Ranong, aged 24)

Consumer barriers to understand nutrition labels

Confusion between types of food labels

Many participants were confused by the different food labels displayed on packages. Though they were likely to describe themselves as nutrition label users, open-ended interviews revealed that they mixed up the ingredient lists on foods dis-

playing a quantitative ingredient declaration (QUID) with the similar NIP. Participants reported that the "nutrition label is [the] ingredient list label" and they looked for a list of ingredients on nutrition labels which aim to encourage heathy eating through a statement about nutrient or substances content (Codex Committee on Food Labelling, 2013) rather than specic ingredients. Examples from these two non-university educated participants misused nutrition labels:

I read [nutrition labels] for how much fat content? [How much] of ingredients like sugar? salt? flavour enhancer? (female, Ranong, aged 43)

I have read [nutrition labels] before. If it contains flavour enhancer, I will not let my child eat it. (male, Ranong, aged 34)

Font size

User and non-user participants reported similar difficulties reading NIP especially on small food packages. Small packages usually use too small a font size to display a range of information making it difficult for consumers to identify and read the nutrition labels.

I never read it. It is so fussy. Crowded with a lot of unknown [terms] with small font size. (female, Bangkok, aged 40)

Small NIP can made people feel bothered. Discouraged to read it. There are too many [words]. (female, Ranong, aged 23)

[GDA] is easier. It is better. For this [NIP], contain too much detail. We purchase food to eat-just 5 baht or 10 baht; nobody wastes time to read them. (female, Ranong, aged 37)

Although GDA font size is obviously bigger than the font size of NIP, most participants still complained that some packages displayed GDA labels with small fonts which are hard to read. "It should be a bigger font than this. ... This [second sample] is also too small. I sometimes need to peer at it." "I want a big font so that some older people will [be comfortable to] read it when they decide to give snacks to children" One male participant made a useful suggestion to make the label more noticeable.

I know but I rarely use it because the font is too small on every nutrition label. ... I think the presenter's picture on packages looks more outstanding. If we limit the size of the presenter's picture and make labels [GDA] bigger and more obvious, we can see it. I think they [food producers] don't want to tell us the nutrient amount. They just have [nutrition label] by law. (male, Bangkok, aged 32)

Technical terms

Most participants understand the terms 'carbohydrate', 'protein' and 'fat' but only a few participants are familiar with the term 'sodium'. Participants had difficulty answering when we asked them about sodium in food. Participants often said "I have heard the term but I don't know what it is" or "Too much is not good". A few participants knew that sodium is a major component in salt.

I don't know that [elderly should avoid high sodium food]. I know that everyone should eat less sodium but I don't know the in-depth reason. I just know that it is not good. Don't eat it too much. (female, Bangkok, aged 40)

Word repetition on NIP

Repeated words on nutrition labels, especially NIP, can confuse participants about the right location of required information. Some technical terms can be repeated up to 3 times within the NIP itself. For example, the word "fat" confusingly appears on the Thai nutrition information panel three times: in the nutrient declaration, in the reference to recommended daily intakes (RDI), and in the footnote of nutrient calories (Figure 2). For example, when we asked a 32 year-old women

from Ranong how much fat intake was recommended for healthy people in one day, based on the displayed RDI reference (Figure 2b), she became confused by the footnote below the nutrition label Figure 2c.

I can find [recommended value] but I am still confused. To find the RDI of fat, I see these show that fat=9, protein=4, and carbohydrate=4, then I [became] confused with this statement '50% reduced fat from original recipe'. ... I thought that RDI of fat possibly is 9.

Many participants did not know what the RDI meant even though it was displayed and explained on nutrition labels. After we asked participants about their understanding of values on the nutrient declaration (Figure 2a) which is the information designed to assist in choosing or comparing foods, it became clear that many participants misinterpreted them as we will show later.

a) Nutrient declaration

	% RDI*
Total Fat 8 g	12%

b) References of Recommended Daily Intake (RDI)

The energy demand for individual may be different. The person whose energy demand of 2,000 kcal/day shall receive nutrients as follows :

Total Fat	Less than	65 g

c) Footnote of nutrient calories

Energy (kcal) per gram : Fat = 9 : Protein = 4 : Carbohydrate = 4

Figure 2 Repeated words in Nutrition Information Panel

Unobtrusive label location

Many participants reported that they rarely see GDA labels due to their location at the corner of packages. GDA labels are hidden when packages are placed on the shelf or held in the hand. This problem was often reported in relation to flexible pillow bag packages. Participants complained about location of GDA as follows.

I never use it. Just saw on some brands. It is quite difficult to see when it [pillow bag package] stands up. If it [food package] is a box, and nothing overlays it or covers up, it can be possible to see [GDA]. (female, Bangkok, aged 29)

This GDA labels is close to the corner of [snack] bags. I think that it difficult to see because it is on the corner. In contrast, on another package,

with a bit higher position of GDA labels, you can obviously see. (female, Bangkok, aged 37)

Discussion and implications

This in-depth qualitative study concerning the interpretation of nutrition labels is the first to be conducted since labels were introduced to Thailand. Previous studies showed that a little over half of the Thai consumers surveyed correctly understood the information on nutrition labels (Kumsri, Juntarasuthi, Rochanawanitchakarn, Yodtheun, & Ratanatikumpon, 2013; Parinyasiri, 2010). The previous studies did not seek an in-depth understanding of the difficulties and barriers that Thai consumers have with nutrition labels. In this study, we included a variety of participants by age, sex, education, and residence, demographically aiming to get a broad insight into the problems people have with understanding nutrition labels.

Many factors that affected nutrition knowledge and use of nutrition labels have been reported elsewhere. Age is associated with nutrition knowledge and understanding of labels in both positive and negative ways. For example, older people have more interest in a healthy diet but less nutrition knowledge and are less likely to read labels closely (Drichoutis & Rodolfo M. Nayga, 2006; Grunert, Wills, & Fernndez-Celemn, 2010; Levings, Maalouf, Tong, & Cogswell, 2015). Gender and socio-economic status are also associated with knowledge. For example, women and high socio-economic status scored better on nutrition knowledge questions (Bogue, Coleman, & Sorenson, 2005). Education and demographic factors also affected the ability to read labels and have nutrition knowledge. For example, a study of 537 undergraduate students revealed they had more exposure to nutrition education than graduate students who included a large group of internationals who may have had limited exposure to nutrition education (Misra, 2007).

In this study, we found that participants had numerous difficulties understanding and responding to labels because of the ways in which they were displayed and the types of information provided on them. Participants did not understand differences between nutrition labels and food labels and were often confused by their similar appearance. Participants had difficulty finding factually correct information on labels that was relevant to their needs. This is partially due to the large amount of information displayed in a small area. Research shows that consumers' attention to any single component of a label declines as the number of components on a label increases (Graham et al., 2012). Furthermore, the information overload on labels deters many consumers from reading them at all (Spink, Singh, & Singh, 2011). This confusing, visual clutter should be reduced (Visschers, Hess, & Siegrist, 2010). Key components, like nutrient information, could be highlighted by using a bold font (Silver & Braun, 1993) while health promotion education should emphasize that the role of nutrition labels is to supply recommended daily intake values.

The study identified several visual barriers. Participants complained about small font size on food packages. In general consumers do not read labels mainly because of small print (Jacobs et al., 2011). Many studies have recommended that minimum font sizes should be around 10 to 12 point size (Mercer et al., 2013). The small font sizes of NIP causes problems in particular for older consumers, and will be an increasing problem as the population ages. Although GDA is easy for consumers to understand, it is usually difficult to see because it is often displayed on bottom corner area of package where consumer difficult to see at first glance. Some type of packaging, such as the flexible pillow bag packages, tend to obscure information located at the bottom of the package. GDA labels should be moved to a higher location on the package where they will be easily visible

as research suggests consumers will spend more time looking at them (Graham & Jeffery, 2011).

Nutrition labels could be improved by reducing visual clutter of NIP, regulating the minimum font size for both NIP and GDA, and displaying them on a prominent location on packages. However, we are concerned that changes to nutrition label laws might adversely affect international trade. To reduce unnecessary trade barriers, any changes should be based on scientific evidence, and should follow the Codex international guidelines on nutrition labelling.

Supplementary nutrition education strategies can reduce barriers and also enhance consumer ability to read and understand labels. Many participants lacked basic knowledge about nutritional terms such as 'sodium'. They knew that food containing high levels of sodium is bad for their health but few participants were aware of the foods containing sodium. Another study also reported that few participants understood the relationship between sodium and health risks (McLean & Hoek, 2014). In general, non-university educated participants were more familiar with the term 'salt' than 'sodium chloride' and 'flavour enhancer' than 'monosodium glutamate'. Another example is the term 'energy' that consumers evaluated as either good or bad for their heath. Participants were confused by information about serving sizes and the use of percentages was difficult to interpret for many lower educated participants.

In a population where many people still have limited education, additional information and training is required for consumers to be able to understand the technical information on food labels. Nutrition labelling was introduced after most of participants graduated from school and these people will be part of an ageing population in the future. The supplementary promotion of nutrition labels should be aimed at this demographic group who are more likely to perceive the benefit of nutrition labels as they age. GDA is able to be better understood by uneducated users but an advertisement campaign is needed to improve consumers' knowledge and awareness (Rimpeekool et al., 2016).

Beyond barriers and difficulties in interpretation, most participants were positive about nutrition labels because they provided nutrient information, and contributed to the trustworthiness of food. However, it may be that processed and packaged food producers benefit from the general trust in products displaying food labels while at the same time obscuring and complicating information that consumers need to make healthy food choices.

Limitations of this study

This study has a number of limitations requiring consideration. First, the quantitative results are not intended to be statistically generalized to the whole population. Instead we aimed to explore evidence and qualitatively deepen understanding of Thai consumer difficulties and barriers with nutrition labels. Secondly, studies containing small participant numbers are often deemed to have lower reliability compared to large quantitative studies. However, this study enabled researchers to investigate verbal and body language and reactions to real food packages in a way that large, questionnaire based studies could not. We consider that our findings will be transferable to similar groups in the Thai population.

Conclusion

Many difficulties and barriers with nutrition labels were identified in this study and some could be overcome through the better design of labels and by supplementary promotion strategies. This in-depth qualitative study revealed that barriers in

understanding nutrition labels included: 1) a confusing variety of food labels, 2) small font sizes, 3) confusing repetition of terms, 4) technical terminology, and 5) unobtrusive locations of GDA labels. Many people also misunderstood or misinterpreted the information on labels because of: 1) low awareness, 2) distrust of the information, 3) low literacy and numeracy, and 4) insufficient nutrition knowledge. If nutrition labels are to have a positive impact on Thai consumer ability to make healthy food choices the problems with the display and information provided on the labels should be addressed. Health promotion campaigns could provide consumers with the knowledge needed to interpret and understand nutrition labels. Without these strategies in place, food labels are unlikely to be an efficient tool to deal with the increasing prevalence of chronic non-communicable diseases in the future.

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CHAPTER 6: NUTRITION LABELLING, SOCIO-DEMOGRAPHIC FACTORS AND FOOD INTAKE AMONG THAIS

Chapter 6 presents Paper 4 in the thesis. It is published by *British Food Journal* and analysed the associations among socio-demographic factors, nutrition label experiences, and food consumption. This paper used data from the overarching Thai Cohort Study (TCS) survey that began in 2005 to investigate the health-risk transition in Thailand. At the 2013 TCS follow-up, contact was made with 42,750 distance learning Open University adults aged 23 to 96 years residing nationwide. Information was gathered on nutrition label experiences (read, understand, and use), socio-demographic factors (sex, age, location, region, religion, household size, education, occupation, and monthly income), and consumption frequency of four indicator foods (instant food, carbonated soft drinks, sweet drinks, and milk). Results describe the different likelihoods of nutrition label experiences (read, understand, and use) in different socio-demographic groups. They also document the good impact of nutrition labels on better eating choices. The results are helpful to nutrition label policy makers who are devising education programs for people with few nutrition label experiences.

Nutrition label experience and consumption of transitional foods among a nationwide cohort of 42,750 Thai adults

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Abstract

Purpose – The purpose of this paper is to assess the usefulness of nutrition labels in Thailand during nutrition transition from traditional to modern diets that increase salt, sugar, and calorie intake and to note socio-demographic interactions and associations with consumption of transitional processed foods.

Design/methodology/approach – The authors studied 42,750 distance learning Open University adults aged 23-96 years in 2013 residing nationwide and participating in an ongoing community-based prospective cohort study. The authors used multivariable logistic regression to relate nutrition label experiences ("read", "good understand", "frequent use"), socio-demographic factors, and consumption of four transitional foods. These foods included "unhealthy" instant foods, carbonated soft drinks, and sweet drinks, or "healthy" milk.

Findings – Overall, two-thirds reported good understanding and frequent use of nutrition labels. Unhealthy transition-indicator processed foods were frequently consumed: instant foods (7 per cent), (carbonated) soft drinks (15 per cent), and sweet drinks (41 per cent). Frequent users of nutrition labels (e.g. females, older persons, professionals) were less likely to consume unhealthy indicator foods. Those with the most positive overall nutrition label experience ("read" + "good understanding" + "frequent use") had the best indicator food profiles: instant foods (odds ratio (OR) 0.63; 95%CI, 0.56-0.70); soft drinks (OR 0.56; 95%CI, 0.52-0.61); sweet drinks (OR 0.79; 95%CI, 0.74-0.85); milk (OR 1.87; 95%CI, 1.74-2.00).

Originality/value – Knowledge protected – those with most nutrition label experience were least likely to consume unhealthy foods. Results support government regulated nutrition labels,

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expanding to include sweet drinks. The study is remarkable for its large size and nationwide footprint. Study subjects were educated, represent Thais of the future, and show high awareness of transition-indicator foods.

Keywords Thailand, Processed foods, Nutrition label, Nutrition transition, Socio-demographic

Paper type Research paper

Introduction

Rapidly modernizing traditional societies have diets that are changing from low fat cereal-based agrarian foods to industrial processed foods, high in sodium and sugar (Kosulwat, 2002; Popkin, 1993). This "nutrition transition" creates prominent risks for increasing burdens of non-communicable diseases (NCDs) (Anderson, 2014; He and MacGregor, 2008; Karppanen and Mervaala, 2006; Lim *et al.*, 2014; Popkin, 2015). Nutrient-related risks are important for diabetes, obesity, hypertension, ischaemic heart disease, and stroke. In addition, sugar and salt are often hidden ingredients in industrial processed foods that are neither sweet nor salty. Nutrition labels are promoted by governments to increase public knowledge of calorie and nutrient intakes (Codex Alimentarius Commission, 2001; Rimpeekool *et al.*, 2015c). Therefore, it is important that health agencies monitor the impact of nutrition labels on food intake behaviour to provide evidence for strategies to promote healthy eating.

In Thailand, a leading South East Asian country with a middle income economy, the nutrition transition is quite advanced and NCDs are now the largest cause (71 per cent) of Thai mortality (World Health Organization, 2014). Accompanying trends show rising consumption of industrial processed foods high in sugar, calories, or sodium (Monteiro *et al.*, 2010, 2011). Indeed, 20 per cent of Thai sodium consumption comes from processed foods such as instant noodles (Supornsilaphachai, 2013). Sugar sweetened beverages have been linked to longitudinal weight gain in Thailand (Lim *et al.*, 2014) and are contributing to growing problems with obesity and diabetes (Popkin *et al.*, 2012). Sugar consumption per person per year has tripled from 12.7 kg in 1983 to 36.6 kg in 2011 (Ministry of Public Health, 2013); sugar and salt consumption in Thailand now double the recommended intakes (Ministry of Public Health, 2011).

In other countries, the impact of nutrition labels on consumers has been related to socio-demographic factors including sex, age, and education (Campos *et al.*, 2011; Drichoutis *et al.*, 2006; Ranilović and Barić, 2011; Satia *et al.*, 2005). Since 1998, the Thai Government has used nutrition labels as a tool to promote healthy diets among the population (Royal Thai Government Gazette, 1998). But in Thailand we know little about label effects or related socio-demographic factors associated with behavioural outcomes including geographic location, region, income, occupation, religion, and household size. Processed foods targeted for labelling are sold "prepackaged" and often "ready-to-eat". Regulations first required nutrition information panels (NIPs) and later added guideline daily amounts (GDAs). In Thailand, NIPs and GDAs are mandated only for specific food products, rather than all. Both were created to respond to consumer concerns about nutrients in pre-packaged foods, especially sugar, fat, and sodium. NIPs and GDAs are now widespread in the Thai food market. In 2013, many "ready-to-eat" foods displayed NIPs (75 per cent) and GDAs (33 per cent) and now the percentages have increased further (Kumsri *et al.*, 2013). In 2015, another government survey found that 46 per cent of sweet drinks (coffee, tea, and herbal drinks), 81 per cent of carbonated soft drinks, 66 per cent of instant foods, and 90 per cent of milk and milk products displayed nutrition labels (Pong-Utta *et al.*, 2016). In 2016, instant foods were obligated to have nutrition labelling (Royal Thai Government Gazette, 2016b).

Some foods associated with the nutrition transition have become a focus of labelling because they are vectors of excess salt and sugar (Baker and Friel, 2014). For example, instant noodles are the most popular high-sodium pre-packaged food (Sinawat *et al.*, 2009). Also nutritionally unhealthy are (carbonated) "soft drinks" and "sweet drinks" with added sugar (categorically separate in Thai) such as iced tea and herb drinks (Lim *et al.*, 2014). In contrast, Thais view milk as healthy transitional food and promote it at school (Smitasiri and Chotiboriboon, 2003).

Milk is minimally processed and at least nutritionally "neutral" and may actually protect against diabetes (Tong *et al.*, 2011). The association between nutrition label experience and consumption of such transition-indicator foods – three unhealthy and one healthy – would shed light on utility of the labels but has never been investigated in Thailand.

To address this knowledge gap we studied nutrition labels and transitional foods in a large nationwide cohort that is part of our ongoing health-risk (and nutrition) transition research in Thailand. That research is focussed on emerging NCD as incomes rise, mother-child mortality falls, and nutrition transition proceeds (Sleigh *et al.*, 2008). Here we report Thai nutrition label experience (reading, understanding, and using labels) and associations with the nutrition transition as represented by the four transition-indicator foods.

Methods

This research on nutrition label experience is a sub-study within an overarching Thai cohort study (TCS) that has been described elsewhere (Seubsman *et al.*, 2011, 2012; Sleigh *et al.*, 2008). The TCS eight year follow-up proceeded throughout 2013 gathering repeat data on many original socio-demographic, health and behaviour variables, and including new questions about nutrition labels. Here we analyse the new data on "reading", "understanding", and "use" of the labels, crosslinking with other cohort data on personal socio-demographic attributes and transitional food consumption.

Study population and data collection

The members of TCS were 87,151 home-based distance learning Sukhothai Thammathirat Open University (STOU) students residing all over Thailand. Generally cohort members displayed considerable variation of socio-economic status, lifestyle, personal behaviours, and were similar to the profile of their community. In 2005, they responded to the baseline questionnaire, representing well the Thai population for sex ratio, median age, religion, ethnicity, regional distribution, and median income (Sleigh *et al.*, 2008). Also, TCS represented well the distance learning student body studying at STOU in 2005 (Seubsman *et al.*, 2012). In 2005, when the Open University cohort began, the prior education level of cohort members was junior high school (4 per cent), high school (45 per cent), diploma/certificate (27 per cent), and university degree (24 per cent). In 2005, TCS members had completed more education than the general Thai population (grade 9: 100 per cent vs 43 per cent; grade 6: both 100 per cent).

Among TCS members, 60,569 (70 per cent) responded at the four year follow up in 2009 and 42,785 (71 per cent) at the eight year follow up in 2013. For each survey (baseline, four and eight year) a questionnaire was developed and pretested with small groups of on-campus STOU students. Whenever possible, standard validated questions were used. The baseline questionnaire (20-pages) collected socio-demographic, cultural, environmental, behavioural, dietary, and health information; the four and eight year questionnaires were shorter (ten pages) and made repeat observations on changeable variables and added new questions according to current research topics.

In 2013, the eight year follow-up was conducted and included new questions on nutrition labelling as well as diet indicators (see indicator foods section). We also recorded repeat data for age, sex, geographic location, urbanization, household size, education, occupation, and income. After excluding monks and prisoners ($n = 35$), who cannot go shopping, 42,750 TCS members remained for analysis.

Study measures and definitions

Socio-demographic factors. In 2013, respondents fell into three age groups: 23-34, 35-49, and $\geqslant 50$ years. We noted location of residence (urban or rural), region (six categories), the

number of people in the household, and income categories. Participants were studying at university in 2005 and had completed years 9-12 of high school. Occupation was elicited by the question "Which of the following best describes your primary occupation?" Most of those not responding to this question were not in paid employment or had retired. Information on religion (Buddhist, Muslim, Christian, and other/none) was obtained from the baseline survey in 2005.

Nutrition labels. Four questions on nutrition labels were included in the 2013 follow-up questionnaire. The first three questions focussed on key label experiences ("read", "understand", "use" – see below). In the fourth question we asked "Would you like to see additional nutrition labels on food products?" (yes/no).

Read "Have you ever seen nutrition labels on food products?" Responses were "seen and read", "seen not read", and "unaware". Responses were dichotomized, contrasting the first experience category ("read") with the last two experience categories (combined as "not read").

Understand "How well do you understand the information presented on nutrition labels?" Possible responses included "understand fully", "understand most information", "understand some information", "do not understand information but I know it has potential", and "do not understand information or its potential". The first two responses were collapsed into "good understanding" and the other three responses into "not good understanding".

Use "How often do you use information from nutrition labels on food products to assist your food purchasing decision?" Possible responses included "every time I shop", "often", "sometimes", "seldom", and "never". The responses were combined so that "every time" and "often" became "frequent use" and other responses as "infrequent use".

For analysis, responses to the questions on read, understand, and use were dichotomized into coherent binary variables. This balanced cell numbers and facilitated interpretation of the results. It also enabled use of logistic regressions which were easily adjusted for covariants.

Indicator foods. Focussed on the nutrition transition, diet was assessed using a simplified food frequency instrument developed (in Thai) for four indicator foods – "instant foods", "soft drinks", "sweet drinks", and "milk". Examples given for instant foods were instant noodles, for soft drinks were coke and pepsi, for sweet drinks were green tea, iced coffee, and herbal drinks, and for milk were fresh, UHT, or powder milk. These four indicator foods were adapted from food items investigated in recent Thai national food consumption surveys (1995, 2003, 2009) (Aekplakorn and Steannoppakao, 2011). They also are prominent in a recent analysis of processed foods and nutrition transition in Asia (Baker and Friel, 2014). The first three indicator foods studied were considered nutritionally unhealthy because of high sodium (instant foods which are likely to be noodles) or high sugar (soft drinks or sweet drinks). The fourth indicator food was considered nutritionally healthy (milk). For each food respondents were asked: "On average how often do you consume the following types of food?" Responses scaled from "never or less than monthly", "1-3 times/month", "1-2 times/week", "3-6 times/week", and "daily or more". For analysis, "frequent" consumption was coded for those who ate the food three or more times/week, and others were categorized as "not frequent".

Statistical analysis

Completed questionnaires returned by mail ($N = 42{,}785$) were scanned and digitized using Thai Scandevet software. Further editing used SQL and SPSS software. For analysis we used Stata v14. Individuals with missing data were excluded from analyses. We also excluded respondents from households with more than 15 people, as they may have been living in institutions (barracks, temples, prisons). We classified occupations into six

groups: professional, managers, office assistants, workers, not working or retired, and unidentified occupation.

We calculated frequencies and proportions for all categorical variables (Table I) and means and standard deviations (SDs) for age (in the text). Categorical variables included socio-demographic attributes, label experience variables (read, understand, and use), and indicator food intakes (instant foods, soft drink, sweet drink, milk).

We constructed multivariable logistic regression models showing the independent effects of the mutually adjusted socio-demographic variables. The dependent variables were the label experiences (three outcomes – Table II) and the indicator food intakes (four outcomes – Table III). Correlation coefficients among independent variables

Attributes	n[a]	%[b]	Attributes	n[a]	%[b]
Sex			*Household size (people)*		
Male	19,295	45.1	1	2,513	6.0
Female	23,455	54.9	2-4	26,306	62.4
Age group (years)			5-15	13,350	31.7
23-34	12,127	28.4	*Education*		
35-49	23,984	56.1	Non university	8,603	20.2
⩾50	6,639	15.5	University	33,925	79.8
Location			*Occupation*		
Rural	18,913	44.7	Worker	8,044	18.9
Urban	23,434	55.3	Manager	6,023	14.2
Region			Professional	11,228	26.4
Central-East	13,107	30.7	Office assistant	13,068	30.8
Bangkok	6,741	15.8	Not working/retired	2,757	6.49
North	8,580	20.1	Unidentified	1,370	3.22
Northeast	8,954	21.0	*Monthly income (baht)*		
South	5,368	12.6	< 10,000	9,378	22.2
Religion[c]			10,001-20,000	15,831	37.4
Buddhist	40,293	94.6	20,001-30,000	9,234	21.8
Muslim	1,491	3.5	> 30,000	7,853	18.6
Christian	746	1.8			
Other/none	72	0.2			

Nutrition label outcomes	n[a]	%[b]
Nutrition labels on food?	37,914	89.0
Read	4,708	11.1
Not read		
Understand the information on "nutrition labels"	29,452	69.5
Good	12,917	30.5
Not good		
Use nutrition labels to assist food purchasing?		
Frequent use	27,457	64.4
Infrequent use	15,173	35.6
Like to see additional nutrition labelling on foods?		
Yes	40,296	96.4
No	418	1.0
Not sure	1,076	2.6

Frequent consumption of indicator foods (⩾3 times/week)	n[a]	%[b]
Instant foods	2,966	7.0
Soft drinks	6,169	14.6
Sweet drinks	17,277	40.7
Milk	19,307	45.5

Notes: $n = 42{,}750$. [a]Sample size may not add to 42,750 due to missing data (0.3-1.1 per cent of variables had missing values); [b]some percentages may not equal 100 due to rounding; [c]information on religion obtained from the 2005 TCS baseline survey

Table I. Socio-demographic attributes, nutrition label outcomes and indicator food intakes of Thai cohort in 2013

Socio-demographic characteristics	Nutrition label experience (OR, 95%CI) Read	Good understanding	Frequent use
Sex			
Male	1.0	1.0	1.0
Female	1.79 (1.68-1.92)***	1.01 (0.97-1.06)	1.65 (1.58-1.73)***
Age group (years)			
23-34	1.0	1.0	1.0
35-49	1.19 (1.11-1.28)***	1.17 (1.12-1.23)***	1.22 (1.16-1.28)***
⩾50	1.19 (1.07-1.32)**	1.57 (1.45-1.69)***	1.39 (1.29-1.49)***
Location			
Rural	1.0	1.0	1.0
Urban	0.86 (0.81-0.93)***	0.89 (0.85-0.93)***	0.97 (0.93-1.02)
Region			
Central-East	1.0	1.0	1.0
Bangkok	0.91 (0.83-1.00)*	0.88 (0.82-0.94)***	0.92 (0.86-0.98)*
North	1.20 (1.10-1.32)***	1.20 (1.12-1.27)***	1.31 (1.23-1.39)***
Northeast	1.14 (1.04-1.25)**	1.12 (1.05-1.19)***	1.24 (1.17-1.32)***
South	1.25 (1.11-1.40)***	1.20 (1.11-1.29)***	1.21 (1.13-1.31)***
Religion			
Buddhist	1.0	1.0	1.0
Muslim	1.09 (0.90-1.32)	1.04 (0.92-1.18)	1.15 (1.02-1.30)*
Christian	0.84 (0.67-1.05)	1.09 (0.92-1.28)	0.98 (0.83-1.14)
Other/no religion	1.12 (0.53-2.35)	1.26 (0.74-2.14)	0.74 (0.46-1.20)
Household size (people)			
1	1.0	1.0	1.0
2-4	0.95 (0.84-1.09)	1.02 (0.93-1.12)	0.94 (0.86-1.03)
5-15	0.97 (0.84-1.11)	1.01 (0.91-1.11)	1.00 (0.91-1.09)
Education			
Non university	1.0	1.0	1.0
University	1.05 (0.97-1.14)	1.14 (1.08-1.21)***	0.96 (0.91-1.02)
Occupation			
Worker	1.0	1.0	1.0
Manager	0.98 (0.87-1.09)	1.17 (1.08-1.26)***	1.08 (1.00-1.17)*
Professional	1.10 (1.00-1.23)	1.30 (1.21-1.40)***	1.17 (1.09-1.25)***
Office assistant	0.92 (0.84-1.01)	0.93 (0.88-0.99)*	0.99 (0.93-1.05)
Not working/retired	1.16 (0.99-1.35)	1.08 (0.97-1.19)	1.08 (0.98-1.19)
Unidentified	1.09 (0.89-1.32)	1.16 (1.02-1.33)*	1.26 (1.11-1.43)***
Monthly income (baht)			
< 10,000	1.0	1.0	1.0
10,001-20,000	1.01 (0.92-1.10)	0.98 (0.92-1.04)	0.98 (0.92-1.04)
20,001-30,000	1.02 (0.92-1.13)	1.07 (1.00-1.15)	1.00 (0.93-1.07)
> 30,000	1.05 (0.94-1.18)	1.17 (1.08-1.27)***	1.01 (0.93-1.09)

Notes: $n = 42{,}750$. Models are adjusted for all socio-demographic characteristic. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table II.
Multivariable logistic regression associating socio-demographic characteristics with nutrition label experience

were calculated and were less than 0.6. For each of the seven models, odds ratios (ORs) and 95 per cent confidence intervals were estimated for the socio-demographic factors.

Finally, we estimated associations between label experience variables and consumption of the four indicator foods (four models – Table IV). To do this, we used the three label experiences (read, understanding, use) to produce a combined Code (1-5) as follows: (1) "not read" (regardless

Socio-demographic characteristics	Frequent consumption (⩾3 times/week) Instant food	Soft drink	Sweet drink	Milk
Sex				
Male	1.0	1.0	1.0	1.0
Female	0.68 (0.63-0.74)***	0.62 (0.59-0.66)***	0.79 (0.76-0.83)***	1.67 (1.60-1.74)***
Age group (years)				
23-34	1.0	1.0	1.0	1.0
35-49	0.63 (0.58-0.68)***	0.55 (0.51-0.58)***	0.83 (0.79-0.87)***	0.75 (0.72-0.79)***
⩾50	0.29 (0.24-0.34)***	0.28 (0.25-0.31)***	0.52 (0.49-0.56)***	0.72 (0.67-0.77)***
Location				
Rural	1.0	1.0	1.0	1.0
Urban	1.11 (1.02-1.21)*	1.27 (1.20-1.36)***	1.19 (1.13-1.24)***	1.00 (0.96-1.05)
Region				
Central-East	1.0	1.0	1.0	1.0
Bangkok	0.98 (0.86-1.11)	1.00 (0.92-1.09)	1.15 (1.08-1.22)***	0.99 (0.93-1.06)
North	1.17 (1.05-1.30)**	0.45 (0.41-0.49)***	0.82 (0.77-0.87)***	1.09 (1.03-1.15)**
Northeast	1.21 (1.09-1.35)***	0.82 (0.76-0.89)***	0.87 (0.82-0.92)***	1.05 (0.99-1.11)
South	0.77 (0.66-0.90)**	0.30 (0.26-0.34)***	0.79 (0.73-0.85)***	0.94 (0.88-1.01)
Religion				
Buddhist	1.0	1.0	1.0	1.0
Muslim	1.33 (1.07-1.64)**	0.82 (0.67-1.00)	1.07 (0.95-1.20)	1.17 (1.04-1.32)**
Christian	1.26 (0.97-1.66)	1.03 (0.83-1.28)	0.92 (0.79-1.08)	0.85 (0.73-0.99)*
Other/no religion	2.79 (1.50-5.20)***	2.23 (1.31-3.80)***	1.35 (0.84-2.19)	1.07 (0.66-1.73)
Household size (people)				
1	1.0	1.0	1.0	1.0
2-4	0.76 (0.66-0.89)**	1.06 (0.94-1.20)	0.92 (0.85-1.00)	0.94 (0.87-1.03)
5-15	0.81 (0.69-0.95)**	1.21 (1.07-1.38)**	0.97 (0.89-1.06)	0.91 (0.83-1.00)*
Education				
Non university	1.0	1.0	1.0	1.0
University	0.78 (0.71-0.85)***	0.83 (0.77-0.89)***	0.95 (0.90-1.00)	0.99 (0.94-1.05)
Occupation				
Worker	1.0	1.0	1.0	1.0
Manager	0.86 (0.74-1.00)*	1.12 (1.01-1.25)*	1.00 (0.93-1.08)	0.93 (0.87-1.01)
Professional	0.87 (0.77-0.99)*	0.95 (0.86-1.04)	0.90 (0.84-0.96)**	0.91 (0.85-0.97)**
Office assistant	0.94 (0.84-1.05)	1.01 (0.93-1.10)	0.93 (0.88-0.99)*	0.86 (0.81-0.92)***
Not working/retired	0.85 (0.71-1.01)	0.90 (0.78-1.03)	0.77 (0.70-0.85)***	1.05 (0.95-1.15)
Unidentified	0.77 (0.60-0.99)*	0.97 (0.82-1.16)	0.86 (0.76-0.97)*	0.92 (0.81-1.04)
Monthly income (baht)				
< 10,000	1.0	1.0	1.0	1.0
10,001-20,000	0.88 (0.79-0.97)*	0.99 (0.92-1.08)	1.09 (1.02-1.15)**	1.04 (0.98-1.10)
20,001-30,000	0.64 (0.56-0.73)***	0.88 (0.80-0.97)*	1.08 (1.01-1.16)*	0.96 (0.90-1.03)
> 30,000	0.44 (0.37-0.52)***	0.82 (0.74-0.92)**	0.99 (0.92-1.07)	0.98 (0.91-1.06)

Notes: $n = 42{,}750$. Models are adjusted for all socio-demographic characteristics; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table III. Multivariable association (OR, 95%CI) of socio-demographic characteristics with frequent consumption of indicator foods

of understanding or use); (2) read, "not good" understanding, and "infrequent" use; (3) read, "good" understanding but "infrequent" use; (4) read, "not good" understanding, and "frequent" use; (5) read, "good" understanding, and "frequent" use. Then for each indicator food outcome we modelled the independent effect of the code and adjusted for all socio-demographic factors.

Table IV.
Multivariable associations of combined label experience with indicator food intake[a]

Label experience			Combined	Odds ratio for frequent consumption of indicator food (≥3 times/week)[b]			
Read	Understand	Use	Code	Instant food	Soft drink	Sweet drink	Milk
0	n/a	n/a	(1)	1.0	1.0	1.0	1.0
1	0	0	(2)	0.75 (0.65-0.87)***	0.79 (0.71-0.88)***	0.98 (0.91-1.07)	1.19 (1.10-1.30)***
1	1	0	(3)	0.75 (0.65-0.87)***	0.83 (0.75-0.92)***	0.95 (0.88-1.03)	1.31 (1.21-1.43)***
1	0	1	(4)	0.71 (0.61-0.83)***	0.56 (0.50-0.63)***	0.87 (0.80-0.95)**	1.63 (1.49-1.78)***
1	1	1	(5)	0.63 (0.56-0.70)***	0.56 (0.52-0.61)***	0.79 (0.74-0.85)***	1.87 (1.74-2.00)***

Notes: [a]The label experience for each descriptive variable (read, understand, use) is shown in binary form (0 = no, 1 = yes). The code reveals the combines label experience as follows: if "read" = 0, Code = (1) ("understand" or "use" are then not applicable or n/a); if "read" = 1, code for each possible combination = (2)-(5); [b]the model for each indicator food outcome is adjusted for all socio-demographic characteristics. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

All multivariable models were saturated (i.e. included all variables assessed) because we found that the ORs and 95 per cent confidence intervals did not change much when non-significant variables were removed. This stability of our effect estimates is a result of the large sample size. Our final models contained all the potential explanatory variables with OR estimates mutually adjusted for the statistical influence of all other variables in the model.

Ethical approval

Ethics approval was obtained from Sukothai Thammathirat Open University Research and Development Institute (protocol 0522/10) and the Australian National University Human research Ethics Committee (protocols 2004/344 and 2009/570). Informed written consent was obtained from all participants.

Results

Overall, responses of 42,750 cohort members were analysed for the eight year survey, including 19,295 men (45.1 per cent) and 23,455 women (54.9 per cent). The mean ± SD age was 40.5 ± 8.5 years, 6.0 per cent lived alone, 55.3 per cent lived in an urban environment, and the most frequent household size was 2-4 persons. Participants resided all over Thailand with the largest groups located in the central-east (30.7 per cent) or Bangkok (15.8 per cent). Most of the cohort (79.8 per cent) was university educated and the most frequent occupations were "professional" (26.4 per cent), or "office assistant" (30.8 per cent). Monthly incomes were modest, with nearly 60 per cent reporting 20,000 baht (approximately USD$550) or less per month. Responses to the nutrition label questions indicated 89.0 per cent had "read", 69.5 per cent had a "good understanding", and 64.4 per cent had "frequent use". Almost everyone (96.4 per cent) "wanted to see additional nutrition labels". The participants also reported frequent consumption of indicator foods – instant foods (7.0 per cent), soft drinks (14.6 per cent), other sweet drinks (40.7 per cent), and milk (45.5 per cent) (Table I).

Socio-demographic characteristics were examined for bivariate associations with nutrition label outcomes (read, good understanding, and frequent use). Overall, age, sex, location, region, religion, household size, education, occupation, and income were all significantly associated ($p < 0.05$) with at least one label outcome. When explored further, associations for age, sex, location, region, and occupation were found to be strongly connected ($p < 0.001$) to at least two of the outcomes.

In multivariable analyses of the three dependent label experience variables (Table II), adjusted for covariates, female participants had "read" labels more (OR 1.79; 95% CI, 1.68-1.92), and "used" them more frequently (OR 1.65; 95% CI, 1.58-1.73). Increasing age associated with reading, good understanding, and frequent use of labels with ORs ranging from 1.17 to 1.57. Living in an urban location was associated with less label "reading" (OR 0.86; 95% CI, 0.81-0.93) and less "good understanding" (OR 0.89; 95% CI, 0.85-0.93) but had no association with "frequent use" of labels. Compared to participants in central-east Thailand, Bangkok residents "read" labels less, had less "good understanding" and reported less "frequent use" with ORs ranging from 0.88 to 0.92. In contrast, people in Southern Thailand reported they "read" labels more, had a "good understanding", and had more "frequent use" with ORs ranging from 1.20 to 1.25. Thai Muslims also "read", "understood", and "frequently used" nutrition labels a little more than the Buddhist group but only the greater use of labels was significant. Some occupations associated with label outcomes, especially professionals, whose adjusted ORs for the three label outcomes ranged from 1.10 to 1.30. Monthly income had little association with label outcomes after adjusting for all other covariates.

Multivariable analysis of independent socio-demographic factors and the four dependent indicator food outcomes (Table III) showed female participants had less frequent consumption of instant foods (OR 0.68; 95% CI, 0.63-0.74), soft drinks (OR 0.62; 95% CI, 0.59-0.66), and sweet drinks (OR 0.79; 95% CI, 0.76-0.83), but more frequent consumption of milk (OR 1.67; 95% CI, 1.60-1.74). Increasing age and rural residence associated with less frequent consumption of all indicator foods, as did residence in the southern region. University educated participants were significantly less likely to consume instant foods and soft drinks, but not sweet drinks and milk. There was a strong inverse association between income and frequent consumption of instant foods.

Finally, we analysed the associations of overall label experience, combining the three experience variables into one composite code (Table IV). People who only read nutrition labels (without good understanding or frequent use) were significantly less likely to frequently consume instant foods and soft drinks, but not sweet drinks, and were significantly more likely to frequently drink milk. Beyond reading labels, "frequent use" was associated with lower ORs of frequent consumption for instant foods, soft drinks, and sweet drinks (ORs range from 0.56 to 0.87) and higher OR for milk intake (OR 1.63; 95% CI, 1.49-1.78). Respondents with the most label experience – "reading" plus "good understanding" plus "frequent use" – had the strongest association with indicator foods, lowering ORs for frequent instant foods (OR 0.63; 95% CI, 0.56-0.70), soft drinks (OR 0.56; 95% CI, 0.52-0.61), and sweet drinks (OR 0.79; 95% CI, 0.74-0.85) while boosting the OR for frequent consumption of milk (OR 1.87; 95% CI, 1.74-2.00).

Discussion

This Thai study systematically assesses the value of nutrition label experience and its association with food consumption. The results enlighten an under-researched area – nutrition label use and changing diets in South East Asia. The topic is important and Thailand is a regional leader in the ongoing nutrition transition. These countries share similar food cultures and some are contemplating the introduction of nutrition labels to combat the transition's health effects.

Except for their generally higher education, the 42,750 cohort adults who participated in our study were geographically and socio-demographically similar to the general Thai population. Overall, 89 per cent of the cohort reported "reading" nutrition labels and about two-thirds reported "good understanding" or "frequent use", so for all three experiences nutrition labels were reaching the study population. Females, those age 50 years or more, and rural or southern residents were the socio-demographic groups with strongest positive

statistical associations with nutrition label experience (read, understand, use). As well, these groups had less frequent consumption of unhealthy indicator foods (instant foods, carbonated soft drinks, and sweet drinks) and more frequent consumption of (healthy) milk. These relationships persisted after adjusting for many covariates.

Our findings agree with international studies that show women tend to have better diets than men and are more likely to eat fruit and fibre, avoid high-fat foods, and limit salt (Wardle *et al.*, 2004) and are more likely to read and use nutrition labels (Campos *et al.*, 2011). This gender differential is attributed to negative social and psychological effects from obesity (Ferguson *et al.*, 2009) and also to greater interest in health. We also found that older adults were more likely to use nutrition labels than others, a result that contrasted with the majority of studies (Campos *et al.*, 2011). However, older Americans use labels significantly more ($p < 0.01$) than younger persons (Stran and Knol, 2013). Chronic diseases usually appear with ageing and may spark an increased interest in healthy diets and label use (Andreas and Panagiotis, 2005).

Our study also found that Thai cultural geography interacts with nutrition labelling. Bangkok respondents were substantially less likely to read them compared to respondents from all other regions. We also found little difference in the nutrition label use for rural and urban Thais in sharp contrast to a US report showing 40 per cent less use for rural adults (Chen *et al.*, 2012). Indeed, rural Thais may have better nutrition behaviour than urban counterparts as urbanization leads to dietary transition to processed foods (Kelly *et al.*, 2010). In Thailand, rural people are less overweight than urban people (Aekplakorn *et al.*, 2007). Recent nationwide research using a random sub-sample of the TCS showed that 85 per cent do some shopping in supermarkets that sell pre-packaged processed foods high in salt, fats, and sugars. However, Thai rural residents retain good access to fresh food markets although supermarkets selling labelled packaged goods, are expanding rapidly in these areas and fresh food markets are receding in cities (Kelly *et al.*, 2014). This transition points to an urgent need for nutrition labelling to help Thais understand the content and healthiness of their newly adopted diets.

We also observed regional differences with the highest odds for reading nutrition labels in the Southern region and in the North. Notably these two culturally distinctive regions also had the highest fruit and vegetable consumption in Thailand reported by the National Health Examination Survey IV in 2009 (National Health Examination Survey Office, 2009). As well, we noted a tendency for Muslims to use nutrition labels a little more than others. This could reflect compliance with Islamic dietary restrictions. So in Thailand both culture and religion are associated with nutrition label use.

We found that education level had a positive statistical association with label experience and higher education associated with less frequent consumption of instant foods and soft drinks. But we did not have much variation of education due to the nature of our cohort. However, in another (qualitative) study of nutrition label use among Thai consumers, we found other label attributes could mediate education effects including readability, technical jargon, unobtrusive location, and suspected truthfulness (Rimpeekool *et al.*, 2015b). We also found education must align with positive attitudes and accepting beliefs to motivate use (Rimpeekool *et al.*, 2015a). As well trust in the safety and quality of the food supply could influence Thai consumers who feel more confident of traditional (unlabelled) food from fresh markets (Banwell *et al.*, 2016). A recent systematic review of trust in food supply systems shows research on this important topic remains very limited (Tonkin *et al.*, 2015).

We found professional people and managers were more likely than others to understand and use nutrition label information and were less likely to report frequent consumption of instant foods. A recent report from Canada showed low socio-economic status associated with poor label comprehension (Sinclair *et al.*, 2013). High income earners reported lower consumption of instant foods and soft drinks. Others have reported that higher income associates with increased

vegetable or fruit intakes as these products are purchased for their healthiness rather than value for money (Konttinen *et al.*, 2013; Satheannoppakao *et al.*, 2009).

This report complements a recent National Food Consumption Survey of Thailand in 2009 which produced similar consumption frequencies for instant foods, soft drinks, and sweet drinks (after allowing for methodological differences) (Aekplakorn and Steannoppakao, 2011). Our report also supports two earlier unpublished surveys each based on random samples of 2,000 people drawn from all regions, with estimates for label understanding for both NIP and GDA of about 60 per cent (Food and Drug Administration Thailand, 2010; Yodtheun *et al.*, 2013).

Some limitations and strengths of our study should be noted. First, participants were educated so for outcomes related to education level it was not possible to generalize results. Otherwise, cohort members were socio-demographically similar to the Thai population. Second, data are based on self-administered responses to mailed questionnaires but cohort members are used to complex information received by mail. Questionnaires were quite long (10-20-pages) so special interest in one or two questions would have little influence on overall responses (Chen *et al.*, 2012). Generally we have found that study drop out from TCS is related to residential mobility and not to health outcomes (Sleigh *et al.*, 2008). Third, our qualitative study, based on in-depth 30-45 minute interviews, produced supportive information (Rimpeekool *et al.*, 2015a). As well, further support comes from formal validations of several TCS questionnaire responses including weight, height, waist circumference, medical outcome Short Form 36, and hypertension (Lim *et al.*, 2008, 2009, 2012; Thawornchaisit *et al.*, 2014). Fourth, we do not have direct information on food purchases. However, other studies have found that nutritional label use contributes to healthier food consumption or reduced consumption of "unhealthy" foods (Azman and Sahak, 2014; Drichoutis *et al.*, 2006; Guthrie *et al.*, 1995; Kreuter *et al.*, 1997; Wills *et al.*, 2009).

The nutrition transition risks considered in this study relate to high intake of sugar and sodium, especially noted among males, urban dwellers, the less educated, and those with lower monthly income. These groups interact less with nutrition labels and have less healthy diets. Nutrition label education and health promotion should target these groups to increase understanding and stimulate healthy eating behaviour. Also, sweet drinks should now be required to have nutrition labels. Our previous qualitative research shows that Thai nutrition labels can be improved for readability and understanding in line with the improved labels launched recently by the USA (US Food and Drug Administration, 2016). We also note that other nutrition interventions are coming to Thailand. MOPH now has a "Health Logo" which approved foods can display (Royal Thai Government Gazette, 2016a) and the Thai Food and Drug Administration proposes a sugar tax (Sattaburuth, 2016).

Further studies could help nutrition labelling policies for Thai consumers. These include the revision of nutrient and serving size reference values and investigation of Thai consumers for visual attention and cognitive processes in relation to labels, testing new research methods such as "eye-tracking technology". Overall, we need a deeper understanding of label experiences in relation to health knowledge, motivation, and psychology. We will then be in a position to explain and modify food-related behaviour. As well we need a better understanding of the industrial impact of nutrition labelling regulations and that will require systematic study of all the main categories of processed food manufacturers.

Conclusion

Our nationwide study of nutrition labels in transitional Thailand showed most respondents read the labels but fewer used the information. Our study participants were of modest means but were well educated. Socio-demographic factors (e.g. income, sex) strongly associated with nutrition label experiences (read, understand, use) and frequent intake of

indicator foods typical of the nutrition transition (instant foods, soft and sweet drinks, milk). Nutrition label experiences were strongly and significantly associated with consumption of transition-indicator foods. These results arise in a South East Asian country that recently defeated malnutrition but now confronts an equally important new community nutrition challenge (Chavasit *et al.*, 2013; Kosulwat, 2002). Overall, our study supports the use of nutrition labels in Thailand and lends weight to the government's planned introduction of mandatory NIP on all pre-packaged foods.

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CHAPTER 7: THAI NUTRITION LABELLING, HIGH BLOOD PRESSURE, HIGH BLOOD LIPIDS, AND OBESITY

Chapter 7 presents Paper 5 in the thesis. It is a manuscript submitted to *PLOS ONE*. It ascertains the associations between nutrition label use and indicators of nutritional chronic disease. Data were received from the Thai Cohort Study participants (see description in Chapter 6) including 42,750 distance learning Open University adults who responded to the 2013 survey questionnaire. Information gained from the survey included nutrition label experiences (read, understand, and use), occurrence of obesity and nutrient-related non-communicable diseases (NCDs) including high blood pressure and high blood lipids, cohort characteristics (sex, age, location, household size, monthly income, physical activity, alcohol consumption, and smoker status). Results report the proportion of nutrition label users among morbidity groups – obesity and two nutrient-related NCDs. It also shows the association between nutrition label experiences (read, understand, and use) and self-reported nutrient-related NCDs. Results here enable better promotion of nutrition labelling to reach target sub-populations at risk.

PLOS ONE

Nutrition label experience, obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults

--Manuscript Draft--

Manuscript Number:	
Article Type:	Research Article
Full Title:	Nutrition label experience, obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults
Short Title:	Nutrition labels use and health outcomes
Corresponding Author:	Wimalin Rimpeekool, M.Sc. Australian National University Acton, ACT AUSTRALIA
Keywords:	nutrition label; Thailand; health status; non-communicable disease; health behaviour
Abstract:	Objective: Our objective was to investigate the associations between nutrition label experience, obesity and nutrient-related NCDs in Thai consumers. Nutrition labels have been promoted for nearly two decades in Thailand to educate people about healthy eating and to combat nutrient-related non-communicable diseases (NCDs). But little is known about how nutrition labels are experienced and whether they are linked with better health. Methods: A cross-sectional study was undertaken with a nationwide cohort of 42,750 distance learning Thai adult students enrolled in an Open University in 2013. We measured exposure as nutrition label experience (read, understand, use). Health outcomes were high blood pressure, high blood lipids, and high Body Mass Index (overweight at risk and obesity). Multivariate logistic regression was used to determine the association between nutrition label experience and health outcome adjusting for sociodemographic attributes, physical activity, smoking, and alcohol intake. Results: Frequent nutrition label use varied by cohort attributes and health outcomes and was least for those with low physical activity and high blood pressure. Being male, older, an urban resident or with low physical activity was associated with increasing high blood pressure and high blood lipids. Compared to those who read, understand and use nutrition labels, participants who did not (read, understand, and use), were more likely to report high blood pressure (Adjusted Odds Ratio 1.33; 1.17-1.51), high blood lipids (AOR 1.26; 1.14-1.39), and obesity (AOR 1.23; 1.13-1.33), but were not more likely to be overweight at risk (AOR 1.06; 0.97-1.16). Conclusions: We found cross-sectional associations between low nutrition label experience and increased likelihood of high blood pressure, high blood lipids, and obesity among Thai adults. Nutrition label education should be promoted as part of a public health approach to appropriate food choices and better lifestyles to reduce obesity and nutrient-related NCDs.
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Question	**Response**

Nutrition label experience, obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults

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Abstract

Objective: Our objective was to investigate the associations between nutrition label experience, obesity and nutrient-related NCDs in Thai consumers. Nutrition labels have been promoted for nearly two decades in Thailand to educate people about healthy eating and to combat nutrient-related non-communicable diseases (NCDs). But little is known about how nutrition labels are experienced and whether they are linked with better health.

Methods: A cross-sectional study was undertaken with a nationwide cohort of 42,750 distance learning Thai adult students enrolled in an Open University in 2013. We measured exposure as nutrition label experience (read, understand, use). Health outcomes were high blood pressure, high blood lipids, and high Body Mass Index (overweight at risk and obesity). Multivariate logistic regression was used to determine the association between nutrition label experience and health outcome adjusting for sociodemographic attributes, physical activity, smoking, and alcohol intake.

Results: Frequent nutrition label use varied by cohort attributes and health outcomes and was least for those with low physical activity and high blood pressure. Being male, older, an urban resident or with low physical activity was associated with increasing high blood pressure and high blood lipids. Compared to those who read, understand and use nutrition labels, participants who did not (read, understand, and use), were more likely to report high blood pressure (Adjusted Odds Ratio 1.33; 1.17-1.51), high blood lipids (AOR 1.26; 1.14-1.39), and obesity (AOR 1.23; 1.13-1.33), but were not more likely to be overweight at risk (AOR 1.06; 0.97-1.16).

Conclusions: We found cross-sectional associations between low nutrition label experience and increased likelihood of high blood pressure, high blood lipids, and obesity among Thai adults. Nutrition label education should be promoted as part of a public health approach to appropriate food choices and better lifestyles to reduce obesity and nutrient-related NCDs.

Introduction

The major goals of nutrition labelling on food packages are to help consumers select healthy foods and to combat widespread, serious nutrient-related diseases. For example, overweight or obesity contributes to the death of 3.4 million people globally [1]. In Thailand, the prevalence of nutrient-related disease and obesity has increased over time to become a national public health problem [2]. Diets have become less healthy and physical activity levels have decreased [3]. Thais now consume more processed foods containing high levels of sugar, fat and sodium, and little fibre [4] which are associated with obesity and non-communicable diseases (NCDs) [5, 6]. Nutrition labels have been promoted for nearly two decades in Thailand to reduce the consumption of unhealthy foods. But we still know little about how labels are experienced by Thai consumers and whether they are associated with health outcomes.

Previous studies, mostly in North America and Europe, have shown that use of nutrition labels can shift consumers to healthier food consumption patterns [7-9]. Compared to non-users, nutrition label users have lower intakes of fat and cholesterol and higher intakes of fruit, vegetables, and fibre [10, 11]. Even college students, who are not focused on the importance of healthy meals, have healthier diets if they read nutrition labels [12]. Consumers who use serving size information on nutrition labels reported eating 150 kcal less per day than those who were non-label users [13]. Patients with chronic diseases who were advised to use nutrition labels consumed less energy, saturated fat, carbohydrates, and sugar, and more fibre than non-label users [14].

The experiences of nutrition labels among Thai consumers with nutrient-related NCDs has not been investigated. Here we report on a cross-sectional study of the associations

between nutrition labelling and nutrient-related NCDs building on data from a large existing cohort study of adult Thai open-university students residing nationwide.

Methods

The Thai Cohort Study (TCS) began in 2005 when distance learning adult students, residing nationwide and enrolled at Sukhothai Thammathirat Open University (STOU), returned a baseline survey and agreed to a longitudinal study of the health-risk transition [15]. Cohort members were of modest means and stayed in their communities but expected to progress because of better education. At baseline they reported their childhood and current environment, occupation, socio-demographic attributes, personal behaviour, transport, well-being, illness, and injury. In 2013, 42,785 cohort members responded to the 8-year follow-up of the TCS. For this analysis, 42,750 TCS members were included after 35 monks and prisoners were excluded because they do not shop for food. The TCS participants in 2013 were aged 20 to 96 years, with a majority aged 30 to 45 years. They closely represented the Thai population for sex ratio, median age, religion, regional distribution, and median income [15] and were very similar to the body of distance learning students studying at STOU at baseline in 2005 [16].

Questionnaires covered a broad variety of topics including nutrition label experience, socio-demographic attributes, health behaviour, body size, and health conditions. For analysis, respondents were divided into two age groups: <40 and 40+ years. We noted location of residence (urban or rural), household size (1-2, 3-4, or 5+ people), and monthly income (<10000, 10001-30000, >30000 Baht). The question on exercise asked about the number of sessions per week. The responses led to a metabolically-adjusted physical activity (sessions/week) calculated as “2 × strenuous + moderate + walking” sessions categorized as

follows: low activity (< 3 sessions/ week), medium (4-11 sessions/ week), and high (≥12 sessions/week) [17]. Alcohol exposure was grouped as follows: non-drinkers, social drinkers, and heavy drinkers [18]. Smoker categories analyzed were as current smokers or non-smokers.

Three questions about nutrition label experience (read, understand, use) were included in the 2013 questionnaires. Responses to each question were digitized in binary format as follows:

- Read (Yes/No). Derived from "Have you ever seen nutrition labels on food products?" The "Yes" response was "seen and read"; "No" responses were "seen not read" or "unaware".
- Understand (Good/Not good). Derived from "How well do you understand the information presented on food nutrition labels?" The "Good" responses were "understand fully" or "understand most information"; "Not good" response were "understand some information", "do not understand information but I know it has potential", or "do not understand information or its potential".
- Use (Frequent/ Infrequent). Derived from "How often do you use information from nutrition labels on food products to assist your food purchasing decision?" The "frequent use" responses were "every time" or "often"; "Infrequent use" responses were "sometimes", "seldom", or "never".

In the 2013 TCS survey, Body Mass Index was calculated by the formula (BMI = kg/m^2) and categorized using Asian cut-offs as "normal" (BMI 18.5-<23), "overweight at risk" (BMI 23-<25), and "obese" (BMI ≥25) [19]. Those found to be underweight were excluded (n= 2455, 5.79%) because this category mixes together young people naturally thin, others who seek thinness, and others who are thin due to disease. Self-reported weight and

height measures in the study population have been validated [20] and our 8-year longitudinal data revealed rapid increase in overweight and obesity in the cohort [21]. Questions were asked about specific doctor-diagnosed diseases including high blood pressure (HBP) and high blood lipids (HBL). HBP responses have been validated [22].

Data scanning and editing used Thai Scandevet software. Further data editing used SQL and SPSS software. For analysis we used Stata v14. Individuals with missing data were excluded from analysis. Finally, we created a "nutrition label experience" as an exposure dose variable (graded code 1 to code 5) by combining the three experience component measures as follows:

(1) "not read" (regardless of use or understanding);

(2) "read" but "not good" understanding and "infrequent" use;

(3) "read" with "not good" understanding but "frequent" use;

(4) "read" with "good" understanding and "infrequent" use;

(5) "read" with "good" understanding and "frequent" use.

We noted cross-sectional associations between this label experience measure and the health outcomes and repeated multiple logistic regressions adjusting for potential confounders – the sociodemographic and health covariates. Adjusted Odds Ratios (ORs) are presented with 95% Confidence Intervals.

Ethics approval was obtained from Sukothai Thammathirat Open University Research and Development Institute (protocol 0522/10) and the Australian National University Human research Ethics Committee (protocols 2004/344 and 2009/570). Informed written consent was obtained from all participants.

Results

Cohort attributes, nutritional label experience, and health outcome

Of the 42,750 cohort members analysed in 2013 (Table 1), 45.1% were males, 51.3% were aged less than 40 years, and 55.3% reported residing in urban areas. About half reported living in a household of 3-4 members. Personal monthly income was reported to be less than 10,000 Baht (300 USD) by most respondents (59.6%). Almost half (45.2%) reported medium physical activity (4-11 sessions/week). In this cohort, the prevalence of HBP, HBL, and obese body size were 7.6%, 13.9%, and 30.4%, respectively. Our respondents reported that 89% read, 70% understand, and 64% use nutrition labels.

Table 1 Frequent nutrition label use by cohort attributes and health outcomes, Thai Cohort Study 2013

Cohort attributes	n (%)	Proportion of frequent nutrition label users (%) by cohort attributes and health outcomes					
		Self-reported doctor diagnosed health outcomes			Body Mass Index (BMI)[a]		
		Neither high blood pressure nor high blood lipids reported[b] (n=33002)	High blood pressure[c] (n = 3026)	High blood lipids [d] (n= 5594)	Normal (n=18336)	Overweight at risk (n=9116)	Obese (n=12005)
Overall	42750 (100)	65.4	60.5	60.6	66.1	64.7	61.5
Sex							
Male	19295 (45.1)	59.6	57.0	55.9	59.0	60.0	57.7
Female	23455 (54.9)	69.7	67.2	66.6	69.8	70.6	66.9
Age (years)							
< 40	21925 (51.3)	63.8	59.2	57.8	64.8	63.2	59.2
≥ 40	20825 (48.7)	67.6	60.8	61.4	67.8	65.8	63.3
Location							
Rural	18913 (44.7)	66.9	60.6	60.7	67.0	66.0	62.9
Urban	23434 (55.3)	64.1	60.5	60.5	65.2	63.6	60.5
Household size							
1-2	8655 (20.5)	64.6	64.8	59.6	65.3	62.9	60.4
3-4	20164 (47.8)	65.2	59.8	60.9	65.9	65.0	61.5
5+	13326 (31.6)	66.3	59.6	60.9	66.7	65.8	62.4
Personal monthly income							
< 10000 Baht	25209 (59.6)	65.1	60.2	60.8	66.1	64.9	60.7
10001-30000 Baht	9234 (21.8)	66.0	57.8	58.8	65.4	64.1	62.4
>30000 Baht	7853 (18.6)	65.8	63.2	61.8	66.9	64.7	62.5
Physical activity [e]							
0-3 sessions/ week	5506 (13.2)	55.4	47.8	51.2	56.5	53.2	51.7
4-11 sessions/ week	18894 (45.2)	64.2	60.4	59.5	64.5	63.4	60.7
≥12 sessions/ week	17433 (41.7)	69.7	65.0	65.6	70.5	69.2	66.1
Alcohol consumption[f]							
Never drinkers	24247 (57.2)	68.0	63.7	63.8	68.4	68.2	64.3
Social drinkers (light)	10367 (24.4)	64.8	58.4	58.1	64.8	63.8	60.8
Heavy drinkers/ social	7798 (18.4)	57.7	55.9	55.0	57.9	57.5	55.8
Current smoker							
No	39292 (92.4)	66.1	61.1	61.4	66.7	65.1	62.5
Yes	3227 (7.6)	56.3	56.5	52.7	56.1	59.8	52.1

[a] Body Mass Index (Asian cut-off): normal (BMI 18.5-<23), overweight (BMI 23-<25), obese (BMI 25+)

[b] Column % shows proportion of frequent nutrition label user among cohort members who did not have high blood pressure and/or high blood lipid (calculated separately by each cohort attribute eg sex)

[c] Column % shows proportion of frequent nutrition label user among cohort members who did not have high blood pressure

[d] Column % shows proportion of frequent nutrition label user among cohort members who did not have high blood lipid

[e] Physical activity (sessions/ week) are calculated by "2 × strenuous + moderate + walking exercise sessions"

[f] Alcohol consumption: 1) Never drink = non-drinker or ex-drinker, 2) Social drink = social with less than 4 glasses/week, 3) Heavy drink = current regular drinker + social with more than 4 glasses/week

Use of nutrition label information is the final goal for health promotion, so in this initial report the analysis is restricted to the associations of label use. In general, respondents with poor health outcomes reported less use of nutrition labels than their healthy counterparts. Females, older age persons, rural residents, and those reporting high physical activity (≥12 sessions/ week) were more frequent label users. Heavy alcohol drinkers and smokers reported less frequent use of nutrition labels, compared to non-drinkers and non-smokers. The lowest proportion (47.8%) of nutrition label users was among a group of participants who had both high blood pressure and low physical activity. The proportion of frequent label use was higher (65.4%) among those without HBP or HBL compared to those who had HBP (60.5%) or HBL (60.6%). Overweight or obese respondents used nutrition labels less than the normal BMI reference group (66.1%).

Analysis of the distribution among respondents (by sex and age group) of each category of "exposure doses" of nutrition label experience reveals the uptake of the labels since first appearing in 1998 (Fig 1). The five exposure categories were not evenly distributed. The highest "dose" of nutrition label experience (exposure code 5) was disproportionately frequent with about half of the cohort reporting this level; to compensate, each of the other four "doses" (exposure codes 1-4) were disproportionately less than 20%. Frequent use of nutrition labels without a good understanding of the information (exposure code 3) was reported by 13.6% of respondents. Infrequent use with good understanding (exposure code 4) was reported by 10.2% of respondents. Among the age-sex subgroups the highest proportion for the highest dose of nutrition label (exposure code 5) were older age females (59.0%).

Fig 1 about here.

Association between nutritional label experiences and related health outcomes

We performed multiple logistic regressions exploring the relationship between nutrition label experience (code 1-5) and health outcomes adjusting for an array of covariates (sex, age, location, household size, income, and physical activity, alcohol consumption, and smoker status). We found statistically significant associations between nutrition label experiences (code 5 as reference) and reported HBP, HBL and obesity (Table 2). As the "exposure dose" (codes 4 to 1) of nutrition labelling fell progressively below the code 5 reference there were dose responses with increasing odds for these three adverse health outcomes. Compared to cohort members who read, have good understanding, and frequent use of nutrition labels (i.e. exposure code 5 reference group), those who do not read, do not have good understanding of, and infrequently use labels (exposure code 1) were 1.33, 1.26, and 1.23 times more likely to report having HBP, HBL, or to be obese. Respondents who read and frequently used labels without a good understanding of them (exposure code 3) were more likely to report HBP (OR 1.15; 1.01-1.29), HBL (OR 1.20; 1.10-1.32) but were not overweight at risk, or obese. In the group of overweight at risk there was no statistically significant link to nutrition label experiences.

177 **Table 2 Cross-sectional associations between nutrition label experiences and related**

178 **health conditions adjusted for cohort attributes, Thai Cohort Study 2013**

Cohort characteristics N= 42,750	Adjusted logistic Odd Ratios (AOR, 95% Confidence Interval) [a]			
	High blood pressure[a]	High blood lipids[a]	Body Mass Index[b]	
			Overweight at risk	Obese
Nutrition label experiences [c] (Read - good understand - Frequent use)				
Code (1) No-N/A-N/A	1.33 (1.17-1.51)***	1.26 (1.14-1.39)***	1.06 (0.97-1.16)	1.23 (1.13-1.33)***
Code (2) Yes-No-No	1.21 (1.05-1.38)**	1.27 (1.15-1.40)***	0.92 (0.85-1.01)	1.02 (0.94-1.10)
Code (3) Yes-No-Yes	1.15 (1.01-1.29)*	1.20 (1.10-1.32)***	0.96 (0.89-1.04)	1.04 (0.97-1.12)
Code (4) Yes-Yes-No	1.09 (0.93-1.26)	1.08 (0.96-1.20)	0.96 (0.88-1.05)	0.93 (0.85-1.01)
Code (5) Yes-Yes-Yes	Ref	Ref	Ref	Ref
Sex				
Male	Ref	Ref	Ref	Ref
Female	0.56 (0.51-0.62)***	0.75 (0.70-0.81)***	0.48 (0.45-0.51)***	0.42 (0.40-0.45)***
Age (years)	1.12 (1.11-1.12)***	1.09 (1.08-1.09)***	1.03 (1.03-1.03)***	1.03 (1.03-1.04)***
Location				
Rural	Ref	Ref	Ref	Ref
Urban	1.18 (1.08-1.29)***	1.27 (1.19-1.36)***	0.99 (0.94-1.05)	1.07 (1.02-1.12)**
Household size (no. person)	0.99 (0.97-1.00)	0.97 (0.96-0.99)**	1.02 (1.01-1.04)***	1.03 (1.02-1.04)***
Personal monthly income				
< 10000 Baht	Ref	Ref	Ref	Ref
10001-30000 Baht	1.04 (0.94-1.16)	1.66 (1.54-1.79)***	1.15 (1.08-1.23)***	1.07 (1.01-1.14)*
>30000 Baht	1.08 (0.97-1.19)	1.63 (1.51-1.77)***	1.15 (1.07-1.24)***	1.11 (1.04-1.19)**
Physical activity [d]				
0-3 sessions/ week	1.60 (1.40-1.83)***	1.65 (1.50-1.82)***	1.04 (0.96-1.14)	1.45 (1.35-1.57)***
4-11 sessions/ week	1.26 (1.15-1.38)***	1.31 (1.23-1.41)***	1.04 (0.98-1.10)	1.16 (1.10-1.22)***
≥12 sessions/ week	Ref	Ref	Ref	Ref
Alcohol consumption				
Never drinkers	Ref	Ref	Ref	Ref
Social drinkers (light)	0.76 (0.69-0.85)***	0.93 (0.86-1.01)	1.03 (0.96-1.10)	0.92 (0.87-0.98)**
Heavy drinkers/ social	1.04 (0.93-1.16)	0.98 (0.90-1.08)	1.22 (1.13-1.33)***	1.22 (1.13-1.31)***
Current smoker				
No	Ref	Ref	Ref	Ref
Yes	1.13 (0.98-1.30)	1.03 (0.91-1.15)	0.80 (0.72-0.89)***	0.86 (0.78-0.94)**

179 [a] Adjusted Odds Ratio for all factors included in the model; *p<0.1; **p<0.05; ***p<0.01;
180 For HBP and HBL, the reference is participants who did not report high blood pressure or high blood lipids as diagnosed by
181 doctors
182 For BMI, the normal BMI is a reference for both overweight at risk and obese analyses.
183 [b] Body Mass Index (Asian cut-off): normal (BMI 18.5-<23), overweight at risk (BMI 23-<25), obese (BMI 25+)
184 [c] For analysis, we categorised cohort members reporting every time/often as “nutrition label users”
185 [d] Physical activity (sessions/ week) are calculated by "2 × strenuous + moderate + walking exercise sessions"
186 [e] Alcohol consumption: 1) Never drink = non-drinker or ex-drinker; 2) Social drink = social with less than 4 glasses/week; 3)
187 Heavy drink = current regular drinker + social with more than 4 glasses/week

Being male and increasing in age strongly associated ($p<0.001$) with HBP, HBL, overweight, and obesity. Urban participants had higher Odds Ratios of HBP (OR 1.18; 1.08-1.29), HBL (OR 1.27; 1.19-1.36), and obesity (OR1.07; 1.02-1.12). Low physical activity increased risk for HBP (OR 1.60; 1.40-1.83), HBL (OR 1.65; 1.50-1.82), and obesity (OR 1.45; 1.35-1.57). Light alcohol drinkers had low odds ratio of HBP but heavy drinkers were at higher risk of being overweight at risk or obese. Smoking status did not statistically associate with HBP and HBL but was related to decreasing adjusted odds for overweight at risk and obese.

Discussion

A Thai Food and Drug Administration public health intervention has supported nutrition labelling of food for the last 18 years and this program has reached a large part of the population. Our cohort resides nationwide and over half of the participants were aware, understood and used the information. We found cross-sectional associations between respondents not reading nutrition labels (i.e. unexposed to the intervention) and a higher occurrence of nutrient-related health outcomes (HBP, HBL, obesity) in Thai adults. This study also found that self-reported HBP, HBL, obesity were associated with sex, age, urban residence, and low physical activity.

Associations between nutrition label experiences and adverse health conditions have never been explored in previous Thai studies partly due to the relatively low number of disease cases available in the population. Our large study found a lower proportion of frequent nutrition label users among participants with nutrient-related health outcomes which contrasts with the widespread assumption that people with adverse health conditions will use nutrition labels more [23]. Our previous qualitative study found that people who had

developed concerns about their health said they were likely to adopt the use of nutrition labels [24]. It is possible that nutrition label experience was low among those who became diseased and subsequently rose but did not reach the level of non-disease counterparts. The current study is not likely to capture this dynamic transition as we do not have longitudinal measurement of nutrition label experience.

In this study, we found similar factors associated with nutrient-related health outcomes and obesity as reported in other studies. Being male and older age were associated with higher risk of HBP, HBL, and obesity. Other studies also show prevalence of HBP was higher among men and older age groups [25-27] while women are less affected than men [28]. Also we found women were more likely to be experienced nutrition label users (read, good understanding, and frequent use).

Recent reports show that urbanisation associates with hypertension and obesity [29, 30]. We provide more evidence that higher HBP, HBL, and obesity link to urban residence. Light alcohol consumption has sometimes been associated with health benefits [31, 32] but our results are mixed. Social drinkers had lower adjusted odds of HBP but heavy drinkers were more likely to report overweight and obesity. The lower adjusted odds of being overweight and obese among smokers in the study reflects the finding that nicotine reduces appetite leading to lower body weight [33].

Our study has some limitations. First, this is a cross-sectional study, so it cannot be used to causally link the impact of nutrition labels to health outcomes due to the possibility of reverse causation. However, this could be explored in the future when new longitudinal data become available. Second, our data on nutrition label experiences was based on respondent self-report and their understanding of information on nutrition labels. It was not feasible to use a questionnaire to ascertain the determinants of their levels of understanding.

Nevertheless, our study adds to existing limited evidence on the patterns of nutrition label use and health in a large nationwide adult sample.

We have demonstrated that the population enrolled in 2005 were similar to the general Thai adult population for age, sex, region, religion, and ethnicity [15]. In addition the enrolled cohort represented well the student body at STOU and cohort attrition at follow up in 2013 was minimized by an array of successful methods [16, 34]. The attrition that did occur mostly effected young unmarried urban males and this group were relatively unaffected by the health outcomes measured and reported [35]. Also our cohort consists of Open University adults who contain a higher proportion of high school completers than the average for the Thai population. It is likely that a lower fraction of the general Thai population will be nutrition label users than in our more educated sample. But cohort members are of modest socio-economic means and remain embedded in their communities. By their educational attainment they point the way to the Thais of tomorrow.

We found that nutrition label non-users are statistically more likely to have HBP, HBL, and obesity. Also participants with these adverse health conditions and with low physical activity levels were considerably less likely to use nutrition labels. It is possible that people with lower physical activity levels are less willing, or able, to address their health conditions. More research with this group would help explore this in greater depth.

Conclusions

The use of nutrition labels has the potential to help people prevent obesity and nutrient-related NCDs. The Thai government could disseminate more widely information about the value of nutrition labels to assist with appropriate food choices.

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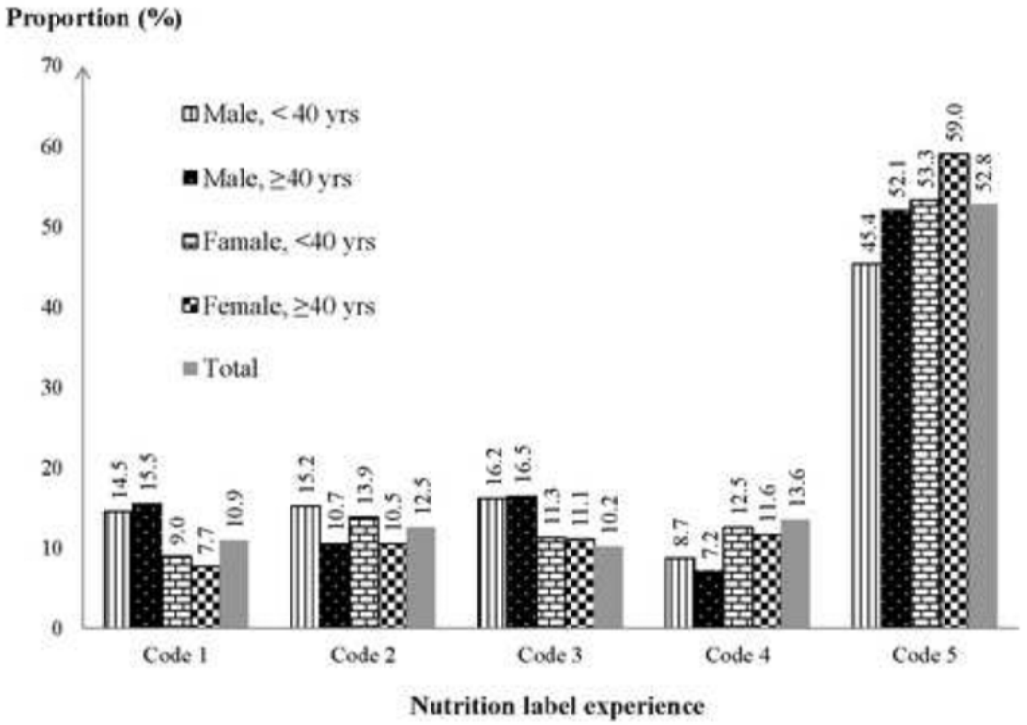

Fig 1 Proportion of cohort participants by age-sex groups in each nutrition label category

CHAPTER 8: DISCUSSION AND CONCLUSIONS

8.1 Overview

This is the final chapter of the thesis. In the first section, there is a brief summary of results followed by an outline of the structure of the chapter. Then the key findings for the results chapters are noted and connected to the research questions and related hypotheses, each of which is disproved or not disproved. The significance of the thesis, strengths and limitations, and future questions are reviewed. The public health policy implications for enhancing utility of the nutrition labels in the future are considered.

The aim of this thesis was to describe the current situation of Thai nutrition labelling and to generate evidence for policies to enhance the utility of future labels. Nutrition labelling has been used in Thailand as a nutrition intervention for the last two decades but the attempt by government to combat nutrition problems has a much longer record than that. However, that long previous record had addressed a different problem – child malnutrition, which had receded by the early 1990s and was no longer a public health problem when nutrition labels were introduced in 1998 (6, 10). The labels were directed at a new set of nutrition problems related to excess energy and nutrient intake which emerged about this time. These novel problems of nutritional excess in Thailand have contributed to rising prevalence of obesity and nutrient-related non-communicable diseases including diabetes, high blood pressure, cardio- and cerebro-vascular diseases, and chronic kidney disease.

The nutrition transition described above involves a change in diet from traditional agrarian foods to modern energy-dense processed foods (high in sugar, fat and sodium), accompanied by many socio-demographic changes along with changes in personal behaviour. These effects are supported by higher order factors such as modern international trade, weakened sovereign power, and internationally constrained food labelling regulations. Developing countries today are disadvantaged when proposing new food regulations due to lack of scientific expertise and the capacity to produce supportive information. This disadvantage has also affected Thailand and research on the topic has been limited. There were no international publications about Thai nutrition labelling until this thesis. The emerging problems connected to nutrition transition frame the research on nutrition labelling presented here.

The research reported here was performed as interlocking components – historical, qualitative and quantitative. The historical component investigated the evolution of labelling, the qualitative component added information about food behaviour and use of nutrition labels, and the epidemiological component quantified the relations among consumer behaviour, nutrition labels, food consumption, and health status. The thesis reveals a “Thai food and nutrition

labelling transition" from the era of imported food products to manufacture in-country of diverse industrial processed foods. Nutrition labelling involves not only public health issues but also connects with many other considerations affecting food production, storage, and trade.

The five result chapters of the thesis (Chapters 3 to 7) contain the main findings of the five sub-studies. Each of these chapters contains one scientific article that is published or submitted, and each article presents its own discussion and conclusion. Here in Chapter 8 the Thesis Discussion reviews the connections among chapter results, providing a picture of the current situation for Thai nutrition labelling and consumers. This chapter is organized around the six research questions and related hypotheses as specified in the Introduction (Chapter 1). The strengths and limitation of this research are described and future research is suggested. Finally, this chapter reviews the significance of this thesis, noting the contribution to public health and implications for nutrition policies.

8.2 Key findings

Research question 1 How did Thai food and nutrition labelling evolve?

Hypothesis [1A] Thai food labelling policies began with food safety.

[1B] When Thailand began to industrialize and joined world trade, it used international standards in labelling.

Research question 1 is investigated in the historical food policy paper in Chapter 3. The food and nutrition labelling transition in Thailand has a long history involving consumer protection and public health for more than 100 years. Thai food laws began in 1927, aiming to protect consumers from adulterated low quality foods, mostly imported products such as skimmed milk. These early food laws focused on food safety requiring disclosure of additives and preservatives inserted in foods as new industrial processes.

Thailand began to industrialize following World War 2 and joined the Codex Alimentarius Commission, the United Nations (UN) agency setting international standards for food, food production, and food safety. This agency has been managed by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) since 1962 and Thailand joined in 1963 as a pioneering member country. From the early 1960s, the food industry and associated regulation in Thailand has always been influenced by international standards and guidelines which set the framework for the World Trade Organization (WTO) now guiding international trade, including food and agriculture.

Thailand has over half a century of experience with international trade laws and food standards and it balances the international and national demands as a routine component of its economy. Despite this extensive experience there is still tension between international and national

standards dealing with foods. Labelling has been a part of Thailand's food system since the 1920s but it was not until 1979 that a comprehensive law was passed dealing with labels. This Food Act of 1979 drew on Codex Alimentarius experience which had accumulated through its long-running food labelling committees. Later the Codex standards for nutrition labelling began to appear in the 1980s and Thailand passed its first laws on these labels in 1998. Thai nutrition labels continue to evolve with the addition of Guideline Daily Amounts (GDA) now complementing the initial Nutrition Information Panel.

The development of Thai food and nutrition labelling represents a substantial contribution from a South East Asian middle-income setting. Thai nutrition labelling has been influenced by the USA and Europe, but has mostly followed international Codex approaches and reflects a long trade experience with many countries.

I conclude that Hypotheses 1A and 1B are not disproved.

Research question 2 What factors influenced Thai nutrition labelling policies?

Hypothesis [2A] Thailand balances international rules with local needs

[2B] Thai nutrition label format followed US nutrition labels.

The historical paper in Chapter 3 addresses this question. The nutrition labelling regulations in Thailand did not follow US nutrition labels but were inspired by the pro-label declaration in Rome of the 1992 International Conference of Nutrition. This conference concluded that nutrition labels provide an excellent communication route to convey nutrition information to consumers. The Thai nutrition labels were eventually launched in 1998 and were shaped by Codex Alimentarius guidelines. Nutrition labels are seen as education tools to combat poor nutrition as agreed by many countries including Thailand at the 1992 Rome conference. Thai nutrition labels were also created to assist Thai food exporters. The labels were created along Codex Alimentarius guidelines but the appearance was similar to US nutrition labels. At that time US nutrition labels had a high regard internationally because they were based on the best science. Also influential when nutrition labels are constructed are the WTO rules for Technical Barriers to Trade. These WTO rules create some national tension.

Hypothesis 2A is not disproved. Codex Alimentarius, and international trade have more influence on Thai food and nutrition labelling policies than any specific country.

Hypothesis 2B is disproved. Thai nutrition labelling did not usually follow US nutrition labels, a conclusion based on evidence presented in Chapter 3 of this thesis.

Research Question 3 What are the knowledge, attitudes, behaviours, and beliefs of Thai consumers about nutrition labels?

Hypothesis [3] Nutrition label users are more educated and more exposed to the media.

Research question 3 is investigated in the paper presented in Chapter 4 which derived from the qualitative research including 14 Bangkok residents and 20 Ranong residents, southwest Thailand. A combined Knowledge-Attitude-Behaviour and Health Belief Model (KAB+HBM) was devised to understand label use. From the interview data, it was apparent that nutrition label users could be classified into four major groups: competent users, confused users, aware non-users, and unaware non-users. "Confused users" had problems using information on the labels or became confused with other labels looking similar. "Aware non-users" lacked motivation even though they were aware of the labels.

In general, more educated participants were more likely to use nutrition labels with good understanding. However, this study also found many educated non-users of nutrition labels who lacked motivation or prioritized other attributes of foods such as price and taste. Motivation for food purchase arises from many sources that may be far from nutrition labels such as annual health check-up scares, post-partum weight gain, changing appearance, and fear of illness and obesity. Today, there are many sources of media and people have access to television, workshops, and books. The internet provides the most interactivity for consumer self-learning although the information is not always accurate. The information obtained for this study revealed that there are many influences on food choices and nutrition labels are part of this mixture of factors in play when Thai consumers purchase foods.

I conclude that Hypothesis 3 is not disproved. But it is not always true that people who are highly educated and exposed to media and education are nutrition label users. The study found highly educated participants who were "aware non-users", who knew the benefit of labels, but did not use them due to lack of motivation.

Research Question 4 What kind of difficulties and barriers confront consumers in understanding nutrition labels in Thailand?

Hypothesis [4] Information on nutrition labels requires a high literacy and numeracy to understand.

Research question 4 is investigated in the paper presented in Chapter 5. The data derived from the 34 in-depth interviews of Bangkok and Ranong residents. This study of difficulties and barriers revealed that the current nutrition labels need to be improved. There are many problems making consumers ignore nutrition labels and they are often constrained by low literacy and numeracy, lack of knowledge about diet-health relationships, doubt about the truthfulness of

nutritional information, and low awareness of nutrition labels, especially GDAs. The interviews revealed five barriers to label utility – small font size, many other non-nutrition food labels of similar appearance, technical terms, word repetition on NIPs, and unobtrusive GDA location.

Overall, problems for nutrition labels emerged in two ways – readability and interpretation. Each component on a nutrition label could be more readable and consumers could be educated about nutrition. Some suggestions are made to confront these difficulties and barriers.

I conclude that hypothesis 4 is not disproved. Thai nutrition labels require high literacy and numeracy. Beyond the hypothesis, this thesis also found more information for improving nutrition labels and these five barriers are discussed above.

Research Question 5	How do socio-demographic factors associate with nutrition label experiences and with food choices?
Hypothesis [5A]	Some population sub-groups are more likely to use nutrition labels than other subgroups.
Hypothesis [5B]	People with more experience of nutrition labels will have better food choices.

Research question 5 is investigated in the paper presented in Chapter 6. The data derive from the 8-year (2013) follow-up of the large nationwide Thai Cohort Study (TCS, n=42,750). This study analysed the association between nutrition label experience (read, often use, and good understanding) and socio-demographic factors (sex, age, location, region, religion, household size, education, occupation, and monthly income). More than half of the participants reported they read the nutrition labels (89.0%), have good understanding (69.5%), and frequently use the information (64.4%). Females, older age groups, rural dwellers, and southern region residents were more likely to read nutrition labels ($p<0.001$). Religion, household size, education level, occupation, and monthly income were not associated with reading nutrition labels.

For understanding nutrition labels there was no difference between sexes. But other sociodemographic factors were strongly associated with reading, understanding or using nutrition labels in Thailand. For example, older age groups, university educated, rural dwellers and southern residents were all much more likely ($p<0.001$) than their respective counterparts to report good understanding of nutrition labels. Religion and household size had no linkage to understanding nutrition labels. But occupation was important and professionals were more likely ($p<0.001$) than other occupations to report understanding nutrition labels. Those with monthly incomes of more than 30,000 baht showed significantly better understanding than the low-income control group (<10,000 baht).

Use of labels also varied with some sociodemographic associations. Females, older age groups and professionals were all more likely ($p<0.001$) to use nutrition labels than their counterparts. There were no difference for label use according to location of residence, education levels, household size, and monthly income.

Thailand appeared to be well advanced in the nutrition transition from agrarian to industrial processed foods. The response to research question 5 focused on food choices related to the transition, tracking three industrial foods (instant foods, carbonated soft drinks, sweet drinks) and one minimally processed "modern Asian food" (milk). The four transition-indicator foods thus included three (unhealthy) processed foods high in sugar and sodium and one (healthy) food. Participants reported frequent consumption of indicator foods – instant foods (7.0%), soft drinks (14.6%), other sweet drinks (40.7%), and milk (45.5%).

Socio-demographic factors associated with processed food consumption. Females, older age groups, and rural dwellers were all less likely to frequently consume instant foods, soft drinks, and sweet drinks. Higher monthly income participants tended to consume less processed food.

Nutrition labels were associated with consumption of indicator foods. Participants who read, had good understanding and frequently used nutrition labels had lower odds of unhealthy food intake and higher odds of healthy food intake. These odds for unhealthy foods were protective and significant as follows: instant foods (OR 0.63, 95%CI 0.56-0.70), "carbonated" soft drinks (OR 0.56, 95%CI 0.52-0.61) and sweet drinks (OR 0.79, 95%CI 0.74-0.85). In contrast the odds for healthy food intake were significantly increased for milk (OR1.87, 95%CI 1.74-2.00).

I conclude that hypothesis 5A is not disproved. Sex had no association with understanding of nutrition labels but other sociodemographic factors were associated with label reading or use.

I conclude that Hypothesis 5B is not disproved. Participants with more nutrition label experience (read, understand, frequent use) were less likely to consume unhealthy foods and more likely to drink milk.

Research Question 6 How does nutrition label experience relate to obesity and nutrient-related NCDs (high blood pressure, high blood lipids)?

Hypothesis [6] Proportions of nutrition label users in groups with obesity and nutrient-related NCDs are higher than among people without the problem.

Research question 6 is investigated in the paper presented in Chapter 7. Thailand now faces serious population health problems due to the increasing prevalence of obesity and nutrient-related NCDs including high blood pressure and high blood lipids. Nutrition labels are an education tool aiming to promote healthy eating and combat such health problems for the last two decades. But we know little about the proportion of nutrition label users among people with

these NCDs. The data for investigating this research question derive from the 8-year (2013) follow-up of the large nationwide Thai Cohort Study (TCS, n=42,750) as described for the previous research question.

The analysis for research question 6 is focused on the proportion of nutrition label users in relation to three nutrient-related health problems (high blood lipid, high blood pressure, and obesity) and their associations. From the 2013 survey, the proportion of nutrition label users was 60.5% in participants with high blood pressure, 60.6% in participants with high blood lipid, and 61.5% in participants with obesity (BMI ≥ 25). Among people without high blood pressure or high blood lipids, the nutrition label user proportion was 65.4% and for people with normal (BMI 18.5-23.0) it was 66.1%. This study found an association between nutrition label experiences (read, understand, and use) and nutrient-related NCDs and obesity. Participants with no nutrition label experience (not read regardless of understand and use) are more likely to report nutrient-related NCD of high blood pressure (OR 1.33, 95%CI 1.17-1.51), high blood lipids (OR 1.26, 95%CI 1.14-1.39), and obesity (OR 1.23, 95%CI 1.13-1.33). However, we also noted that the impact of nutrition label utility on long-term health outcomes should be further investigated when longitudinal data is available.

I conclude that Hypothesis 6 is disproved. The proportion of nutrition label user is lower among the diseased or obese groups than the normal cohort members. Participants, who read, understand, and frequently use nutrition labels have significantly fewer diet-health problems.

8.3 Limitations and strengths of this thesis

The main advantage of this thesis is that it uses a combination of methods resulting in a pioneering historical review, substantive qualitative field studies and quantitative analysis of a large-scale nationwide epidemiological cohort. This triangulation of research on Thai consumers, nutrition labels and processed foods would be expected to increase the validity of the information. This helps to explain consumer behaviour and related factors from many perspectives. However, each study has some limitations and strengths to consider.

The historical study (Chapter 3) was constrained by destruction of old documents before they could be scanned into electronic form. This happened with one archival repository that potentially contained relevant material. In addition, some rare pictures of old processed food advertisements were ruined by the floods of 2011. However, the strength of this study is also related to access, which was unrestricted and successful for a wide variety of historical source material. Information identified included rare books, old newspaper articles, and notifications of laws. This study also gained valuable information from Thai experts who were involved in drafting nutrition labelling laws. All collected information allowed us to understand the

evolution of nutrition labelling in its historical context which in turn explained both why and how the current situation developed in Thailand. So the historical study strengthens the thesis.

For the qualitative research (Chapters 4 and 5), the study was based on a relatively small number of participants (n=34) and was not intended to be statistically generalized to the whole Thai population. However, data were self-validating by the process social scientists call "saturation" whereby some answers constantly recur and yield stable in-depth information (42). Qualitative interviews allowed us to explore individual lifestyles and health concerns, especially important for obtaining information from less educated participants.

There was one other feature that was very useful and which probably increased the volume and validity of the information obtained. The feature relates to the culture and language of the researcher who is a Thai national fluent in her first language. Accordingly, the qualitative research was never constrained by confusion or misunderstanding of culture or language. Furthermore, the researcher could explore nuance and subtlety that would not be apparent to a non-Thai investigator. This role as a cultural insider confers emic status on the investigator who then can get closer to the truth than etic (cultural outsider) counterparts (227).

For the quantitative research (Chapters 6 and 7), questions were introduced on labelling in 2013 at the 8-year follow-up and occupied half a page or 5% of the 10 page questionnaires. This space constraint was partly offset by incorporating and analysing other collected data that occupied 35% of the questionnaire, dealing with sociodemographic attributes, food choices, and health status – topics that covered several pages. The sample of distance learning Open University Thai adults in the cohort may not generalize well to the Thai population. TCS participants were better educated than the general population and this restricted information about the influence of education on utility of nutrition labelling. However, TCS results can show what Thailand will be like in the future when the general population is better educated than now. Fortunately these data are based on responses to mailed questionnaires (self-administered) and distance learning students can do this well.

Regarding health status, analysis of survey data was limited to only three diet-health problems (obesity, high blood pressure, and high blood lipid) due to the number of diagnosed cases. For kidney disease, which may connect to looking for sodium content on nutrition labels, the cases are too few in number to allow for multiple logistic regression analysis. Results allow us to report 2013 cross-sectional associations between nutrition label experience and various reported health problems but longitudinal diet-health data are not available yet.

One other feature of the qualitative and quantitative data obtained for this research is that both datasets are relatively large within the usual constraints of the method used. This is helpful for gaining confidence in the results and is particularly important in conferring statistical power on the many estimates of epidemiological associations in the quantitative TCS report. Study size

should therefore be considered a strength of the quantitative research, boosting the statistical significance of the epidemiological measurements. And the substantial data size, which is somewhat larger than usual for such qualitative research, also confers high descriptive power for beliefs, understanding and behaviours explored.

8.4 Future research

To make the appropriate changes to future nutrition labels, Thailand needs more nutrition label research focused on both nutrition labels and consumers. We need to investigate the utility of each element of Thai nutrition labels, and we need to understand the influences of nutrition labels on consumer eating choices and health status.

Consumer eating and lifestyle have been transformed over the last two decades but the reference values for nutrition labelling are still the same. Recommended Daily Intakes (RDIs) and standardized serving sizes need to be revised and need to respond to nutritional problems as they prevail in the Thai population now. Also, the new standards have to work closely with industry and take account of the ongoing nutrition transition.

Nutrition label design influences consumer reading behaviour but self-reported data on nutrition labels may not be enough to gain deep information for improving the design. It is also difficult to evaluate consumer attention and response to label components (228). Further Thai research could adopt new methods such as “eye-tracking technology” to measure visual attention and this will help us understand consumer attention and cognitive processes, leading to a better label design.

For more understanding of consumer behaviour, further research requires more comprehensive questions with a large number of participants. Questionnaires would include more in-depth information on basic nutritional knowledge, nutrition label tests, health status, and food recall. These would help researchers understand the association between consumer knowledge, background, health motivation, nutrition psychology, nutrition label design and use behaviour. These are benefits expected from improved consumer psychological and nutrition education.

Influences of long-term use of nutrition labels on health outcomes are still questioned. Longitudinal studies on the effects of labels on food choices are required to clarify the temporal direction of influences connecting labels and health. Further studies could be performed in collaboration with the Thai Cohort Study to explore this unanswered question.

8.5 Significance of this thesis

Information on nutrition label development in Thailand published in international journals was not available when this thesis was planned and executed. Some information had been published in Thai without multivariable analysis or other adjustments for confounding. There was also limited unpublished information as university theses on various aspects of the topic and in conference posters reporting market surveys of packaging and consumer studies of NIP and GDA.

This thesis appears to be the first organized historical record of the Thai processed food industry and related food and nutrition labelling. Such an integrated understanding of the historical context is a significant advance in our knowledge. This information is now available in a published international journal article as an open access Food Policy paper. This paper is presented in Chapter 3 and more historical information is included in the Introduction (Chapter 1) and Literature Review (Chapter 2) of this thesis. Future research on nutrition labelling in Thailand will now be able to take account of the historical record and this should help to frame better questions. Furthermore, future researchers will understand better the variety of national and international influences and the challenges and tensions that have a long historical imprint.

Other components of the thesis, particularly the qualitative in-depth interview research (Chapters 4 and 5), begin to address the challenges and lay a clear pathway for the future. Thai policy makers have been able to appreciate consumer difficulty with nutrition labels via qualitative research reported from other countries. But consumer interviews about nutrition labels had never been reported in Thailand. It appears that this thesis maybe the first published qualitative study of this topic in Thailand and it provides local insight into consumer difficulties with nutrition labels.

This information is significant and timely because Thai nutrition labelling requires substantial revision to improve consumer understanding and utility. The labels must become more readable and the information presented must be easier to interpret and focused on current nutritional challenges posed by the ongoing nutrition transition and the changing food behaviours. The data provide information on problems never mentioned before, such as confusing nutrition labels with other labels, repeated words, unobtrusive location of GDA, and consumer lack of motivation (even if educated) when not interested in nutrition. Policy makers should be aware that some consumers take little interest in nutrition. This is significant as it indicates that education alone will not be enough as many consumers lack motivation to read the labels.

The quantitative component of research for this thesis is on a large nationwide scale due to the connection with the Thai Cohort Study. The analysis revealed an association among nutrition label experience (read, understand, use), sociodemographic factors, and processed food

consumption. These findings are significant for Thailand, providing new information at the population level and suggesting that transitional food choices may be improved when there is understanding and use of nutrition labels. It is apparent that socio-demographic factors will be important influences on future strategies for nutrition labels in Thailand. The analysis also contributes information about nutrition label use in relation to diet-health diseases that have not been investigated in large Thai populations. These topics need more work to understand how to integrate the information into future promotional campaigns.

8.6 Public health implications

The findings of this thesis have public health implications for Thailand. First, by providing historical information on the context and genesis of nutrition labelling, future research on this topic can be more relevant and aware of potential tensions related to international trade. Second, by showing what consumers want, the research points the way to improvements needed for future labels. Third, the information obtained from the fieldwork and from the TCS data reveals the problem of aware (unmotivated) nutrition label non-users and the potential for education to better link nutrition and health. This would increase the utility and impact of nutrition labels in transitional Thailand. More details on the implications are given below.

8.6.1 Scientific support for food labelling

The historical study showed Thailand is now a large global food trader with considerable international experience of food and nutrition labels. But Thailand is also a developing country and is scientifically unequal when compared to the USA or EU. Such inequality limits the production of defensible supporting evidence for labelling reforms if they are challenged through the WTO as Technical Barriers to Trade. This happened when the attempt to introduce multiple traffic light nutrition labelling was defeated in 2006.

The thesis also shows how nutrition labelling relates to both public health and international trade and politics. Researchers on this topic need to understand the history and context as they seek ways to improve the impact of nutrition labelling in Thailand. They also need to be aware that Thailand should match its global food trade eminence with a similar high standard of supportive food science and local consumer protection. That it does not make the required investments is a consequence of being a developing economy and shows that even for a food trader of Thailand's experience and importance the infrastructure to succeed internationally is yet to appear and is urgently needed.

8.6.2 Improvement of nutrition labelling

The qualitative research revealed that current Thai nutrition labels need to be improved. Details emerged on the nature of the problems. The implications were that nutrition labels need

appropriate font size, less repetition, less clutter, more distinctive design, and better location. This research leads on to the need for more sophisticated measurement of perception and cognition in relation to nutrition labels of the future.

8.6.3 Nutrition label promotion

The thesis research reveals barriers and difficulties with implications for the promotion of better nutrition using nutrition labels as the information channel. The quantitative epidemiological research showed that frequent nutrition label experiences (read, understand, and use) associated with better eating choices (less unhealthy foods, more healthy foods). The implications are that nutrition labelling is reaching some of the population to good effect. But it will be necessary to motivate consumers and boost population belief connecting nutrition and health. People with diagnosed diet-health disease should be encouraged to use nutrition labels to assist their food choices. Consumers can be more selective when choosing foods and can be better informed about the ongoing nutrition transition and the risks that come with it.

Information Technology is already boosting consumer knowledge. The qualitative research reported in this thesis found that consumers use the internet and social media as knowledge sources for food choices. Applying social media to nutrition label promotion and campaigns would be another way to educate consumers. Developing mobile applications and generating messages or pictures would be another way that Information Technology can help consumers more easily understand information on nutrition labels in the future.

8.6.4 Nutrition labelling and health

Food prepared at home in Thailand is now being replaced with ready-to-eat and processed food containing high sugar, fat, and sodium and this links to pandemic obesity and nutrient-related NCDs. The thesis research found associations between nutrition label experience and health status. The proportions of nutrition label users in groups with obesity and with nutrient-related NCDs are lower than in normal groups. The implications are that obesity and NCD risk groups require more education so that nutrition labels can assist their food choices. These groups already have health motivation to change their eating behaviour and increase their use of nutrition labels but are limited by their knowledge level. Health services, especially diabetic and hypertension clinics, should prepare and provide more nutrition label information for this group. Longitudinal research in Thailand on nutrition label behaviour and health impact is needed.

8.7 Scientific contribution

Some elements of the thesis make a contribution to science. For example, the historical paper reveals the evolution of nutrition labelling in Thailand and that information frames the research

agenda today. This contribution goes beyond Thailand and shows other countries one pathway to understanding their situation with nutrition labels.

Another scientific contribution emerged from the qualitative study in relation to educated non-users who lack motivation to use the labels. This group had not been clearly identified before although they form a potentially large part of the future problem and fit well in the Health Belief Model used for the qualitative study. The technique used for this study component included open-ended questions and these were very useful and should be employed in future research.

The quantitative epidemiological study revealed positive linkages between good food choices and nutrition label experience. Also, cross-sectional associations between nutrition label experience and lower prevalences of obesity and nutrient-related NCDs were found. This is encouraging and suggests that longitudinal research could lead to scientifically justifiable population interventions. Follow-up in the TCS or similar longitudinal health research with other groups should resolve questions about final benefits of improved nutrition labelling in Thailand. This is important for Thailand and for many of the other countries at a similar stage of nutrition transition. Nutrition labelling has substantial potential to benefit populations confronting obesity and nutrient-related NCDs.

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APPENDIX A

CONFERENCE PRESENTATIONS: POSTERS AND ABSTRACTS

1. Rimpeekool W, Seubsman S, Banwell C, Kirk M, Yiengprugsawan V, Sleigh A. Use of nutrition labels among educated Thai adults: socio-demographic factors and motivations. *The 12th Asian Congress of Nutrition (ACN2015)*; 14 - 18 May 2015; Yokohama, Japan, 2015. (Poster presentation)

Australian National University

Use of nutrition labels among educated Thai adults: socio-demographic factors and motivations

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Introduction

Nutrition labels have been used on Thai food packaging as a tool to promote healthy eating since 1998. Thai adult behaviour towards nutrition labels has rarely been investigated.

Our research includes sub-studies on Thai nutrition label usage in relation to socio-demographic factors, attitudes, motivations , difficulties and barriers in interpretation.

In this study, we
- investigated association between socio-demographic factors and nutrition label use frequency
- explored motivations that increase likelihood of using nutrition labels to make decisions about foods

Methods

Quantitative

This quantitative study is a part of an overarching research project entitled "the Thai Health-Risk Transition: a Thai Cohort Study (TCS)", a large national cohort of distance-learning students from Sukhothai Thammathirat Open University. A cohort survey was conducted in 2013 with 42,785 members. Questions included use of nutrition labels by socio-demographic factors.

Qualitative

Semi-structured qualitative interviews were performed using open-ended questions with 34 participants (14 Bangkok TCS and 20 Ranong provincial non-university participants) to explore motivations behind likelihood of using nutrition labels. Each interview lasted around 30-45 minutes and was recorded with audio-video equipment. This study's protocol has been considered and approved by the Australian National University Human Research Ethics Committee (Protocol 2013/148).

Results

Quantitative results – Demographic factors

Thai Adults (N=42,664) reported frequency of using nutrition labels.

In general, adult respondents 89% had seen and read nutrition labels. 64.4% were frequent users. Only 15.2% reported fully understanding the information on nutrition labels.

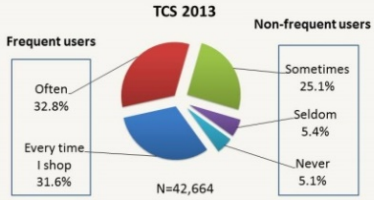

Table 1 Association between socio-demographic factors and frequent use of nutrition labels, Thai Cohort Study, 2013

Factors	n (%)	Often use nutrition labels [a] %	Adjusted Odds Ratio (95% CI)[b]
Sex			
Male	19,330 (45.2)	58.7	Ref
Female	23,455 (54.8)	69.1	1.66 (1.59-1.74)***
Age groups			
≤ 35	14,267 (33.4)	62.3	Ref
36-45	17,048 (39.9)	65.2	1.21 (1.15-1.27)***
46-50	5,748 (13.4)	64.8	1.23 (1.14-1.32)***
>50	5,722 (13.4)	66.7	1.41 (1.31-1.51)***
Location			
City/town	23,446 (55.3)	63.4	Ref
Countryside	18,936 (44.7)	65.6	1.03 (0.99-1.08)
Region			
Bangkok	6,742 (15.8)	60.4	Ref
Central-east	13,115 (30.7)	61.9	1.08 (1.02-1.16)*
North	8,592 (20.1)	67.7	1.42 (1.32-1.52)***
Northeast	8,965 (21.0)	66.4	1.35 (1.25-1.45)***
South	5,371 (12.6)	66.9	1.35 (1.25-1.46)***
Household size			
1-2	8,657 (20.5)	63.5	Ref
3-4	20,170 (47.7)	64.3	1.00 (0.95-1.06)
> 5	13,484 (31.9)	65.2	1.05 (0.99-1.12)
Education			
< Bachelor	8,622 (20.3)	63.5	Ref
Bachelor or higher	33,940 (79.7)	64.6	0.96 (0.91-1.02)
Monthly income (Baht)			
≤ 20,000	25,234 (59.6)	64.3	Ref
20,001-30,000	9,234 (21.8)	64.2	1.01 (0.95-1.06)
> 30,001	7,853 (18.6)	64.9	1.01 (0.95-1.08)
Occupation			
Workers	8,000 (18.8)	61.9	Ref
Managers	6,023 (14.2)	64.6	1.08 (1.00-1.16)
Professionals	11,228 (26.4)	68.0	1.17 (1.10-1.25)***
Office assistants	13,068 (30.8)	62.2	0.98 (0.93-1.04)
Not working/ Others	2,801 (6.6)	65.0	1.06 (0.96-1.16)
Uncertain	1,370 (3.2)	68.6	1.25 (1.10-1.41)***

[a] 'often use' include participants who 'often' and 'every time' use nutrition labels
[b] adjusted by sex, age, location, region, household size, education, income, and occupation
* P<0.05, ** P<0.01, *** P<0.001

Qualitative results - Motivations

Most interviewees who used nutrition labels were motivated by perceived susceptibility to sickness or severity of existing health issues in themselves or surrounding persons. Examples are given below:

Negative results from health check-up and medical diagnosis

> *"Three years before, I ate normally. I liked deep-fried food and squid. My turning point was a health check-up.*
> *Before this, my age was not too high so I did not mind [about food choice]. I was not a fat guy. After health check-up, I found that my blood cholesterol was too high."*

(male, age 36, nutrition label user)

At risk of a diet-related health issue

> *"Recently, I begin to control my weight. After I got pregnant, my weight did not decrease even though I ate the same.*
> *... For me, it is important because if I get diabetes, many bad effects will come to me."*

(female, age 29, BMI 24.84, nutrition label user)

Other people's experiences or illness

> *"Because I am afraid of illness and obesity. ... They [public health service mobile unit] came to set up a booth.*
> *They have a blood check-up service, blood pressure measurement, and also giving hospital brochure. ... Many food sellers went to get a check-up. Most of them have diabetes and high blood pressure."*

(male, age 40, nutrition label user)

Conclusion

Consumer use of nutrition labels was high in this mostly university educated study sample. Females, older age, and professionals are more likely to often use nutrition labels. Despite more variety of media impacting eating lifestyles, urban Bangkokians were less likely to be aware, or use nutrition labels than rural residents.

For motivation, participants easily become nutrition label users when they perceived adverse health problems beyond other factors such as price, brand, taste. We found that current advertisement did not have enough power to awaken consumers in using nutrition labels.

Thai government policy makers should consider more public education campaigns to awaken and enable consumers to make more fully informed and efficient food purchasing decisions.

Acknowledgement
This study was supported by the International Collaborative Research Grants Scheme with joint grants from the Wellcome Trust UK (GR071587MA) and the Australian National Health and Medical Research Council (NHMRC, grant No.268055). It was also supported by a global health grant from the NHMRC (585426) and by a Thai Studies Field Research Grant by the Royal Thai Embassy and the Asia Institute, University of Melbourne. We also thank Thai Cohort Study staff of Sukhothai Thammathirat Open University and Tesco Lotus Supermarket in Ranong province.

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2. Rimpeekool W, Banwell C, Seubsman S, Kirk M, Yiengprugsawan V, Sleigh A. Motivations and barriers of using nutrition labels in Thai consumers. *2015 RSPH student conference*; 19 October 2015; Australian National University, Canberra, Australia, 2015. (Oral presentation)

Introduction/Background: Nutrition labels have been used on Thai food packages since 1998 but there is little information on Thai consumer responses to the labels. To understand the impact of nutrition labels, Thai consumer responses towards motivation and barriers are required. The study aimed to provide the important qualitative information for improving Thai nutrition label promotion and related educational strategies.

Methodology: Semi-structured qualitative 45 minute in-depth interviews using open-ended questions were performed with 34 participants (14 urban TCS and 20 non-TCS rural participants) to explore motivations and barriers relating to use of nutrition labels. Real snack packages were used and interviews were video recorded and analysed by Atlas.ti.

Results: Overall, most (25 participants) reported that they were aware of nutrition labels but only one-third (10 participants) used, and derived any benefit from them. We found that considered use of nutrition labels reflected an interplay between consumers' knowledge, attitude, and beliefs. We identified four difficulties (low awareness, suspected truthfulness of information, low literacy and numeracy, and insufficient nutrition knowledge), and five barriers (confusing labels, small font size, technical terms, repeated words, unobtrusive location) that impeded consumer use of nutrition labels.

Conclusions: To increase the use and usefulness of nutrition labels, we suggest practical ways to amend promotional strategies. Reducing those identified difficulties and barriers would enhance consumer understanding of information on nutrition labels. Results of this study identify issues that contribute to the better design of nutrition labels and will contribute to better nutrition education strategies in the future.

3. Rimpeekool W, Seubsman S, Banwell C, Kirk M, Yiengprugsawan V, Sleigh A. Evolution of Thai food and nutrition labelling policy: health transition, consumer protection, and food industry. *21th Biennial Conference (Asian Studies Association of Australia, ASAA 2016)*; 5-7 July 2016; Australian National University, Canberra, Australia, 2015. (Oral presentation)

Today Thai food products are increasingly recognised by global consumers and associated with high quality safe foods. However, to get to this point Thailand underwent a transition from a subsistence agricultural society to a modern middle-income state with a large food industry producing for domestic consumers and the world market. Many challenges and tensions at play in the evolution of Thai food labelling have never been analysed. Our study is the first to review the historical evolution of Thai food and nutrition labelling policies. A total of 189 documents including government e-database, publications, and archival materials regarding Thai food labelling dated between 1908 and 2014 were examined and analysed. All information was summarized with annotations describing the laws, specific notifications and relevant ancillary information. For over a century Thai food labelling regulations evolved interacting with domestic economic development and international trade. Initially, Thai food labelling protected consumers from adulterated foods especially imports in 1910s. It began to involve international standards in the 1960s when Thailand became a food exporter. Now, nutrition and health influence food labelling. Many regulations and laws have emerged, especially in 1998 (nutrition labelling) and 2011 (GDA labelling). Thai consumers are increasingly aware of nutrients and government measures responded with consumer-friendly label. But domestic protection is in tension with the rules of the global food trade. Future food label policies in many countries will face challenges in balancing consumer protection, free trade agreements, and adherence to international guidelines.

Keywords: food label, nutrition, policy, trade, tension

4. Rimpeekool W, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Impact of nutrition label use and other factors on frequency of sugar sweetened beverage consumption in Thailand. *Australian Epidemiological Association Conference (AEA2016)*; 14-16 September 2016; Australian National University, Canberra, Australia, 2016. (Oral presentation)

Background: Sugar consumption reduction is a priority in many countries. Nutrition labels on packaged foods to reduce sugar intake have been promoted for decades. In Thailand, consumers are often unaware of the sugar content of their sugar sweetened beverages (SSBs) and overweight prevalence is high and rising.

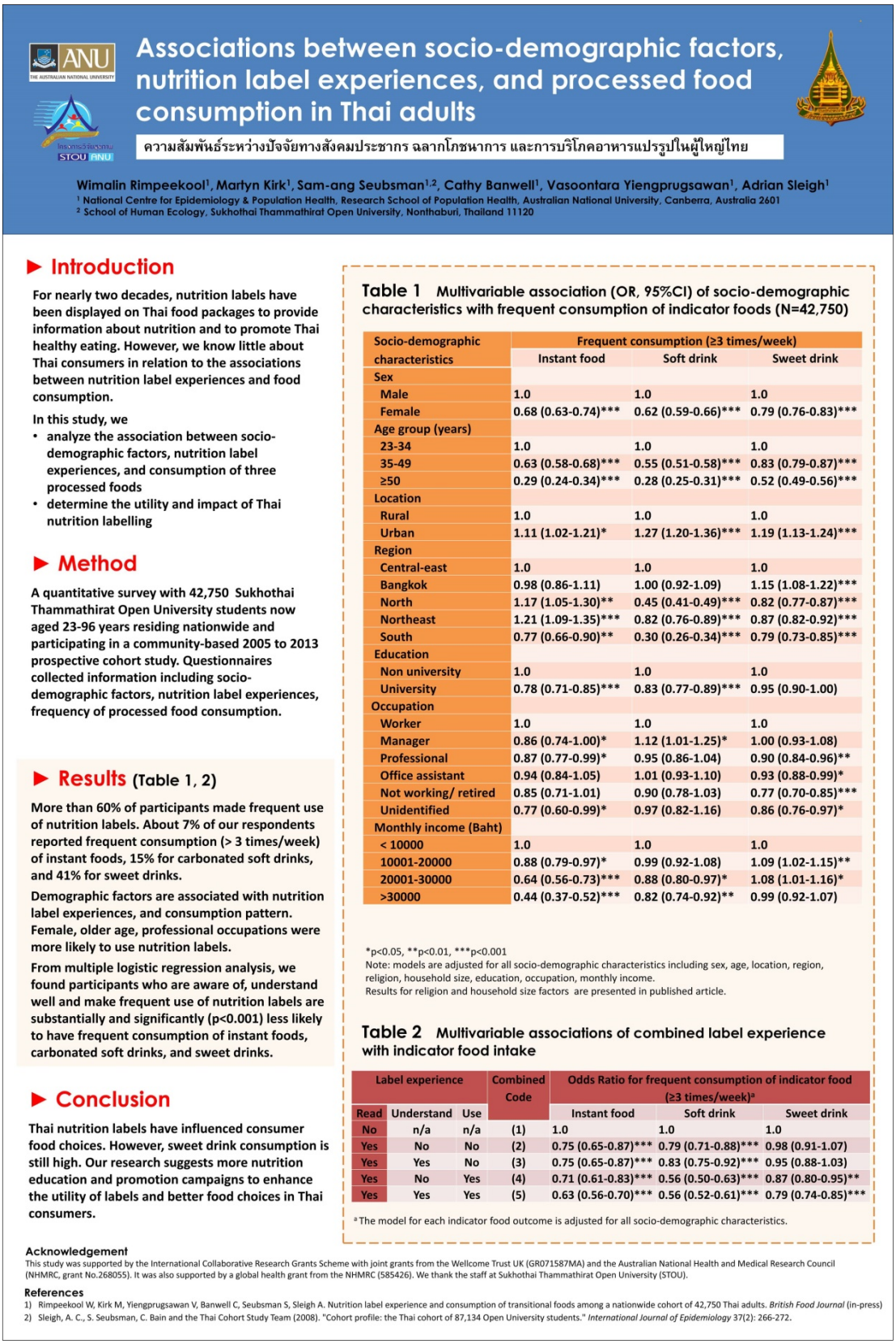
Objectives: To inform nutrition education strategies, we explore factors associated with frequent SSB consumption. We also consider whether nutrition label usage associates with reduced consumption of SSBs.

Methods: We conducted a quantitative nationwide survey in 2013 with 42,750 community-based distance learning adult Sukhothai Thammathirat Open University (STOU) students residing all over Thailand. A questionnaire collected information including socio-demographic factors, height and weight, nutrition label experience, and SSB consumption. Carbonated soft drinks (CD) and other sweet drinks (SD) were analysed separately.

Results: More than 60% of participants use nutrition labels to assist food choices. About 41% of our participants reported frequent consumption of SD and 15% reported frequent consumption of CD. Male, younger aged, obese, urban living, or lower educated participants more often consumed SSBs. Participants with higher education or income consumed less SSBs. Frequent nutrition label use associated with lower odds of frequent consumption of CD (OR=0.66, 95%CI=0.62-0.70) and SD (OR=0.82, 95%CI=0.79-0.86).

Discussion/Conclusions: More than half of participants use nutrition labels to assist food purchasing. Label users consume less SSB but males, urban dwellers, and the obese consume more. Better targeted nutrition education could enhance the impact of nutrition labels by improving consumers' ability to determine the healthiness of their foods.

5. Rimpeekool W, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Associations between socio-demographic factors, nutrition label experiences, and processed food consumption in Thai adults. *The 10th Thailand Congress of Nutrition (TCN2016)*; 18-20 October 2016 Bangkok International Trade & Exhibition Centre, Bangkok (BITEC), 2016. (Poster presentation)



Associations between socio-demographic factors, nutrition label experiences, and processed food consumption in Thai adults

ความสัมพันธ์ระหว่างปัจจัยทางสังคมประชากร ฉลากโภชนาการ และการบริโภคอาหารแปรรูปในผู้ใหญ่ไทย

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► Introduction

For nearly two decades, nutrition labels have been displayed on Thai food packages to provide information about nutrition and to promote Thai healthy eating. However, we know little about Thai consumers in relation to the associations between nutrition label experiences and food consumption.

In this study, we

- analyze the association between socio-demographic factors, nutrition label experiences, and consumption of three processed foods
- determine the utility and impact of Thai nutrition labelling

► Method

A quantitative survey with 42,750 Sukhothai Thammathirat Open University students now aged 23-96 years residing nationwide and participating in a community-based 2005 to 2013 prospective cohort study. Questionnaires collected information including socio-demographic factors, nutrition label experiences, frequency of processed food consumption.

► Results (Table 1, 2)

More than 60% of participants made frequent use of nutrition labels. About 7% of our respondents reported frequent consumption (> 3 times/week) of instant foods, 15% for carbonated soft drinks, and 41% for sweet drinks.

Demographic factors are associated with nutrition label experiences, and consumption pattern. Female, older age, professional occupations were more likely to use nutrition labels.

From multiple logistic regression analysis, we found participants who are aware of, understand well and make frequent use of nutrition labels are substantially and significantly (p<0.001) less likely to have frequent consumption of instant foods, carbonated soft drinks, and sweet drinks.

► Conclusion

Thai nutrition labels have influenced consumer food choices. However, sweet drink consumption is still high. Our research suggests more nutrition education and promotion campaigns to enhance the utility of labels and better food choices in Thai consumers.

Table 1 Multivariable association (OR, 95%CI) of socio-demographic characteristics with frequent consumption of indicator foods (N=42,750)

Socio-demographic characteristics	Frequent consumption (≥3 times/week)		
	Instant food	Soft drink	Sweet drink
Sex			
Male	1.0	1.0	1.0
Female	0.68 (0.63-0.74)***	0.62 (0.59-0.66)***	0.79 (0.76-0.83)***
Age group (years)			
23-34	1.0	1.0	1.0
35-49	0.63 (0.58-0.68)***	0.55 (0.51-0.58)***	0.83 (0.79-0.87)***
≥50	0.29 (0.24-0.34)***	0.28 (0.25-0.31)***	0.52 (0.49-0.56)***
Location			
Rural	1.0	1.0	1.0
Urban	1.11 (1.02-1.21)*	1.27 (1.20-1.36)***	1.19 (1.13-1.24)***
Region			
Central-east	1.0	1.0	1.0
Bangkok	0.98 (0.86-1.11)	1.00 (0.92-1.09)	1.15 (1.08-1.22)***
North	1.17 (1.05-1.30)**	0.45 (0.41-0.49)***	0.82 (0.77-0.87)***
Northeast	1.21 (1.09-1.35)***	0.82 (0.76-0.89)***	0.87 (0.82-0.92)***
South	0.77 (0.66-0.90)**	0.30 (0.26-0.34)***	0.79 (0.73-0.85)***
Education			
Non university	1.0	1.0	1.0
University	0.78 (0.71-0.85)***	0.83 (0.77-0.89)***	0.95 (0.90-1.00)
Occupation			
Worker	1.0	1.0	1.0
Manager	0.86 (0.74-1.00)*	1.12 (1.01-1.25)*	1.00 (0.93-1.08)
Professional	0.87 (0.77-0.99)*	0.95 (0.86-1.04)	0.90 (0.84-0.96)**
Office assistant	0.94 (0.84-1.05)	1.01 (0.93-1.10)	0.93 (0.88-0.99)*
Not working/ retired	0.85 (0.71-1.01)	0.90 (0.78-1.03)	0.77 (0.70-0.85)***
Unidentified	0.77 (0.60-0.99)*	0.97 (0.82-1.16)	0.86 (0.76-0.97)*
Monthly income (Baht)			
< 10000	1.0	1.0	1.0
10001-20000	0.88 (0.79-0.97)*	0.99 (0.92-1.08)	1.09 (1.02-1.15)**
20001-30000	0.64 (0.56-0.73)***	0.88 (0.80-0.97)*	1.08 (1.01-1.16)*
>30000	0.44 (0.37-0.52)***	0.82 (0.74-0.92)**	0.99 (0.92-1.07)

*p<0.05, **p<0.01, ***p<0.001
Note: models are adjusted for all socio-demographic characteristics including sex, age, location, region, religion, household size, education, occupation, monthly income.
Results for religion and household size factors are presented in published article.

Table 2 Multivariable associations of combined label experience with indicator food intake

Label experience			Combined Code	Odds Ratio for frequent consumption of indicator food (≥3 times/week)[a]		
Read	Understand	Use		Instant food	Soft drink	Sweet drink
No	n/a	n/a	(1)	1.0	1.0	1.0
Yes	No	No	(2)	0.75 (0.65-0.87)***	0.79 (0.71-0.88)***	0.98 (0.91-1.07)
Yes	Yes	No	(3)	0.75 (0.65-0.87)***	0.83 (0.75-0.92)***	0.95 (0.88-1.03)
Yes	No	Yes	(4)	0.71 (0.61-0.83)***	0.56 (0.50-0.63)***	0.87 (0.80-0.95)**
Yes	Yes	Yes	(5)	0.63 (0.56-0.70)***	0.56 (0.52-0.61)***	0.79 (0.74-0.85)***

[a] The model for each indicator food outcome is adjusted for all socio-demographic characteristics.

Acknowledgement
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1) Rimpeekool W, Kirk M, Yiengprugsawan V, Banwell C, Seubsman S, Sleigh A. Nutrition label experience and consumption of transitional foods among a nationwide cohort of 42,750 Thai adults. *British Food Journal* (in-press)
2) Sleigh, A. C., S. Seubsman, C. Bain and the Thai Cohort Study Team (2008). "Cohort profile: the Thai cohort of 87,134 Open University students." *International Journal of Epidemiology* 37(2): 266-272.

APPENDIX B

RELATED CO-AUTHOR PUBLICATIONS

1. Mercer R, Young M, **Rimpeekool W**, Marshall A, Hector D, Dickson J, et al. Literature review on the impact of label format on consumers' attention and comprehension for mandated label elements. Food Standards Australia New Zealand: 2013. Available online at https://www.foodstandards.gov.au/publications/Documents/Literature%20review%20on%20label%20format%20-%20commissioned%20report%202013.pdf

REPORT

Literature review on the impact of label format on consumers' attention and comprehension for mandated label elements

Prepared For:
Food Standards Australia New Zealand

Submitted by:
Rob Mercer, Michelle Young, Wimalin Rimpeekool, Dr Al Marshall, Dr Deborah Hector, Jenny Dickson, Dr Rebecca Phillips

Submitted July 2013

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2. Banwell C, Dixon J, Kelly M, Seubsman S, Yiengprugsuwan V, **Rimpeekool W**, et al. Methodological approaches connecting the food system to the urban nutrition transition: fresh food retailing in Thailand. First Mediterranean Conference on Food Supply and Distribution Systems in Urban Environments; 6-7 July 2015; Rome 2015.

Methodological approaches connecting the food system to the urban nutrition transition: fresh food retailing in Thailand.

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ABSTRACT

This paper stems from a 10 year multi-disciplinary, staged research programme with a broad remit to explore Thailand's health and nutrition transition. It focusses on the central role of food retail formats (fresh markets and supermarkets) within the food system in supplying urban populations with healthy, fresh foods. It describes the evidence-based methods a Thai and Australian research team has used to examine the impact of food retail transformations on the health of the Thai population. The team was drawn from multiple disciplines to develop research capable of examining the complex interactive effects of supermarket expansion and fresh market decline. This particular issue, and the multi-dimensional and multi-level approach used for its study, are relevant more widely than in Thailand with the 'supermarket revolution' being of interest to the FAO and development agencies for some time. Ultimately supermarkets have an influence on the nutrition transition across all nations where they have even a moderate presence.

However, the timing and exact nature of the nutrition transition varies from country to country according to government regulatory and foreign investment regimes, while cultural factors like trust in the food source shapes where people shop. Any study of the upstream level determinants of the nutrition transition must, by necessity, involve retail format histories and the accompanying retail planning and foreign investment policies. These studies should also be capable of explaining the role of national and sub-population culinary cultures in mediating what diets citizens will find acceptable, and what food shopping and consumption practices they are willing to alter and which they want to retain.

Drawing on different bodies of evidence, our multi-stage research program has combined four main approaches (described in detail below and in cited papers) which capture data at the micro, meso and macro levels: 1) epidemiological research to measure the associations between dietary risks and outcomes over a decade, 2) case studies of food retail sites using multiple, ethnographic methods, 3) policy analysis based on readings of Thai and English grey and published literature, 4) a social history of Thailand's culinary culture with an emphasis on food procurement approaches over the last century.

The research design and suite of methods used reflect a public health ecology approach. This approach recognises public health outcomes to be the result of dynamics in multiple systems: demographic, cultural, social, bio-environmental, political and economic. It attempts to find plausible pathways between different levels of health determinants, and to use the pathways descriptions as the basis for narratives of policy change.

1

3. Banwell C, Dixon J, Kelly M, Seubsman S, **Rimpeekool W**, Sleigh A. What's Old is New Again: Innovative Policies to Support Thai Fresh Markets within a Healthy Food System. *World Food Policy*. 2016;2(2):51-66.

World Food Policy - Volume 2 Issue 2/Volume 3 Issue 1, Fall 2015/Spring 2016

What's Old Is New Again: Innovative Policies to Support Thai Fresh Markets Within a Healthy Food System

Cathy Banwell[A], Jane Dixon[A], Matthew Kelly[B], Sam-ang Seubsman[C], Wimalin Rimpeekool[A] & Adrian Sleigh[B]

Traditionally, Thais have bought their food from fresh markets. However, recently multi-national supermarket chains have expanded rapidly so that currently, Thais procure food from both modern and traditional retail formats. If Thailand were to follow the Western pattern, supermarkets will become the dominant food retail format.

We present a synthesis of 10 years of multidisciplinary research, examining the contribution of food retail to the Thai nutrition and health transition, to demonstrate that fresh markets provide access to fresh, affordable, nutritious foods. Fresh market shoppers have healthier diets and lower chronic disease risks than other groups.

In the South East Asia context, the protection of fresh markets constitutes a novel intervention to protect and promote nutrition-sensitive retail. This could be achieved through policy action nationally, with monitoring of national and multi-national supermarket chain growth, regionally, with planning to safeguard fresh markets' urban locations, and locally, with the development of food hubs.

***Keywords**: food system, nutrition-sensitive agriculture, food retail, nutrition transition, Thailand*

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doi: 10.18278/wfp.2.2.3.1.4

4. Yiengprugsuwan V, **Rimpeekool W**, Papier K, Banwell C, Seubsman S, Sleigh A. Relationship between eight-year weight change, body size and health in a large cohort of adults in Thailand. *Journal of Epidemiology*. 2016. (In-Press)

Abstract

Overweight and obesity have been shown to be risk factors for a range of non-communicable diseases, especially cardio-metabolic conditions worldwide. But less is known about the effects of weight change on adults' overall health and wellbeing, particularly in transitional low and middle-income countries. This study aimed to assess the relationship between eight year weight change and measures of self-assessed health among Thai adults.

Data were collected from Thai adults aged 25-40 years (n=27,003) enrolled in the Thai cohort Study and surveyed in 2005, 2009 and 2013. We used self-reported weight and height measurements at baseline and 2013 and three standard health questions asked at the two time points (overall health, energy, and emotion) to investigate the effects of weight change on health.

Between 2005 and 2013, 6.0% of participants lost more than 5 % of their baseline weight; 38.5% were stable (-5%<Δ≤+5%); 23.0% slightly gained weight (5%<Δ≤10%); 22.8% gained moderate weight (10%<Δ≤20%); and 9.4% had heavy weight gain (Δ>20%). Moderate (10%<Δ≤20%) and heavy weight gain (Δ>20%) were both associated with an increased risk of reporting 'poor or very poor' overall health in 2013 among participants who had a normal Body Mass Index (Adjusted Odds Ratio, AOR 1.39 [95% Confidence Interval 1.13-1.71] and 1.44 [1.09-1.90]) , were overweight (1.53 [1.01-2.29] and 1.82 [1.04-3.19]) or had obesity (AOR 2.47 [1.74-3.51] and 3.20 [2.00-5.16]) in 2005. Weight gain of over 20% also had a negative impact on energy level among cohort members with a normal BMI in 2005 with AOR 1.36 [1.11-1.65] and among participants with obesity in 2005 AOR 1.93 [1.38-2.71]. For those who were underweight, had a normal BMI, and had obesity at baseline, weight loss of more than 5% associated with reporting emotional problems. Excessive weight gain impacted on participants who were underweight or had obesity at baseline.

Our study found that weight change, in particular weight gain, was associated with negative health outcomes and this effect appeared to increases at higher levels of body size. Findings would be useful to promote weight maintenance and healthy lifestyles.

APPENDIX C

DOCUMENTS USED IN INTERVIEWS

This appendix contains all documents used for 34 in-depth interviews including the list of questions, information sheet, and informed consent (Chapters 4 and 5).

Interview question guideline

This is an interview question guideline submitted to Australian National University Human Research Ethics Committee. Each participant was face-to-face interviewed for 30–45 minutes using semi-structured questions with open-ended approach adapted from Grounded Theory.

Part 1 General

1) Tell me about your food shopping; what kind of foods do you purchase? and how you decide what to buy?
2) How unhealthy or healthy do you consider to one food product compared to another product? (KAB)
3) Have you ever had any training in nutrition? (KAB)
4) Do you believe that what you eat can make you sick? (HBM)
5) Do you believe your food choices can prevent illness? (HBM)
6) What kinds of food that you do not buy? How do your beliefs influence your purchasing? (HBM)

Part 2 Knowledge and perception on nutrition labelling

Note: For 3)-7), participant is given food product examples that contain both NIP and GDA nutrition labels for use in questioning. Accuracy of answers, behaviors, and time use will be noted. (VDO)

7) Do you know about nutrition labels? Which label is called "GDA" nutrition label?
8) Why do you read/ not read nutrition labels? How often you use nutrition labels?
9) What is your motivation/barrier to read the nutrition information and GDA nutrition label on food package? Is there something that stops you from reading nutrition labels (probe for colour, size, print, types of information)?
10) What nutrient information you always look for?

Part 3 Understanding and behavior

11) What could you tell about a product by looking at this label (nutrition information panel and GDA label)? (words and numbers)
12) Do you know the nutrients related to health outcome/disease? (energy/ sugar/ fat/ sodium) Could you give the example?
13) Which product do you think would be the best for people with diabetes by lowering sugar intake/ who want to reduce their risk of blood pressure by lowing sodium intake?
Note: Give two food samples to participant to choosing.

Part 4 Attitude

14) How important is the mandatory labelling information to you?
15) Which nutrition label format is easier to understand?
16) How accurate is information on nutrition labels in your thinking?
17) What do you like and not like about nutrition information panels and GDA labels?

Part 5 Opinion and suggestion

18) What is your expectation about nutrition labels?
19) How could nutrition labelling be improved for your better understanding?

.....

Information Sheet

Nutrition Labelling of food for Promoting Consumer's Health in Thailand

I want to thank you for participating in my project and taking time to meet me today. My name is Wimalin Rimpeekool, PhD student at Australian National University and I would like to interview you about nutrition labelling. The research is to determine the effect of the current nutrition labelling in Thailand and recommend the appropriate policy for consumer's health in Thailand

This interview will take around 30-45 minutes. If you agree, I will audio and video record our conversation to make sure that I am not missing any detail of your comments because I may not be able to write it down fast enough. All your responses will be confidential and used for the nutrition labelling research only. The information included in my report and any other publications will never identify you.

You may finish the interview or withdraw from this study at any time. If you have any concerns or complaints, you may contact my supervisor A/Prof Sam-ang Seubsman at Sukothai Thammathirat Open University or the Office of Research Integrity at the Australian National University. The telephone and e-mail contact information is as follows:

Contacts

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Human Ecology, Sukothai Thammathirat Open University, Nonthaburi, Thailand
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เอกสารชี้แจงผู้เข้าร่วมการวิจัย

Nutrition Labelling of food for Promoting Consumer's Health in Thailand

ดิฉันขอขอบพระคุณท่านที่เสียสละเวลาเพื่อร่วมให้การสัมภาษณ์ในงานวิจัยของดิฉันค่ะ ดิฉันชื่อ วิมลิน ริมปิกุล เป็นนักศึกษาปริญญาเอกมหาวิทยาลัยแห่งชาติออสเตรเลีย (the Australian National University) ดิฉันมีความประสงค์ที่จะสัมภาษณ์ท่านในหัวข้อวิจัยเกี่ยวกับฉลากโภชนาการ (nutrition labelling) งานวิจัยนี้มีวัตถุประสงค์เพื่อที่จะศึกษาผลของการใช้ฉลากโภชนาการรูปแบบปัจจุบันที่ใช้อยู่ในประเทศไทย และจัดทำข้อเสนอแนะนโยบายฉลากโภชนาการที่เหมาะสมต่อสุขภาพที่ดีของผู้บริโภคไทย

การสัมภาษณ์นี้จะใช้เวลาประมาณ 30-45 นาที หากท่านไม่ขัดข้อง ดิฉันจะขอทำการบันทึกเสียงและวีดีโอการสนทนาครั้งนี้ เพื่อให้เกิดความมั่นใจว่าดิฉันจะไม่พลาดทุกความคิดเห็นและคำเสนอแนะของท่าน เนื่องจากดิฉันไม่อาจจะบันทึกตำสนทนาได้เร็วเพียงพอ ดิฉันขอยืนยันว่าข้อมูลของท่านไม่ว่าจะเป็นรูปแบบใดก็ตามจะถูกปิดเป็นความลับและใช้เฉพาะงานวิจัย ข้อมูลที่บันทึกในรายงานการวิจัยหรืองานวิจัยที่ได้รับการตีพิมพ์จะไม่มีการระบุเฉพาะเจาะจงถึงตัวท่าน

ท่านสามารถหยุดการสัมภาษณ์หรือถอนตัวจากงานวิจัยนี้ในทุกเมื่อที่ท่านต้องการ หากท่านรู้สึกมีความกังวลหรือมีข้อข้องใจ สามารถติดต่อ ผศ.ดร.สำอาง สืบสมาน มหาวิทยาลัยสุโขทัยธรรมาธิราช หรือ สำนักงานตรวจสอบจริยธรรมในการวิจัยของมหาวิทยาลัยแห่งชาติออสเตรเลีย ตามหมายเลขโทรศัพท์และอีเมล์ ดังนี้

ติดต่อ

ผศ.ดร.สำอาง สืบสมาน

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Consent Form

Nutrition Labelling of food for Promoting Consumer's Health in Thailand

Interviewee name/code number ..... Provice .....

Date ..... Time ..... Place of interview .....

I have read the information sheet relating to this study and have been informed that:

The research is to determine the effect of the current nutrition labelling in Thailand and recommend the appropriate policy for consumer's health in Thailand.

This interview will take around 30-45 minutes. If you agree, I will audio and video record our conversation to make sure that I am not missing any detail of your comments because I may not be able to write it down fast enough. All your responses will be confidential and used for nutrition labelling research only. The information included in my report and any other publications will never identify you.

You may finish the interview at any time or withdraw from the study at any time. If you have any concerns or complaints, you may contact my supervisor A/Prof Sam-ang Seubsman at Sukothai Thammathirat Open University or the Office of Research Integrity at the Australian National University.

Do you have any questions about this interview?

Do you give consent for participation in this study of nutrition labelling?

- I agree to participate ☐
- I agree to video record ☐
- I agree to audio record ☐
- I am happy for your video recording to be shown to other people as part of an academic presentation ☐

Name ..... Signature .....

Witness ..... Signature ..... Date .....

Contacts

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เอกสารแสดงความยินยอม

Nutrition Labelling of food for Promoting Consumer's Health in Thailand

ชื่อผู้ถูกสัมภาษณ์/ รหัส ..... จังหวัด .....

วันที่ ..... เวลา ..... สถานที่สัมภาษณ์ .....

ข้าพเจ้าได้อ่านเอกสารชี้แจงรายละเอียดงานวิจัยนี้และได้รับทราบว่า:

งานวิจัยนี้มีวัตถุประสงค์เพื่อที่จะศึกษาผลของการใช้ฉลากโภชนาการรูปแบบปัจจุบันที่ใช้อยู่ในประเทศไทย และจัดทำข้อเสนอแนะนโยบายฉลากโภชนาการที่เหมาะสมต่อสุขภาพที่ดีของผู้บริโภคไทย

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ท่านสามารถหยุดการสัมภาษณ์หรือถอนตัวจากงานวิจัยนี้ในทุกเมื่อที่ท่านต้องการ หากท่านรู้สึกมีความกังวลหรือมีข้อข้องใจ สามารถติดต่อ ผศ.ดร.สำอาง สืบสมาน มหาวิทยาลัยสุโขทัยธรรมาธิราช หรือ สำนักงานตรวจสอบจริยธรรมในการวิจัยของมหาวิทยาลัยแห่งชาติออสเตรเลีย ตามหมายเลขโทรศัพท์และอีเมล์

ท่านมีคำถามหรือข้อสงสัยเกี่ยวกับการสัมภาษณ์หรือไม่?

ท่านยินยอมที่จะเข้าร่วมในงานวิจัยฉลากโภชนาการครั้งนี้หรือไม่?

- ข้าพเจ้ายินยอมที่จะเข้าร่วมงานวิจัยครั้งนี้ ☐
- ข้าพเจ้ายินยอมให้มีการบันทึกวีดีโอ ☐
- ข้าพเจ้ายินยอมให้มีการบันทึกสื่อเสียง ☐
- ข้าพเจ้าอนุญาติให้สามารถเผยแพร่บันทึกภาพวิดีโอของข้าพเจ้าต่อบุคคลอื่น เพื่อใช้ในการนำเสนอผลงานทางวิชาการ ☐

ผู้ถูกสัมภาษณ์ ..... ลายเซ็น .....

พยาน ..... ลายเซ็น ..... วันที่ .....

ผศ.ดร.สำอาง สืบสมาน

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APPENDIX D

THAI COHORT STUDY 2013 FOLLOW-UP QUESTIONNAIRE

This appendix contains the original Thai and translated English questionnaire used in 2013 Thai Cohort Study follow-up. The survey included questions about nutrition label experience, socio-demographic factors, consumption frequency of certain foods, and health status – all used for analyses in Chapters 6 and 7. Also available was an array of repeat measures that were part of the overarching longitudinal Thai Health-Risk Transition Project.

Questionnaire

Thai Health Research Project 2013

Universal codes:

-7 = "Multiple response". It is assigned to data item where **program** detected that **there are more than one checkbox** being checked for any multiple choice questions.

-9 = "Missing value". It is assigned to data item where **program** detected that the data image is **blank.**

addsend

Dear Thai Cohort Study members

TCSID ☐☐☐☐☐ tcsid

With all of your much valued help our Thai Health Research Project has achieved substantial success. Analysing the information you have provided in your questionnaire responses has helped us understand better the risks to Thai peoples' health.

It is now time for us to follow up again on the health of our members. The further information you provide here will help us assess the health of Thai people and be of benefit to all of Thai society. The project follows strict ethical standards and all of your personal information will be held in the strictest confidence. Your name and address will be kept separately from your other data and will only be used to contact you. Your continued involvement in this project is completely voluntary, and if you wish to withdraw at any time please inform us.

If **you are the person whose name appears on the document above** and you are willing to continue participating in this health research project based at Sukhothai Thammathirat Open University please write your name and sign this form below. When you have completed the questionnaire please return it in the envelope included here. You do not need to attach a stamp.

(Name)..... sign1 Date...../...../..... dsign

(Mr/Mrs/Miss ..... sign2 .....)

If you have any doubts or concerns or need more information on the project please contact us on 02-5047780 during business hours. Thanks and regards.

(Associate Professor Sam-ang Seubsman)

Director Thai Health Research Project

This page will be separated and treated as confidential

Your assistance in filling out this form is very important for the success of our research project. We need to know if your name, address or other details have changed from those shown on the front of the envelope.

Have you changed your **name-surname, address or telephone number from those shown on the front cover of this questionnaire?**

Please **place a cross ✕ in the appropriate boxes** ❑. **Please use a blue or black pen**

addch

1 ❑ **Have not changed** name-surname, address or telephone number → **Please go to the instructions at the top of the next page**

2 ❑ **There has been a change** to my personal information as follows

❑ **Name-surname** addch1 ❑ **Address** addch2 ❑ **Telephone number** addch3

Please give details below

First Name..... name1 ..... Family Name ..... sname1 .....

Family Name..... add1n1 ..... Moo Ban ..... add1n2 ..... Soi ..... add1n3 .....

Road..... add1n4 ..... Tambol/Kwang ..... add1n5 ..... District/Khet ..... add1n6` .....

Province..... add1n7 ..... Postcode ☐☐☐☐☐ add1zip

Home Tel..... add1htel ..... Office Tel..... add1wtel .....

Mobile..... add1mtel ..... Email..... email .....

Other contact person (if we cannot contact you)

First Name..... name2 ..... Family Name ..... sname2 .....

Family Name..... add2n1 ..... Moo Ban ..... add2n2 ..... Soi ..... add2n3 .....

Road..... add2n4 ..... Tambol/Kwang ..... add2n5 ..... District/Khet ..... add2n6 .....

Province..... add2n7 ..... Postcode ☐☐☐☐☐ add2zip

Home Tel..... add2htel ..... Office Tel..... add2wtel .....

Mobile..... add2mtel .....

Please keep a record of your member code (TCSID) from the front of the envelope to use as a reference in any future communication with the Thai Health Risk Transition Study

This page will be separated and treated as confidential

Instructions: Use **a blue or black pen to put a cross** ✕ in the ☐ next to the selected choice to get to this image ☒. Select one answer **except** when told "You may choose **more than** one answer." For numeric answers, write number(s) **clearly** in the box(es) - one number per box. eg [2][4]

A Information on you and your work

A1 Sex a1 ☐1 Male ☐2 Female

A2 When were you born *(according to your Citizen ID Card)*

[ ][ ] / [ ][ ] / [ ][ ][ ][ ]

a2bd a2bm a2by

(eg [1][5] / [0][1] / [2][5][1][3] *if born 15 January 2513 please put)*

A3 Where is your current residence located?

a3 ☐1 Countryside ☐2 City/town

A4 How long have you lived at your current residence?

a4 [ ][ ] **years** *(eg if you have lived there 3 years please write* [0][3] *Years)*

A5 How far in kilometres is it from your current residence to each of the following places? (kms)

Place \ Distance	Less than 5 kms	5-10 kms.	11-20 kms	More than 20 kms
Supermarket/ minimart a5n1	1	2	3	4
ATM a5n2	1	2	3	4
Hospital a5n3	1	2	3	4
Post office a5n4	1	2	3	4
District office a5n5	1	2	3	4
School a5n6	1	2	3	4
Traffic light a5n7	1	2	3	4
Fresh market a5n8	1	2	3	4
Bus stop a5n9	1	2	3	4
Motorcycle taxi stand a5n10	1	2	3	4
Internet café a5n11	1	2	3	4

A6 In the past 5 years, has the area where you currently live become more urbanized?

a6 ☐1 Yes ☐2 No ☐3 Unsure

A7 How many people live at your current residence?

a7 [ ][ ] **people** *(including you)*

(eg if there are 3 people please put [0][3] *)*

A8 At present do you have any paid employment?

a8 ☐1 Yes ☐2 No → Go to question **A14**

A9 At present how many hours of paid work do you do per week? [ ][ ][ ] **hours/week**

a9

A10 How secure do you feel about your job or career future in your current occupation?

a10 ☐1 Not at all secure ☐2 Moderately secure ☐3 Secure ☐4 Extremely secure

A11 Which of the following best describes your primary occupation? *(Please choose only one answer)*

a11
- ☐1 Senior manager
- ☐2 Middle manager
- ☐3 Professional (eg accountant, doctor, academic)
- ☐4 Skilled worker (eg carpenters, hairdresser, craftsman)
- ☐5 Office assistant
- ☐6 Agricultural or fisheries worker
- ☐7 Factory or assembly worker
- ☐8 Elementary worker (non-physical) (eg courier)
- ☐9 Elementary worker (physical) (eg construction)
- ☐10 Other, please explain.....a11x.....

❶

A12 In the past 12 months, have you experienced uncomfortably hot temperatures in your workplace arising primarily from one of the following causes?

(Please choose only one answer)

a12
- 1 I am not bothered by high temperatures at work
- 2 Heat from working outdoors
- 3 Heat from machinery or production processes
- 4 Heat from working in a vehicle
- 5 Heat from work in a stuffy/poorly ventilated building
- 6 Other, please explain..... a12x .....

A13 In the past 12 months, when you experienced the workplace heat exposure described *in question A12*, **what was your reaction?** *(You may choose more than one answer)*

- a13n1 No reaction
- a13n2 Mild discomfort
- a13n3 Prickly heat/ heat rash
- a13n4 Headache/migraine
- a13n5 Nausea or vomiting
- a13n6 Severe dehydration
- a13n7 Dizziness/ fainting with sweating
- a13n8 Heat stroke (disorientation /elevated body temp but no sweating)
- a13n9 Muscle cramps
- a13n10 Low blood pressure

A14 What is your personal average monthly income?

a14
- 1 ≤3,000 baht
- 2 3,001 - 7,000 baht
- 3 7,001 - 10,000 baht
- 4 10,001 - 20,000 baht
- 5 20,001 - 30,000 baht
- 6 > 30,000 baht

A15 What is your household's average monthly income?

a15
- 1 ≤3,000 baht
- 2 3,001 - 7,000 baht
- 3 7,001 - 10,000 baht
- 4 10,001 - 20,000 baht
- 5 20,001 - 30,000 baht
- 6 > 30,000 baht

A16 What is your highest level of education *(not including any current studies)*?

a16
- 1 Junior high school or equivalent
- 2 Completed high school or equivalent
- 3 Post-high school diploma or certificate
- 4 Bachelor or higher university degree

A17 What is your current marital status? *(Please choose only one answer)*

a17
- 1 First marriage
- 2 Remarried

} Go to question **A19**

- 3 Separated (but not divorced)
- 4 Divorced
- 5 Widowed
- 6 Never married

A18 If not currently married, do you have a partner?

a18
- 1 Yes and we live together
- 2 Yes but don't live
- 3 Don't have a partner

A19 How tall are you? ☐☐☐ a19 **cms** *(without shoes)*

A20 What is your weight now? ☐☐☐ a20 **kgs**

(eg if your weight is 62 kgs write 0 6 2 *)*

A21 Do you currently care for a chronically ill/disabled/ or frail family member or other person you know?

a21 1 Yes 2 No → Go to question **B1**

A22 How many hours per week do you care for this chronically ill/disabled/or frail person?

a22 ☐☐☐ **hours/ week**

A23 How many years have you cared for the person mentioned above? a23 ☐☐ **years**

A24 What type/s of care do you provide to the person mentioned above?

(You may choose more than one answer)

- a24n1 Help prepare food or eat
- a24n2 Help bathe
- a24n3 Help getting dressed
- a24n4 Mobility (moving the person)
- a24n5 Help going to temples/attending religious activities
- a24n6 Shopping and/or providing daily food
- a24n7 Emotional support/cheering up
- a24n8 Cognitive care (helping to understand)
- a24n9 Financial support
- a24n10 Other

❷

B Your general health

B1 Overall how would you rate your health in the past 4 weeks?

b1
- 1 Excellent
- 2 Very good
- 3 Good
- 4 Fair
- 5 Poor
- 6 Very poor

B2 During the past 4 weeks, how much did physical health problems limit your usual physical activities *(such as walking or climbing stairs)***?**

b2
- 1 Not at all
- 2 Very little
- 3 Some
- 4 Quite a lot
- 5 Could not do physical activities

B3 During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

b3
- 1 None at all
- 2 A little bit
- 3 Some
- 4 Quite a lot
- 5 Could not do daily work

B4 How much bodily pain have you had during the past 4 weeks?

b4
- 1 None
- 2 Very mild
- 3 Mild
- 4 Moderate
- 5 Severe
- 6 Very severe

B5 During the past 4 weeks, how much energy did you have?

b5
- 1 Very much
- 2 Quite a lot
- 3 Some
- 4 A little
- 5 None

B6 During the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?

b6
- 1 Not at all
- 2 Very little
- 3 Somewhat
- 4 Quite a lot
- 5 Could not do social activities

B7 During the past 4 weeks, how much have you been bothered by emotional problems *(such as feeling anxious, depressed or irritable)***?**

b7
- 1 Not at all
- 2 Slightly
- 3 Moderately
- 4 Quite a lot
- 5 Extremely

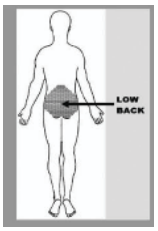
B8 During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?

b8
- 1 Not at all
- 2 Very little
- 3 Somewhat
- 4 Quite a lot
- 5 Could not do daily activities

B9 In the past 4 weeks, to what extent has your health limited you in any of the following physical activities?

Limitation for the following physical activities		Not at all	A little	A lot
Climbing a flight of stairs	b9n1	1	2	3
Walking one hundred metre	b9n2	1	2	3
Bending, kneeling or stoopi	b9n3	1	2	3
Dressing yourself	b9n4	1	2	3

B10 In the past 4 weeks, have you had pain in your low back *(in the area shown in the diagram)***?**



b10
- 1 Yes
- 2 No → Go to question **B12**

B11 If yes, was this pain bad enough to limit your usual activities or change your daily routine for more than one day?

b11
- 1 Yes
- 2 No

❸

B12 Adults can have up to 32 natural teeth. How many of your own teeth do you have?

b12 ☐1 None ☐2 1-5 teeth ☐3 6-19 teeth ☐4 20 teeth or more

B13 Do your teeth or dentures currently cause you….

(You may choose more than one answer)

☐ b13n1 Discomfort speaking ☐ b13n2 Discomfort swallowing
☐ b13n3 Discomfort chewing ☐ b13n4 Loss of social confidence
☐ b13n5 Pain ☐ b13n6 None of these

C Your Life

C1 How much support do you feel you get from each of the following groups. *(please place a cross ✕ in the box which best applies to you for each question)*

		Very little	A little	Quite a lot	A lot	Not applicable
Family	c1n1	1	2	3	4	5
Neighbours	c1n2	1	2	3	4	5
Friends	c1n3	1	2	3	4	5
Employee/ supervisor	c1n4	1	2	3	4	5

C2 In the <u>past 4 weeks</u> how much of the time did you feel…? *(please place a cross ✕ in the box which fits best for each question)*

Your feelings *(in the past 4 weeks)*		All of the time	Most of the time	Some of the time	A little of the time	None of the time
…so sad nothing could cheer you up?	c2n1	1	2	3	4	5
…nervous?	c2n2	1	2	3	4	5
…restless or fidgety?	c2n3	1	2	3	4	5
…hopeless?	c2n4	1	2	3	4	5
…everything was an effort?	c2n5	1	2	3	4	5
…worthless?	c2n6	1	2	3	4	5
…happy?	c2n7	1	2	3	4	5

C3 How often do you feel self-conscious or worried in the company of others because of your weight?

c3 ☐1 Often ☐2 Sometimes ☐3 Never

C4 Regarding your current body size: Do you feel you need to

c4 ☐1 Gain weight ☐2 Lose weight ☐3 Stay the same

c5

C5 In the <u>past 12 months</u>, have you modified your diet to ☐1 Gain weight ☐2 Lose weight ☐3 Did not modify diet

c6

C6 How often do you have trouble controlling your food intake? ☐1 Often ☐2 Sometimes ☐3 Never

C7 Thinking about your own life and personal circumstances, how satisfied are you with…

(Cross box on 0 → 10 scale that fits best for each question)

Satisfaction with:	Completely Dissatisfied ← → Completely Satisfied										
	0	1	2	3	4	5	6	7	8	9	10
…your standard of living? c7n1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
…how safe you feel? c7n2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
…feeling part of your community? c7n3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
…your life as a whole? c7n4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
…the amount of spare time you have? c7n5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

C8 Generally speaking, how much would you say that most people can be trusted?

c8 ☐1 Most people can be trusted ☐2 You must be wary of people at all times

C9 How much of an effect did the flood crisis in 2011 have on your physical possessions *(house or belongings)***?**

c9 ☐1 A lot ☐2 Some effect ☐3 Little effect ☐4 No effect

C10 How much of an effect did the flood crisis in 2011 have on your mental health?

c10 ☐1 A lot ☐2 Some effect ☐3 Little effect ☐4 No effe

C11 In general in 2012 what impact have floods had on you when compared with 2011?

c11 ☐1 More than 2011 ☐2 Less than 2011 ☐3 About the same as 2011 ☐4 Did not have any effect

D Your food and physical activity

D1 How many serves of vegetables do you eat per day? d1 ☐☐ **serves/day** *eg if you eat 3 per day please put* 0 3

(for vegetables 1 serve = 1/2 cup of cooked vegetables or 1 cup of raw vegetables)

D2 How many serves of fruit do you eat per day? d2 ☐☐ **serves/day** *eg if you eat 5serves per day please put* 0 5

(for fruit 1 serve = 1 banana, 1 slice of papaya or 1 cup of diced pieces of fruit)

D3 How many teaspoons of fish sauce do you add to your food in an average day? d3 ☐☐ **teaspoons per day**

if you don't add fish sauce at all please put 0 0

D4 How many teaspoons of sugar do you add to your meals and drinks in an average day? d4 ☐☐ **teaspoons per day**

if you don't add sugar at all please put 0 0

D5 Have you ever seen "nutrition labels" on food?

d5 ☐1 I have seen them and have read them ☐2 I have seen them but have not yet read one ☐3 I am unaware of them

D6 How often do you use information from nutrition labels on food products to assist your food purchasing decisions?

d6 ☐1 Every time I shop ☐2 Often ☐3 Sometimes ☐4 Seldom ☐5 Never

D7 How well do you understand the information presented on food "nutrition labels"?

d7
1 I understand fully
2 I understand most of the information
3 I understand some of the information
4 I do not understand the information but I know it has potential benefit
5 I don't understand the information or its potential benefit

D8 Would you like to see more nutrition labeling on foods?

d8 1 Yes 2 No 3 Don't know

D9 On average how often do you eat the following types of food? *(Please cross the one box which fits best for each food type)*

	Never or less than monthly	1-3 times/month	1-2 times/week	3-6 times/week	Daily or more
Food or dessert with coconut milk d9n1	1	2	3	4	5
Deep fried food d9n2	1	2	3	4	5
Instant foods eg instant noodles d9n3	1	2	3	4	5
Fermented/ salted raw food eg crab, fish d9n4	1	2	3	4	5
Fermented fruit/ vegetable d9n5	1	2	3	4	5
White rice or white sticky rice d9n6	1	2	3	4	5
Brown or combined brown and white rice d9n7	1	2	3	4	5
Fish and fish products d9n8	1	2	3	4	5
Soft drink (eg 7-Up, coke, pepsi) d9n9	1	2	3	4	5
Other sweetened drinks (eg iced tea or coffee, sweetened herb drinks) d9n10	1	2	3	4	5
Milk – fresh, carton or powder d9n11	1	2	3	4	5
Vitamins or food supplements d9n12	1	2	3	4	5
Fast food (Western style/farang) eg hamburger, pizza d9n13	1	2	3	4	5
Western bakery products eg cake, cookies d9n14	1	2	3	4	5

D10 On your past normal day (ie not a day off or weekend)**, how many times did you have a meal?** d10 ☐☐ **times/day**

(please include meals and snacks)

D11 In the <u>past 7 days</u>, how many times did you eat a main meal alone? d11 ☐☐ **times/day**

D12 When you eat alone do you eat more, less or the same as when you eat with others?

d12 1 More 2 Less 3 About the same

6

D13 How much of the following types of exercise do you do in a typical week?

(If you exercise 3 times per week please put 0 3 *If you don't do that type of exercise at all please put* 0 0 *)*

Walking continuously <u>for at least 10 minutes</u> *(for work, recreation, exercise or to get from place to place)*	d13n1	☐☐ times per week
Vigorous physical activities for <u>more than 20 minutes</u> *(that made you breathe harder or puff and pant)*	d13n2	☐☐ times per week
Moderate physical activities for <u>more than 20 minutes</u> *(like social tennis, golf, gentle swimming or work around the house or other work)*	d13n3	☐☐ times per week

D14 How often do you do household cleaning or gardening work?

d14 1 Seldom or never 2 1-3 times/month 3 Once or twice/week 4 3-4 times/week 5 Everyday or almost everyday

D15 How many hours per day (ie per 24 hours) do you <u>usually</u> spend on the following activities?

Activities		Duration
Standing for any purpose at all *(eg for work, while socializing etc.)*	d15n1	☐☐ hours/day
Sitting for any purpose *(eg reading, resting, writing, thinking, TV, or computer)*	d15n2	☐☐ hours/day
Sleeping *(if you regularly sleep during the day include this also)*	d15n3	☐☐ hours/day
Watching TV and/or playing computer games?	d15n4	☐☐ hours/day

E Your injuries

Your injuries – traffic related

E1 In the <u>past 12 months</u>, how many times did you get injured in a traffic crash

e1 0 Never → Go to question **E7**
1 One 2 Two
3 Three 4 ☐ Four or more

E2 When you experienced your <u>most serious</u> traffic related injury did you receive medical care?

e2 1 Yes 2 No

E3 Did this injury <u>limit</u> your normal activities for one day or more?

e3 1 Yes 2 No

E4 When this injury occurred what was your role?

e4 1 Driver 2 Passenger
3 Pedestrian → Go to question **E6**

E5 Type of vehicle you were in or on as driver or passenger?

e5 1 Bicycle 2 Motorbike
3 Bus, van, tour coach
4 Car/pick-up 5 Other (eg train, plane, boat)

7

E6 What was the other party in the collision causing the traffic-related injury?

e6
- 1 Bicycle
- 2 Motorbike
- 3 Bus, van, tour coach
- 4 Car/pick-up
- 5 Other vehicle (eg train, boat)
- 6 Pedestrian
- 7 Animal (eg dog)
- 8 Other object not vehicle (eg tree, road, wall)

Your injuries – non-traffic-related

E7 In the past 12 months, how many times did you have a NON-TRAFFIC injury?

e7
- 0 Never → Go to question **F1**
- 1 One
- 2 Two
- 3 Three
- 4 Four or more

E8 When you experienced your most serious non-traffic-related injury did you receive medical care?

e8
- 1 Yes
- 2 No

E9 Did this injury limit your normal activities for one day or more?

e9
- 1 Yes
- 2 No

E10 How were you injured?

e10
- 1 Assault (punch, push or kick)
- 2 Other blunt (non-sharp) force
- 3 Stab/cut
- 4 Gunshot
- 5 Fall (not pushed)
- 6 Lifting heavy obje
- 7 Fire, heat, scald
- 8 Near-drowning
- 9 Bite or sting (animal, insect)
- 10 Poisoning
- 11 Choking
- 12 Other

E11 What was the location at which your most serious non-traffic related injury occurred?

e11
- 1 Home
- 2 Sports facility
- 3 Workplace (agricultural)
- 4 Workplace (non-agricultural)
- 5 Other

E12 What was the nature of your most serious non-traffic injury? *(You may choose more than one answer)*

- Fracture e12n1
- Sprain, strain or dislocation e12n2
- Cut, bite or open wound e12n3
- Bruise or superficial injury e12n4
- Burn/scald e12n5
- Concussion e12n6
- Organ system (internal) injury e12n7
- Other e12n8

E13 How did this non-traffic injury occur?

(Please choose only one answer)

e13
- 1 Unintentional/ accident
- 2 Intentional by another person
- 3 Intentional (not involving another person)

F Your Health History

F1 Have you ever received a confirmed diagnosis from a doctor that you definitely have any of the following diseases?

Health condition		Definitely have disease	Doctor said I am at risk of the disease	Don't have the disease
Diabetes	f1n1	1	2	3
High cholesterol/high blood lipids	f1n2	1	2	3
High blood pressure	f1n3	1	2	3
Ischemic (coronary) heart disease	f1n4	1	2	3
Cerebrovascular disease (stroke)	f1n5	1	2	3
Liver cancer	f1n6	1	2	3
Lung cancer	f1n7	1	2	3
Stomach cancer	f1n8	1	2	3
Colon-rectum cancer	f1n9	1	2	3
Breast cancer	f1n10	1	2	3
Other cancers	f1n11	1	2	3
Kidney disease	f1n12	1	2	3
Other disease (specify)……f1n13x…..	f1n13	1	2	3

F2 What health insurance scheme/s covers you at present and for how long have you been covered? *(You may choose more than one answer)(If you have been covered by a scheme for less than one year please put* 0 1 *)*

Type of health insurance		Length of coverage	
☐ Don't have insurance	f2n1		
☐ Civil Servants Coverage	f2n2	f2n2y	Yrs.
☐ Employer provided cover	f2n3	f2n3y	Yrs.
☐ Private health insurance	f2n4	f2n4y	Yrs.
☐ Social Security Scheme	f2n5	f2n5y	Yrs.
☐ Universal Coverage Sche	f2n6	f2n6y	Yrs.
☐ Other f2n7x	f2n7	f2n7y	Yrs.

F3 In the past 12 months how many times have you used the following types of health services? *(You may choose more than one answer)*

Health service type	Number of visits (past 12 months) eg if you visited once in the past year please put 0 1 times	
Government health centre	f3n1	times
Community hospital	f3n2	times
Private health clinic	f3n3	times
Government hospital	f3n4	times
Private hospital	f3n5	times
Traditional medicine	f3n6	times
Pharmacy	f3n7	times
Other f2n8x	f3n8	times

G Smoking, alcohol and transport

G1 Are you a <u>current</u> smoker?

g1 ☐1 No ☐2 Yes and I smoke g1n ☐☐ cigarettes per day

G2 Please describe your current alcohol drinking?

g2 ☐1 Don't drink ☐2 Used to drink but quit
☐3 Drink in social situations, about g2n3 ☐☐ glasses/week
☐4 Current regular drinker of about g2n4 ☐☐ glasses/ day

G3 In the <u>past 12 months</u> have you ever driven a vehicle after consuming 3 or more glasses of alcohol?

g3 ☐1 Yes ☐2 No
☐3 Don't normally drive

G4 In the <u>past 12 months</u>, for personal transport how often did you…?

		Always	Sometimes	Never	Not applicable	
Use car safety belt (<u>front seat</u>)	g4n1	1	2	3	4	No safety belt or don't ride in front seat
Use car safety belt (<u>back seat</u>)	g4n2	1	2	3	4	No safety belt or don't ride in back seat
Ride on back step of "song thaew"	g4n3	1	2	3	4	Don't use "song thaew"
Ride in back of open truck/pick up	g4n4	1	2	3	4	Don't use such vehicle
Use motorcycle helmet	g4n5	1	2	3	4	Don't use motorcycle
Ride on motorcycle with 3 or more peo	g4n6	1	2	3	4	Don't use motorcycle

H Birth and contraception *(for cohort member women only to answer)*

(Male cohort members please ignore this section)

H1 How many babies have you ever given birth to? h1 ☐☐ **Babies** *(If you have never given birth please put* ☐0☐0 *)*

H2 Please tell us about your past and present use of the following contraceptives *(*If you have used for less than one year please put ☐0☐0 *)*

Have you ever taken or used the following types of hormonal contraceptives?		Age started using?	Age past used? (*or age now if still using*)	How long did you use it altogether? (*don't count periods of non-use)*
Oral contraceptive pill h2n1	☐1 No ☐2 Yes →	h2n1a ☐☐ yrs	h2n1b ☐☐ yrs	h2n1c ☐☐ yrs
Injections every three months (depo provera) h2n2	☐1 No ☐2 Yes →	h2n2a ☐☐ yrs	h2n2b ☐☐ yrs	h2n2c ☐☐ yrs
Contraceptive implant under the skin (may past 3-5 years) h2n3	☐1 No ☐2 Yes →	h2n3a ☐☐ yrs	h2n3b ☐☐ yrs	h2n3c ☐☐ yrs

Thank you very much for your kind cooperation

⑩

แบบสอบถาม

โครงการวิจัยสุขภาพ ปี 2556

Universal codes:

-7 = "ตอบมามากกว่า 1 คำตอบ" สำหรับคำถามที่กำหนดให้ตอบได้เพียง 1 คำตอบ แต่มีการตอบมามากกว่า 1 โปรแกรมจะให้ค่าเป็น -7

-9 = "Missing value" สำหรับคำถามที่ไม่มีการตอบมา หรือว่างมา **ยกเว้นคำถามที่กำหนดให้สามารถเลือกตอบได้มากกว่า 1 คำตอบ**

***** สำหรับคำถามที่กำหนดให้สามารถเลือกตอบได้มากกว่า 1 คำตอบ ค่าที่เป็นไปได้มีเพียง 2 ค่า คือ 0 หรือ 1 เท่านั้น**

addsend

เรียน สมาชิกโครงการวิจัยสุขภาพทุกท่าน **รหัสสมาชิก TCSID** ☐☐☐☐☐ tcsid

ความก้าวหน้าของโครงการวิจัยสุขภาพที่ท่านมีส่วนสำคัญยิ่งต่อความสำเร็จนั้น ได้ก้าวมาสู่ขั้นการดำเนินงานวิจัยทางสุขภาพอย่างเต็มรูปแบบ ข้อมูลที่ท่านได้ตอบแบบสอบถามกลับมา โครงการฯ ได้นำมาวิเคราะห์ปัจจัยที่ส่งผลต่อสุขภาพ นั้น

บัดนี้ เป็นช่วงเวลาการติดตามสภาวะสุขภาพของสมาชิกโครงการฯ ข้อมูลที่ท่านตอบกลับมาจะเป็นประโยชน์อย่างยิ่งต่อการสร้างองค์ความรู้ด้านสุขภาพในบริบทของสังคมไทย และโครงการฯ จะได้ดำเนินการตามแนวจริยธรรมของการวิจัยอย่างเคร่งครัด ข้อมูลรายบุคคลจะถูกเก็บเป็นความลับ สำหรับชื่อและที่อยู่ทางโครงการฯ จะใช้สำหรับการติดต่อกับท่านเท่านั้น โดยตระหนักดีว่าท่านได้ให้ความร่วมมือตอบแบบสอบถามด้วยความสมัครใจ อย่างไรก็ตาม หากท่านไม่มีความประสงค์จะเป็นสมาชิกของโครงการฯ ท่านสามารถแจ้งให้โครงการฯ ทราบทุกเมื่อ

หาก**ท่านคือบุคคลที่ปรากฏชื่อตามเอกสารด้านบนนี้** และยินดีให้ความร่วมมือกับโครงการวิจัยสุขภาพ มหาวิทยาลัยสุโขทัยธรรมาธิราช โปรดลงชื่อในช่องว่างข้างล่างแล้วกรุณาตอบแบบสอบถาม ส่งกลับมาในซองที่แนบมาพร้อมนี้ โดยไม่ต้องติดแสตมป์

(ลงชื่อ).....sign1..... วันที่ dsign /...../.....

(นาย/นาง/นางสาว .....sign2.....)

หากมีข้อสงสัย สอบถามรายละเอียดเพิ่มเติมได้ที่หมายเลขโทรศัพท์ 02 -5047780 ในเวลาราชการ ขอขอบคุณทุกท่านมา ณ โอกาสนี้

(รองศาสตราจารย์ ดร. สำอาง สืบสมาน)
ผู้อำนวยการศูนย์วิจัยและสร้างเสริมสุขภาวะคนไทย

หน้านี้จะได้รับจัดเก็บเป็นความลับแยกออกจากส่วนอื่น

ความร่วมมือตอบแบบสอบถามของสมาชิกทุกท่าน คือสิ่งสำคัญสูงสุดต่อความสำเร็จของโครงการวิจัยสุขภาพ โดยที่สามารถติดต่อกับท่านได้ หากท่านเปลี่ยนแปลงชื่อ ที่อยู่ หรือหมายเลขโทรศัพท์ โปรดแจ้งให้ทางโครงการฯ ทราบตามแบบฟอร์มข้างล่างนี้ จะขอบคุณยิ่ง

ท่านมีการ เปลี่ยนแปลง **ชื่อ-สกุล ที่อยู่ เบอร์โทรศัพท์ ไปจากหน้าปกแบบสอบถาม** หรือไม่

โปรด **กาเครื่องหมาย ✕ ลงช่องสี่เหลี่ยม ❑ โดยใช้ปากกาสีน้ำเงินหรือดำ**

addch

❑ 1 **ไม่มีการเปลี่ยนแปลง** ทั้งชื่อ - สกุล ที่อยู่ และเบอร์โทรศัพท์ → **โปรดข้ามไปอ่านคำชี้แจงหน้าถัดไป**

❑ 2 **มีการเปลี่ยนแปลงข้อมูล** ในรายการต่อไปนี้ ❑ **ชื่อ - สกุล** addch1 ❑ **ที่อยู่** addch2 ❑ **เบอร์โทรศัพท์** addch3

โดยมีรายละเอียดที่เปลี่ยนแปลงดังนี้

ชื่อ..... name1 ..... นามสกุล ..... sname1 .....

ที่อยู่ : เลขที่..... add1n1 ..... หมู่บ้าน ..... add1n2 ..... ซอย ..... add1n3 .....

ถนน..... add1n4 ..... ตำบล/แขวง ..... add1n5 ..... อำเภอ/เขต ..... add1n6` .....

จังหวัด..... add1n7 ..... รหัสไปรษณีย์ ☐☐☐☐☐ add1zip

เบอร์โทรศัพท์บ้าน..... add1htel ..... โทรศัพท์ที่ทำงาน..... add1wtel .....

โทรศัพท์มือถือ..... add1mtel ..... e-mail..... email .....

บุคคลอื่นที่สามารถติดต่อได้ (กรณีที่ติดต่อท่านไม่ได้)

ชื่อ..... name2 ..... นามสกุล ..... sname2 .....

ที่อยู่ : เลขที่..... add2n1 ..... หมู่บ้าน ..... add2n2 ..... ซอย ..... add2n3 .....

ถนน..... add2n4 ..... ตำบล/แขวง ..... add2n5 ..... อำเภอ/เขต ..... add2n6 .....

จังหวัด..... add2n7 ..... รหัสไปรษณีย์ ..... add2zip .....

เบอร์โทรศัพท์บ้าน..... add2htel ..... โทรศัพท์ที่ทำงาน..... add2wtel .....

โทรศัพท์มือถือ..... add2mtel .....

กรุณาจดเลขหมายรหัสสมาชิก TCSID จากหน้าปกเก็บไว้ใช้อ้างอิงในอนาคต เพื่อความสะดวกของท่านในการติดต่อกับโครงการวิจัยสุขภาพ

หน้านี้จะได้รับจัดเก็บเป็นความลับแยกออกจากส่วนอื่น

คำชี้แจง โปรดใช้ปากกาสีน้ำเงินหรือดำ กาเครื่องหมาย × ลงช่องสี่เหลี่ยม ☐ หน้าตัวเลือกที่ต้องการดังรูป ☒ โดยเลือกเพียงคำตอบเดียว**ยกเว้น**ข้อที่มีระบุว่า "เลือกได้**มากกว่า** 1 คำตอบ" ส่วนคำถามที่ให้เขียนคำตอบเป็นตัวเลขนั้น โปรดใส่ตัวเลขลงภายในช่อง ☐ ช่องละหนึ่งตัวเลข เช่น **24** ให้แยกตัวเลขลงในช่องดังนี้ [2][4]

A ข้อมูลเกี่ยวกับตัวท่านและการงานของท่าน

A1 เพศ [1] ชาย [2] หญิง a1

A2 วัน เดือน ปีเกิดของท่าน (ตามบัตรประจำตัวประชาชน)

[ ][ ] / [ ][ ] / [ ][ ][ ][ ]

a2bd a2bm a2by

(เช่น [1][5] / [0][1] / [2][5][1][3] คือเกิด 15 มกราคม 2513)

A3 บ้านที่ท่านพักอาศัยใน<u>ปัจจุบัน</u>อยู่ที่ไหน

a3 [1] ในชนบท [2] ในเมือง

A4 ท่านอาศัยอยู่บ้านหลังนี้มานานเท่าไร a4 [ ][ ] **ปี**

(เช่น ถ้าอยู่มานาน 3 ปี โปรดใส่ตัวเลข [0][3] ปี)

A5 บ้านของท่านอยู่ห่างจากสถานที่ต่อไปนี้เป็นระยะทางประมาณกี่กิโลเมตร (กม.)

ระยะทาง / สถานที่	น้อยกว่า 5 กม.	5-10 กม.	11-20 กม.	ไกลกว่า 20 กม. ขึ้นไป
ซูเปอร์มาร์เก็ต, มินิมาร์ท a5n1	1	2	3	4
ตู้กดเงิน ATM a5n2	1	2	3	4
โรงพยาบาล a5n3	1	2	3	4
ไปรษณีย์ a5n4	1	2	3	4
ที่ว่าการอำเภอ a5n5	1	2	3	4
โรงเรียน a5n6	1	2	3	4
สี่แยกไฟแดง a5n7	1	2	3	4
ตลาดสด a5n8	1	2	3	4
ป้ายรถประจำ a5n9	1	2	3	4
วินมอเตอร์ไซ a5n10	1	2	3	4
ร้านอินเตอร์เ a5n11	1	2	3	4

A6 ในช่วง <u>5 ปีที่ผ่านมา</u> ท่านคิดว่าท้องถิ่นที่ท่านอาศัยอยู่ในปัจจุบันเป็นชุมชนเมืองมากขึ้น ใช่หรือไม่

a6 [1] ใช่ [2] ไม่ใช่ [3] ไม่แน่ใจ

A7 บ้านของท่านมีอยู่กี่คน [ ][ ] a7 **คน** *(รวมทั้งตัวท่าน)*

(เช่น ถ้าอยู่ 3 คน โปรดใส่ ตัวเลข [0][3])

A8 ปัจจุบันท่านทำงานที่มีรายได้ใช่หรือไม่

a8 [1] ใช่ [2] ไม่ใช่ → ข้ามไปตอบข้อ **A14**

A9 ปัจจุบันท่านทำงานที่สร้างรายได้ประมาณ<u>สัปดาห์</u>ละกี่ชั่วโมง [ ][ ][ ] **ชั่วโมง/สัปดาห์**

a9

A10 ท่านรู้สึกมั่นคงในอนาคตการทำงานหรืออาชีพที่ทำอยู่ขณะนี้เพียงใด

a10 [1] ไม่มั่นคงเลย [2] มั่นคงเล็กน้อย [3] มั่นคง [4] มั่นคงมาก

A11 งานหลักที่ท่านทำมีลักษณะตรงกับข้อใดมากที่สุด

(เลือกเพียง 1 คำตอบ)

a11
- [1] ผู้บริหารระดับอาวุโส [2] ผู้บริหารระดับกลาง
- [3] งานวิชาชีพ (เช่น นักบัญชี แพทย์ นักวิชาการ)
- [4] ช่างชำนาญงาน (เช่น งานฝีมือ ช่างไม้ ช่างผม)
- [5] เจ้าหน้าที่ในสำนักงาน/บริษัท
- [6] เกษตร/ประมง/เลี้ยงสัตว์
- [7] ทำงานโรงงาน
- [8] งานขั้นพื้นฐานใช้แรงเบาๆ (เช่น ส่งเอกสาร)
- [9] งานขั้นพื้นฐานที่ใช้แรงมาก (เช่น งานก่อสร้าง)
- [10] อื่นๆ โปรดระบุ.....a11x.....

❶

A12 ในช่วง 12 เดือนที่ผ่านมา ท่านประสบปัญหาจากความร้อน/อากาศร้อนในขณะทำงาน จนทำให้ท่านรู้สึกไม่สบายตัว เนื่องจากสาเหตุใดบ่อยที่สุด

(เลือกเพียง 1 คำตอบ)

a12
- 1 ☐ ไม่มีปัญหาเรื่องความร้อนรบกวนในที่ทำงาน
- 2 ☐ ความร้อนจากการทำงานกลางแจ้ง
- 3 ☐ ความร้อนจากเครื่องจักร หรือกระบวนการผลิต
- 4 ☐ ความร้อนจากการทำงานที่ต้องใช้ยานพาหนะ
- 5 ☐ ความร้อนจากการทำงานในอาคารที่อบอ้าว
- 6 ☐ อื่นๆ โปรดระบุ.....a12x.....

A13 ในช่วง 12 เดือนที่ผ่านมา เมื่อท่านมีปัญหาความร้อนในขณะทำงาน *จากข้อA12* ทำให้ท่านมีอาการในข้อใดต่อไปนี้ *(เลือกได้มากกว่า 1 คำตอบ)*

- a13n1 ☐ ไม่มีอาการใดๆ
- a13n2 ☐ รู้สึกไม่สบายตัวเท่านั้น
- a13n3 ☐ มีผด / ผื่นคัน
- a13n4 ☐ ปวดศีรษะ / ปวดขมับ
- a13n5 ☐ คลื่นไส้ / อาเจียน
- a13n6 ☐ รู้สึกขาดน้ำอย่างรุนแรง/กระหายน้ำมาก
- a13n7 ☐ วิงเวียน / หน้ามืด / เป็นลม (แบบมีเหงื่อออก)
- a13n8 ☐ เป็นลมแดด - หมดสติ โดยร่างกายมีอุณหภูมิสูง ผิวหนังร้อนและแห้ง (แบบไม่มีเหงื่อ)
- a13n9 ☐ ปวดกล้ามเนื้อ / เป็นตะคริว
- a13n10 ☐ ความดันต่ำ

A14 ท่านมีรายได้ประมาณเดือนละเท่าไร

a14
- 1 ☐ น้อยกว่าหรือ= 3,000 บาท
- 2 ☐ 3,001 - 7,000 บาท
- 3 ☐ 7,001 - 10,000 บาท
- 4 ☐ 10,001 - 20,000 บาท
- 5 ☐ 20,001 - 30,000 บาท
- 6 ☐ มากกว่า 30,000 บาทขึ้นไป

A15 ครอบครัวของท่านมีรายได้ประมาณเดือนละเท่าไร

a15
- 1 ☐ น้อยกว่าหรือ= 3,000 บาท
- 2 ☐ 3,001 - 7,000 บาท
- 3 ☐ 7,001 - 10,000 บาท
- 4 ☐ 10,001 - 20,000 บาท
- 5 ☐ 20,001 - 30,000 บาท
- 6 ☐ มากกว่า 30,000 บาทขึ้นไป

A16 การศึกษาสูงสุดของท่าน *(ไม่รวมที่กำลังศึกษาอยู่ขณะนี้)*

a16
- 1 ☐ ม.3 หรือเทียบเท่า
- 2 ☐ ม.6 / ปวช. หรือเทียบเท่า
- 3 ☐ ป.วิชาชีพเทคนิค/ชั้นสูง/อนุปริญญา
- 4 ☐ ปริญญาตรีหรือสูงกว่า

A17 สถานภาพสมรสของท่านในปัจจุบัน *(เลือกเพียง 1 คำตอบ)*

a17
- 1 ☐ แต่งงานครั้งแรก
- 2 ☐ แต่งงานครั้งที่ 2 หรือมากกว่า

} ข้ามไปตอบข้อ **A19**

- 3 ☐ แยกทางกัน/เลิกกันแล้ว (แต่ยังไม่ได้หย่า)
- 4 ☐ หย่า
- 5 ☐ หม้าย (คู่สมรสเสียชีวิต)
- 6 ☐ ไม่เคยแต่งงาน

A18 ถ้าปัจจุบันยังไม่แต่งงาน ท่านมีแฟน(คนรัก)หรือไม่

a18
- 1 ☐ มีและอยู่ด้วยกัน
- 2 ☐ มี แต่ไม่ได้อยู่ด้วยกัน
- 3 ☐ ไม่มี

A19 ท่านสูงเท่าไร a19 ☐☐☐ **เซ็นติเมตร** *(ไม่สวมรองเท้า)*

A20 ปัจจุบันท่านมีน้ำหนักเท่าไร a20 ☐☐☐ **กิโลกรัม**

(เช่น ท่านมีน้ำหนัก 62 กิโลกรัม โปรดใส่ตัวเลข 0 6 2 *)*

A21 ท่านต้องดูแลสมาชิกในครอบครัว หรือคนรู้จักที่ป่วยเรื้อรัง/ทุพพลภาพ/ชราภาพหรือไม่

a21 1 ☐ ดูแล 2 ☐ ไม่ได้ดูแล → ข้ามไปตอบข้อ **B1**

A22 ท่านดูแลบุคคลที่ป่วยเรื้อรัง/ทุพพลภาพ/ชราภาพ สัปดาห์ละกี่ชั่วโมง a22 ☐☐☐ **ชั่วโมง/สัปดาห์**

A23 ท่านดูแลบุคคลดังกล่าวข้างต้น มาแล้วกี่ปี a23 ☐☐ **ปี**

A24 ท่านช่วยดูแลบุคคลดังกล่าวข้างต้นอย่างไรบ้าง

(เลือกได้มากกว่า 1 คำตอบ)

- a24n1 ☐ ช่วยเตรียมหรือป้อนอาหาร
- a24n2 ☐ ช่วยอาบน้ำ
- a24n3 ☐ ช่วยแต่งตัว
- a24n4 ☐ ช่วยขยับตัว เคลื่อนย้าย
- a24n5 ☐ ช่วยพาไปวัด/ร่วมพิธีทางศาสนา
- a24n6 ☐ ช่วยซื้อของกินของใช้
- a24n7 ☐ ช่วยทำให้คลายเครียด
- a24n8 ☐ ช่วยด้านความทรงจำ เช่น อธิบายเรื่องราวต่างๆ
- a24n9 ☐ ช่วยด้านการเงิน
- a24n10 ☐ อื่นๆ

❷

B สุขภาวะโดยรวมของท่าน

B1 ในช่วง 4 สัปดาห์ที่ผ่านมา โดยทั่วไปท่านประเมินสุขภาพของท่านว่าอย่างไร

b1 [1] ดีที่สุด [2] ดีมาก [3] ดี [4] พอใช้ [5] แย่ [6] แย่มาก

B2 ในช่วง 4 สัปดาห์ที่ผ่านมา ปัญหาสุขภาพกายจำกัดกิจกรรมทางกายตามปกติของท่าน *(เช่น การเดิน หรือการขึ้นลงบันได)* **มากน้อยแค่ไหน**

b2 [1] ไม่เลย [2] น้อยมาก [3] พอสมควร [4] ค่อนข้างมาก [5] ไม่สามารถทำกิจกรรมทางกายต่างๆได้

B3 ในช่วง 4 สัปดาห์ที่ผ่านมา ท่านมีความลำบากในการทำงานประจำวัน ทั้งงานในบ้านและนอกบ้านที่เป็นผลมาจากสุขภาพทางกายของท่าน มากน้อยแค่ไหน

b3 [1] ไม่มีเลย [2] มีน้อยมาก [3] มีพอสมควร [4] มีค่อนข้างมาก [5] ไม่สามารถทำงานประจำวันได้

B4 ในช่วง 4 สัปดาห์ที่ผ่านมา ท่านมีความเจ็บปวดทางร่างกาย มากน้อยแค่ไหน

b4 [1] ไม่มีเลย [2] น้อยมาก [3] น้อย [4] ปานกลาง [5] รุนแรง [6] รุนแรงมาก

B5 ในช่วง 4 สัปดาห์ที่ผ่านมา ท่านมีความรู้สึกกระฉับกระเฉง มากน้อยแค่ไหน

b5 [1] มีมาก [2] มีค่อนข้างมาก [3] มีบ้าง [4] มีเล็กน้อย [5] ไม่มีเลย

B6 ในช่วง 4 สัปดาห์ที่ผ่านมา สุขภาพทางกาย หรือปัญหาด้านอารมณ์ของท่าน จำกัดกิจกรรมทางสังคมตามปกติของท่านที่มีกับครอบครัว หรือเพื่อน มากน้อยแค่ไหน

b6 [1] ไม่เลย [2] น้อยมาก [3] พอสมควร [4] ค่อนข้างมาก [5] ไม่สามารถทำกิจกรรมทางสังคมต่างๆได้

B7 ในช่วง 4 สัปดาห์ที่ผ่านมา ปัญหาด้านอารมณ์ *(เช่น รู้สึกกังวล ซึมเศร้า หรือหงุดหงิด)* **รบกวนท่านมากน้อยแค่ไหน**

b7 [1] ไม่เลย [2] เล็กน้อย [3] ปานกลาง [4] ค่อนข้างมาก [5] มากที่สุด

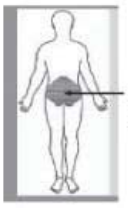
B8 ในช่วง 4 สัปดาห์ที่ผ่านมา ปัญหาส่วนตัวหรือปัญหาด้านอารมณ์ ทำให้ท่านไม่สามารถทำงาน เรียนหนังสือ หรือทำกิจกรรมประจำวันอื่นๆ ของท่านได้ตามปกติมากน้อยเพียงใด

b8 [1] ไม่เลย [2] น้อยมาก [3] พอสมควร [4] ค่อนข้างมาก [5] ไม่สามารถทำกิจกรรมประจำวันต่างๆได้

B9 ในช่วง 4 สัปดาห์ที่ผ่านมา ภาวะสุขภาพของท่านเป็นอุปสรรคต่อการทำกิจกรรมต่อไปนี้ มากน้อยเพียงใด

อุปสรรคต่อกิจกรรม ต่อไปนี้		ไม่มีเลย	มีเล็กน้อย	มีมาก
การขึ้นบันได 1 ชั้น	b9n1	1	2	3
การเดิน 100 เมตร	b9n2	1	2	3
การคุกเข่า เอี้ยวตัว	b9n3	1	2	3
การใส่เสื้อผ้าแต่งตัว	b9n4	1	2	3

B10 ในช่วง 4 สัปดาห์ที่ผ่านมา ท่านปวดหลังส่วนล่าง *(บริเวณที่แสดงในรูป)* **หรือไม่**



b10 [1] ใช่ [2] ไม่ใช่ → ข้ามไปตอบข้อ B12

B11 ถ้าใช่ อาการปวดนั้นทำให้ท่านไม่สามารถทำงาน หรือไม่สามารถทำกิจกรรมประจำวันอื่นๆได้มากกว่า 1 วันขึ้นไป ใช่หรือไม่

b11 [1] ใช่ [2] ไม่ใช่

B12 ผู้ใหญ่มีฟันแท้ทั้งสิ้น 32 ซี่ ท่านมีฟันแท้จำนวนกี่ซี่

b12 ☐1 ไม่มีเลย ☐2 1-5 ซี่ ☐3 6-19 ซี่ ☐4 20 ซี่หรือมากกว่า

B13 ปัจจุบัน ฟันแท้หรือฟันปลอมของท่าน ทำให้ท่านมีอาการต่อไปนี้หรือไม่ *(เลือกได้มากกว่า 1 คำตอบ)*

☐ b13n1 ไม่สะดวกเวลาพูด
☐ b13n2 กลืนไม่สะดวก
☐ b13n3 เคี้ยวไม่สะดวก
☐ b13n4 ขาดความมั่นใจเมื่อเข้าสังคม
☐ b13n5 รู้สึกเจ็บปวด
☐ b13n6 ไม่มีอาการดังกล่าว

C ชีวิตของท่าน

C1 ท่านได้รับการสนับสนุนจากกลุ่มทางสังคมมากน้อยแค่ไหน *(โปรดใส่เครื่องหมาย x ลงในช่องที่ตรงกับความคิดเห็นของท่าน)*

	น้อยมาก	ค่อนข้างน้อย	ค่อนข้างมาก	มากที่สุด	ไม่มีบุคคลดังกล่าว
ครอบครัวของท่าน c1n1	1	2	3	4	5
เพื่อนบ้าน c1n2	1	2	3	4	5
เพื่อน c1n3	1	2	3	4	5
นายจ้าง/หัวหน้า c1n4	1	2	3	4	5

C2 ในช่วง <u>4 สัปดาห์ที่ผ่านมา</u> ท่านมีความรู้สึกต่อไปนี้บ่อยแค่ไหน *(โปรดกา x ลงในช่องที่ตรงกับความรู้สึกของท่านในแต่ละข้อ)*

ความรู้สึก *(ในช่วง 4 สัปดาห์ที่ผ่านมา)*	ตลอดเวลา	เกือบตลอดเวลา	บางเวลา	น้อยครั้ง	ไม่เคยเลย
รู้สึกเศร้ามากจนไม่มีอะไรช่วยให้ดีขึ้นได้ c2n1	1	2	3	4	5
รู้สึกกังวล c2n2	1	2	3	4	5
รู้สึกกระวนกระวาย c2n3	1	2	3	4	5
รู้สึกหมดหวัง c2n4	1	2	3	4	5
รู้สึกว่าต้องใช้ความพยายามในการทำทุกสิ่งทุก c2n5	1	2	3	4	5
รู้สึกไร้ค่า c2n6	1	2	3	4	5
รู้สึกมีความสุข c2n7	1	2	3	4	5

C3 ท่านรู้สึกกระมัดระวังหรือกังวลเรื่องน้ำหนักตัวเมื่ออยู่ต่อหน้าคนอื่นบ่อยแค่ไหน

c3 ☐1 บ่อยครั้ง ☐2 บางครั้ง ☐3 ไม่เลย

C4 เกี่ยวกับรูปร่างของท่านในปัจจุบัน ท่านต้องการทำอย่างไร

c4 ☐1 ลดน้ำหนัก ☐2 เพิ่มน้ำหนัก ☐3 ให้น้ำหนักคงเดิมอยู่เช่นนี้

C5 ในช่วง <u>12 เดือนที่ผ่านมา</u> ท่านควบคุมอาหารเพื่อจุดประสงค์ใด c5 ☐1 เพิ่มน้ำหนัก ☐2 ลดน้ำหนัก ☐3 ไม่เคยควบคุม

C6 ท่านมีปัญหาบ่อยแค่ไหน ในการควบคุมการกินอาหาร c6 ☐1 บ่อยครั้ง ☐2 บางครั้ง ☐3 ไม่มีปัญหา

C7 เมื่อคิดถึงชีวิตและสภาพแวดล้อมของท่าน ท่านมีความพอใจกับสิ่งต่อไปนี้ในระดับใด *(โปรดใส่เครื่องหมาย x ลงในช่องระดับ 0 → 10 คะแนน ที่ตรงกับความคิดเห็นของท่าน)*

ความพอใจต่อชีวิตและสภาพแวดล้อม		ไม่พอใจอย่างยิ่ง ←										→ พอใจที่สุด
		0	1	2	3	4	5	6	7	8	9	10
มาตรฐานการดำรงชีวิต	c7n1	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
ความรู้สึกปลอดภัย	c7n2	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
ความรู้สึกเป็นส่วนหนึ่งของชุมชน	c7n3	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
ชีวิตโดยรวมของท่าน	c7n4	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
เวลาว่างส่วนตัว	c7n5	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

C8 โดยทั่วไป ท่านรู้สึกว่าสามารถวางใจผู้อื่นได้เพียงใด

c8 ❑1 สามารถวางใจได้เกือบทุกคน ❑2 ต้องระมัดระวังผู้อื่นตลอดเวลา

C9 <u>น้ำท่วมเมื่อปี 2554</u> ท่านได้รับผลกระทบทางกายภาพมากน้อยแค่ไหน *(บ้านเรือน ทรัพย์สิน ฯลฯ)*

c9 ❑1 มากที่สุด ❑2 ค่อนข้างมาก ❑3 เล็กน้อย ❑4 ไม่เลย

C10 <u>น้ำท่วมเมื่อปี 2554</u> ท่านได้รับผลกระทบทางจิตใจมากน้อยแค่ไหน

c10 ❑1 มากที่สุด ❑2 ค่อนข้างมาก ❑3 เล็กน้อย ❑4 ไม่เลย

C11 โดยภาพรวมแล้ว <u>ในปี 2555</u> ท่านได้รับผลกระทบจากน้ำท่วมมากน้อยแค่ไหน เมื่อเทียบกับปี 2554

c11 ❑1 มากกว่าเดิม ❑2 น้อยกว่าเดิม ❑3 เท่าเดิม ❑4 ไม่ได้รับผลกระทบ

D อาหารและกิจกรรมการเคลื่อนไหวร่างกาย

D1 ท่านรับประทานผักจำนวนกี่ส่วนต่อวัน d1 ❑❑ **ส่วนต่อวัน** เช่น ถ้ากิน 3 ส่วน ใส่ตัวเลข 0 3
(เช่น ผัก 1 ส่วน = ผักปรุงสุก ครึ่งถ้วยตวง หรือผักดิบ 1 ถ้วยตวง)

D2 ท่านรับประทานผลไม้จำนวนกี่ส่วนต่อวัน d2 ❑❑ **ส่วนต่อวัน** เช่น ถ้ากิน 5 ส่วน ใส่ตัวเลข 0 5
(เช่น กล้วย 1 ลูก = 1 ส่วน หรือ มะละกอ 1 ชิ้น 5-6 คำ = 1 ส่วน)

D3 ตามปกติเวลากินอาหาร ท่านเติมน้ำปลาเฉลี่ย กี่ช้อนชาต่อวัน d3 ❑❑ **ช้อนชาต่อวัน** *ถ้าไม่เติมเลย ใส่ตัวเลข* 0 0
(ช้อนชา คือ ช้อนกาแฟเล็กๆ)

D4 ตามปกติเวลากินอาหาร/เครื่องดื่ม ท่านเติมน้ำตาลเฉลี่ย กี่ช้อนชาต่อวัน d4 ❑❑ **ช้อนชาต่อวัน** *ถ้าไม่เติมเลย ใส่* 0 0

D5 ท่านเคยเห็น "ฉลากโภชนาการ" หรือไม่

d5 ❑1 เคยเห็นและเคยอ่านแล้ว ❑2 เคยเห็นแต่ยังไม่เคยอ่าน ❑3 ไม่เคยรู้จักเลย

D6 ท่านใช้ ฉลากโภชนาการ ประกอบการตัดสินใจซื้อผลิตภัณฑ์อาหาร บ่อยครั้งแค่ไหน

d6 ❑1 ทุกครั้งที่ซื้อ ❑2 บ่อยครั้ง ❑3 บางครั้ง ❑4 นานๆครั้ง ❑5 ไม่เคยเลย

❺

D7 ท่านเข้าใจข้อมูลบนฉลากโภชนาการดีเพียงใด

d7 ☐1 เข้าใจดีอย่างยิ่ง ☐2 เข้าใจเป็นส่วนใหญ่ ☐3 เข้าใจบางส่วน
☐4 ไม่เข้าใจ แต่รู้ว่ามีประโยชน์ ☐5 ไม่เข้าใจและไม่รู้ว่ามีประโยชน์

D8 ท่านอยากให้มีฉลากโภชนาการครอบคลุมอาหารชนิดต่างๆ มากขึ้นหรือไม่

d8 ☐1 ใช่ ☐2 ไม่ใช่ ☐3 ไม่ทราบ

D9 โดยเฉลี่ยแล้ว ท่านรับประทานอาหารต่อไปนี้ บ่อยครั้งแค่ไหน*(กาเครื่องหมาย x ลงช่องที่ตรงตามที่ท่านรับประทานจริง)*

		ไม่เคย/น้อยกว่าเดือนละครั้ง	เดือนละ 1-3 ครั้ง	สัปดาห์ละ1-2 ครั้ง	สัปดาห์ละ3-6 ครั้ง	วันละครั้งหรือมากกว่า
อาหาร/ขนมหวานที่ประกอบด้วยกะทิ	d9n1	☐1	☐2	☐3	☐4	☐5
อาหารประเภททอด	d9n2	☐1	☐2	☐3	☐4	☐5
อาหารกึ่งสำเร็จรูป เช่น บะหมี่ซอง	d9n3	☐1	☐2	☐3	☐4	☐5
อาหารหมักดอง (ดิบ) เช่น แหนม ปลาร้า	d9n4	☐1	☐2	☐3	☐4	☐5
ผักผลไม้ดอง	d9n5	☐1	☐2	☐3	☐4	☐5
ข้าวจ้าวหรือข้าวเหนียวขัดขาว	d9n6	☐1	☐2	☐3	☐4	☐5
ข้าวกล้อง/หรือข้าวขาวผสมข้าวกล้อง	d9n7	☐1	☐2	☐3	☐4	☐5
ปลา/ผลิตภัณฑ์จากปลา	d9n8	☐1	☐2	☐3	☐4	☐5
น้ำอัดลม เช่น โค้ก เป๊ปซี่ ฯลฯ	d9n9	☐1	☐2	☐3	☐4	☐5
เครื่องดื่มผสมน้ำตาล เช่น ชาเขียว กาแฟเย็น น้ำสมุนไพร	d9n10	☐1	☐2	☐3	☐4	☐5
นม เช่น นมสด นมกล่อง นมผง ฯลฯ	d9n11	☐1	☐2	☐3	☐4	☐5
ผลิตภัณฑ์อาหารเสริม เช่น วิตามิน	d9n12	☐1	☐2	☐3	☐4	☐5
อาหารจานด่วนแบบตะวันตก เช่น แฮมเบอร์เกอร์ พิซซ่า	d9n13	☐1	☐2	☐3	☐4	☐5
ขนมแบบตะวันตก เช่น โดนัท คุ้กกี้	d9n14	☐1	☐2	☐3	☐4	☐5

D10 ในวันธรรมดาที่ผ่านมา (ไม่ใช่วันหยุด) **ท่านรับประทานอาหารต่างๆ กี่ครั้ง** d10 ☐☐ **ครั้งต่อวัน** *(รวมมื้อหลักและมื้อว่าง)*

D11 ในช่วง <u>7 วันที่ผ่านมา</u> ท่านรับประทานอาหารมื้อหลักโดยลำพังกี่ครั้ง ☐☐ d11 **ครั้งต่อวัน**

D12 เมื่อท่านกินอาหารตามลำพัง ท่านกินมากขึ้นหรือน้อยลง เมื่อเทียบกับการกินร่วมกับคนอื่นๆ

d12 ☐1 มากขึ้น ☐2 น้อยลง ☐3 เท่าเดิม

❻

D13 โดยปกติ ท่านใช้เวลาในการเคลื่อนไหวร่างกายดังต่อไปนี้ ประมาณกี่ครั้งในหนึ่งสัปดาห์

(เช่น ถ้าเคลื่อนไหวร่างกาย 3 ครั้งต่อสัปดาห์ โปรดใส่ตัวเลข 0 3 *ถ้าไม่ได้ทำเลย โปรดใส่ตัวเลข* 0 0 *)*

เดินอย่างต่อเนื่อง <u>อย่างน้อย 10 นาที</u> (เช่น เดินเพื่อทำงาน เดินพักผ่อน เดินออกกำลังกาย หรือเดินเพื่อไปถึงที่ใดที่หนึ่ง)	d13n1	☐☐ ครั้งต่อสัปดาห์
การเคลื่อนไหวร่างกายที่ใช้แรงมาก <u>นานกว่า 20 นาทีขึ้นไป</u> (ทำให้หายใจแรงและเร็ว เช่น แอโรบิค กีฬาที่ใช้แรงมาก ขี่จักรยาน วิ่ง)	d13n2	☐☐ ครั้งต่อสัปดาห์
การเคลื่อนไหวร่างกายที่ใช้แรงระดับปานกลาง <u>นานกว่า 20 นาทีขึ้นไป</u> (เช่น การสังสรรค์ เล่นเทนนิส กอล์ฟ ว่ายน้ำช้าๆ ทำงานบ้าน หรืองานอื่นๆ)	d13n3	☐☐ ครั้งต่อสัปดาห์

D14 ท่านทำงานบ้าน เช่น ทำความสะอาด หรือทำสวน บ่อยครั้งเพียงใด

d14 ☐1 น้อยมากหรือไม่เคยเลย ☐2 1 - 3 ครั้ง / เดือน ☐3 1 - 2 ครั้ง / สัปดาห์
☐4 3 - 4 ครั้ง / สัปดาห์ ☐5 เกือบทุกวันหรือทุกวัน

D15 โดยปกติ ในหนึ่งวัน (24 ชั่วโมง) ท่านใช้เวลาในการทำสิ่งเหล่านี้ประมาณวันละกี่ชั่วโมง

กิจกรรม		ระยะเวลา
ยืนทุกกรณี (เช่น ยืนทำงาน ยืนคุย ฯลฯ)	d15n1	☐☐ ชั่วโมงต่อวัน
นั่งทุกกรณี (เช่น นั่งอ่านหนังสือ ขีดเขียน นั่งพักผ่อน นั่งคิด รวมเวลาที่นั่งดูโทรทัศน์ หรือนั่งทำงาน/เล่นเกมคอมพิวเตอร์)	d15n2	☐☐ ชั่วโมงต่อวัน
นอน (หากนอนกลางวันเป็นประจำให้นับรวมด้วย)	d15n3	☐☐ ชั่วโมงต่อวัน
นั่งเฉพาะกรณีดูโทรทัศน์และ/หรือนั่งเล่นคอมพิวเตอร์/นั่งเล่นเกม	d15n4	☐☐ ชั่วโมงต่อวัน

E การบาดเจ็บ

การบาดเจ็บ-ที่เกี่ยวข้องกับการจราจร

E1 ในช่วง <u>12 เดือนที่ผ่านมา</u> ท่านเคยได้รับบาดเจ็บจากอุบัติเหตุที่เกี่ยวข้องกับการจราจร จำนวนกี่ครั้ง

e1 ☐0 ไม่เคยได้รับบาดเจ็บ → ข้ามไปตอบข้อ **E7**
☐1 1 ครั้ง ☐2 2 ครั้ง
☐3 3 ครั้ง ☐4 4 ครั้งขึ้นไป

E2 การบาดเจ็บที่เกี่ยวกับการจราจรครั้ง<u>ที่เจ็บหนักที่สุด</u>นั้น ท่านต้องเข้ารับการรักษาพยาบาลหรือไม่

e2 ☐1 ใช่ ☐2 ไม่ใช่

E3 การบาดเจ็บครั้งนั้นมีผลทำให้ท่าน<u>ไม่สามารถ</u>ใช้ชีวิตได้ตามปกติตั้งแต่ 1 วันขึ้นไปหรือไม่

e3 ☐1 ใช่ ☐2 ไม่ใช่

E4 การบาดเจ็บครั้งนั้นท่านมีบทบาทอย่างไร

e4 ☐1 เป็นผู้ขับขี่ ☐2 เป็นผู้โดยสาร
☐3 เป็นผู้สัญจร → ข้ามไปตอบข้อ **E6**

E5 การบาดเจ็บครั้งนั้นยานพาหนะที่ท่านขับขี่โดยสารคือ

e5 ☐1 รถจักรยาน ☐2 รถมอเตอร์ไซค์
☐3 รถโดยสาร/รถตู้/รถทัวร์
☐4 รถยนต์/รถปิ๊กอัพ ☐5 อื่นๆ เช่น รถไฟ เรือ

❼

E6 คู่กรณี ที่ทำให้ท่านได้รับบาดเจ็บครั้งนั้น คือ

e6
- 1 รถจักรยาน
- 2 รถมอเตอร์ไซค์
- 3 รถโดยสาร/รถตู้/รถทัวร์
- 4 รถยนต์/รถปิ๊กอัพ
- 5 ยานพาหนะอื่นๆ เช่น รถไฟ รถอีแต๋น เรือ
- 6 ผู้สัญจร
- 7 สัตว์ เช่น สุนัข
- 8 สิ่งอื่นที่ไม่ใช่ยานพาหนะ เช่น ชนต้นไม้ กำแพง ผิวถนน

การบาดเจ็บ - ที่ไม่เกี่ยวข้องกับการจราจร

E7 ในช่วง 12 เดือนที่ผ่านมา ท่านเคยได้รับการบาดเจ็บที่ไม่เกี่ยวข้องกับการจราจร จำนวนกี่ครั้ง

e7
- 0 ไม่เคยได้รับบาดเจ็บ → ข้ามไปตอบข้อ F1
- 1 1 ครั้ง
- 2 2 ครั้ง
- 3 3 ครั้ง
- 4 4 ครั้งขึ้นไป

E8 การบาดเจ็บที่ไม่เกี่ยวข้องกับการจราจรครั้งที่เจ็บหนักที่สุดนั้น ท่านต้องเข้ารับการรักษาพยาบาลหรือไม่

e8
- 1 ใช่
- 2 ไม่ใช่

E9 การบาดเจ็บครั้งนั้นมีผลทำให้ไม่สามารถใช้ชีวิตได้ตามปกติตั้งแต่ 1 วันขึ้นไปหรือไม่

e9
- 1 ใช่
- 2 ไม่ใช่

E10 การบาดเจ็บครั้งที่เจ็บหนักที่สุดนั้น เกิดขึ้นอย่างไร

e10
- 1 ถูกทำร้าย (เช่น ถูกชก ผลัก เตะ)
- 2 ถูกกระแทก/ของตกใส่หรืออื่นๆ
- 3 ถูกของมีคมบาด/แทง
- 4 ถูกยิง
- 5 พลัดตกหรือหกล้มเอง
- 6 ยกของหนัก
- 7 แผลไฟไหมหรือน้ำร้อนลวก
- 8 จมน้ำ
- 9 ถูกแมลง/สัตว์/กัดหรือต่อย
- 10 ถูกสารพิษ
- 11 สำลัก
- 12 อื่นๆ

E11 การบาดเจ็บที่ไม่เกี่ยวกับการจราจรครั้งที่เจ็บหนักที่สุดนั้น เกิดขึ้นที่ไหน e11
- 1 ที่พักอาศัย
- 2 สถานที่เล่นกีฬาหรือออกกำลังกาย
- 3 สถานที่ทำงาน (ด้านเกษตรกรรม เช่น ไร่ นา)
- 4 สถานที่ทำงานอื่นๆ (ที่ไม่เกี่ยวกับเกษตรกรรม)
- 5 อื่นๆ

E12 การบาดเจ็บที่ไม่เกี่ยวกับการจราจรครั้งนั้น มีอาการแบบใด *(เลือกได้มากกว่า 1 คำตอบ)*
- กระดูกหัก แตก ร้าว e12n1
- เคล็ด ขัดยอกหรือข้อเคลื่อน e12n2
- แผลจากของมีคม แผลถูกกัด หรือแผลเปิด e12n3
- ฟกช้ำหรือบาดเจ็บบริเวณผิวหนัง e12n4
- แผลไฟไหม้/น้ำร้อนลวก e12n5
- แผลปูด/บวมจากการถูกอัด/กระแทก e12n6
- อวัยวะภายในร่างกายได้รับบาดเจ็บ e12n7
- อื่นๆ e12n8

E13 การบาดเจ็บที่ไม่เกี่ยวกับการจราจรครั้งนั้น เกิดขึ้นอย่างไร *(เลือกเพียง 1 คำตอบ)*
- 1 ไม่ได้ตั้งใจ เป็นอุบัติเหตุ
- 2 ตั้งใจกระทำโดยบุคคลอื่น
- 3 ตั้งใจกระทำ (ไม่มีบุคคลอื่นเกี่ยวข้อง)

e13

8

F ประวัติเกี่ยวกับสุขภาพของท่าน

F1 ท่านเคยได้รับการยืนยันอย่างชัดเจน จากแพทย์ว่าท่านเป็นโรคใดต่อไปนี้บ้าง

รายการ		เป็น	แพทย์บอกว่าท่านเสี่ยงที่จะเป็น	ไม่เป็น
เบาหวาน	f1n1	1	2	3
คอเลสเตอรอลสูงหรือไขมันในเลือดสูง	f1n2	1	2	3
ความดันโลหิตสูง	f1n3	1	2	3
โรคหัวใจขาดเลือด	f1n4	1	2	3
โรคหลอดเลือดในสมอง (Stroke)	f1n5	1	2	3
มะเร็งตับ	f1n6	1	2	3
มะเร็งปอด	f1n7	1	2	3
มะเร็งกระเพาะอาหาร	f1n8	1	2	3
มะเร็งลำไส้	f1n9	1	2	3
มะเร็งเต้านม	f1n10	1	2	3
มะเร็งอวัยวะอื่นๆ	f1n11	1	2	3
โรคเกี่ยวกับไต	f1n12	1	2	3
โรคอื่นๆ(ระบุ).....f1n13x.....	f1n13	1	2	3

F2 ปัจจุบันท่านมีหลักประกันสุขภาพประเภทใดบ้าง และคุ้มครองมานานกี่ปี *(เลือกได้มากกว่า 1 คำตอบ)*

(ถ้าปัจจุบันคุ้มครองมาแล้วน้อยกว่า 1 ปี โปรดใส่ตัวเลข 0 1)

ประเภทของหลักประกันสุขภาพ		ระยะเวลาที่คุ้มครองมาแล้ว
☐ ไม่มีสวัสดิการใดๆ	f2n1	
☐ สวัสดิการข้าราชการ	f2n2	f2n2y ☐☐ ปี
☐ สวัสดิการพนักงาน/	f2n3	f2n3y ☐☐ ปี
☐ ประกันสุขภาพของ	f2n4	f2n4y ☐☐ ปี
☐ ประกันสังคม	f2n5	f2n5y ☐☐ ปี
☐ ประกันสุขภาพถ้วน	f2n6	f2n6y ☐☐ ปี
☐ อื่นๆ.....f2n7x.....	f2n7	f2n7y ☐☐ ปี

F3 ในช่วง 12 เดือน ที่ผ่านมา ท่านเข้ารับบริการสุขภาพกี่ครั้ง จากสถานพยาบาลใดบ้าง *(เลือกได้มากกว่า 1 คำตอบ)*

สถานพยาบาล		จำนวนครั้ง (ในช่วง 12 เดือนที่ผ่านมา) เช่น ใช้บริการปีละครั้งใส่ 0 1 ครั้ง
สถานีอนามัย	f3n1	☐☐ ครั้ง
โรงพยาบาลชุมชน	f3n2	☐☐ ครั้ง
คลินิกเอกชน	f3n3	☐☐ ครั้ง
โรงพยาบาลของรัฐ	f3n4	☐☐ ครั้ง
โรงพยาบาลของเอกชน	f3n5	☐☐ ครั้ง
แพทย์แผนไทย	f3n6	☐☐ ครั้ง
ร้านขายยา	f3n7	☐☐ ครั้ง
อื่นๆ.....f2n8x.....	f3n8	☐☐ ครั้ง

G บุหรี่ แอลกอฮอล์ และการเดินทาง

G1 ปัจจุบันท่านสูบบุหรี่หรือไม่ g1n

g1 ☐1 ไม่สูบ ☐2 สูบ โดยสูบวันละ ☐☐ มวน

G2 การดื่มแอลกอฮอล์ของท่านในปัจจุบันเป็นแบบใด

g2 ☐1 ไม่เคยดื่มเลย ☐2 เคยดื่ม แต่เลิกแล้ว
☐3 ดื่มเฉพาะเวลาเข้าสังคม ประมาณ g2n3 ☐☐ แก้ว/สัปดาห์
☐4 ดื่มเป็นประจำ ประมาณ ☐☐ แก้ว/วัน g2n4

G3 ในช่วง 12 เดือนที่ผ่านมา ท่านเคยขับขี่ยานพาหนะหลังดื่มแอลกอฮอล์ตั้งแต่ 3 แก้วขึ้นไป หรือไม่

g3 ☐1 เคย ☐2 ไม่เคย ☐3 ปกติไม่ได้ขับขี่ยานพาหนะ

G4 ในช่วง 12 เดือนที่ผ่านมา ท่านกระทำสิ่งต่อไปนี้บ่อยครั้งเพียงใด ในการเดินทาง

		ทำประจำ	ทำบางครั้ง	ไม่เคยทำ	ไม่เข้าข่าย เนื่องจาก	
คาดเข็มขัดนิรภัยเมื่อนั่งรถยนต์เบาะหน้า	g4n1	1	2	3	4	รถไม่มีเข็มขัดนิรภัย/ไม่นั่งรถยนต์เบาะหน้า
คาดเข็มขัดนิรภัยเมื่อนั่งรถยนต์เบาะหลัง	g4n2	1	2	3	4	รถไม่มีเข็มขัดนิรภัย/ไม่นั่งรถยนต์เบาะหลัง
นั่ง/ยืนบริเวณบันไดท้ายรถสองแถว	g4n3	1	2	3	4	ไม่ใช้รถสองแถว
นั่งในกระบะท้ายไม่มีหลังคา	g4n4	1	2	3	4	ไม่นั่งในกระบะท้าย
สวมหมวกนิรภัยขณะขับขี่/ซ้อนมอเตอร์ไซค์	g4n5	1	2	3	4	ไม่ใช้รถมอเตอร์ไซค์
ขับขี่/ซ้อนมอเตอร์ไซค์สามคนหรือมากกว่า	g4n6	1	2	3	4	ไม่ใช้รถมอเตอร์ไซค์

H คำถามเกี่ยวกับการให้กำเนิดและคุมกำเนิด *(เฉพาะสมาชิกสตรี ของโครงการวิจัยสุขภาพเท่านั้น)*

*(สมาชิก**ชายไม่ต้องตอบ**ข้อต่อไปนี้)*

H1 ท่านเคยให้กำเนิดบุตรมาแล้วทั้งหมดกี่คน h1 ☐☐ คน *(กรณีโสด หรือไม่เคยให้กำเนิดบุตร โปรดใส่ตัวเลข 0 0)*

H2 โปรดระบุการคุมกำเนิดที่ท่านเคยใช้ในอดีตและปัจจุบัน *(ถ้าใช้มาน้อยกว่า 1 ปี โปรดใส่ตัวเลข 0 0)*

ท่านเคยใช้การคุมกำเนิดด้วยวิธีต่อไปนี้หรือไม่		อายุที่เริ่มใช้ครั้งแรก	อายุที่ใช้ครั้งล่าสุด *(อายุปัจจุบันถ้ายังใช้อยู่)*	ใช้มานานกี่ปีแล้ว *(ไม่รวมช่วงที่ไม่ใช้)*
ยาเม็ดคุมกำเนิด h2n1	☐1 ไม่ใช่ ☐2 ใช่ →	h2n1a ☐☐ ปี	h2n1b ☐☐ ปี	h2n1c ☐☐ ปี
ยาฉีดคุมกำเนิดทุก 3 เดือน (เดโป-โปรวีร่า) h2n2	☐1 ไม่ใช่ ☐2 ใช่ →	h2n2a ☐☐ ปี	h2n2b ☐☐ ปี	h2n2c ☐☐ ปี
ยาคุมกำเนิดแบบฝังใต้ผิวหนัง (มีผลในการคุม 3-5 ปี) h2n3	☐1 ไม่ใช่ ☐2 ใช่ →	h2n3a ☐☐ ปี	h2n3b ☐☐ ปี	h2n3c ☐☐ ปี

ขอขอบคุณในความร่วมมืออย่างดียิ่ง

APPENDIX E

THESIS PHOTOS

This appendix contains photographs from my fieldwork study in Thailand and from other thesis related activities. Each photograph is accompanied by brief comment. My interviews were performed in two areas: Bangkok (capital city of Thailand) and Ranong (Southern part of Thailand). For Bangkok, interviews were done at work or at home for each participant. For Ranong, the interview area was set up near the entrance of the Tesco Lotus supermarket. Fieldwork results are presented in published articles (Chapter 4 and 5). Photos also record some other thesis activities including a 2014 Thai Cohort Study meeting and workshop for data editing. As well there were various conferences, interviews of nutrition label experts and photographs of some of these activities are included.

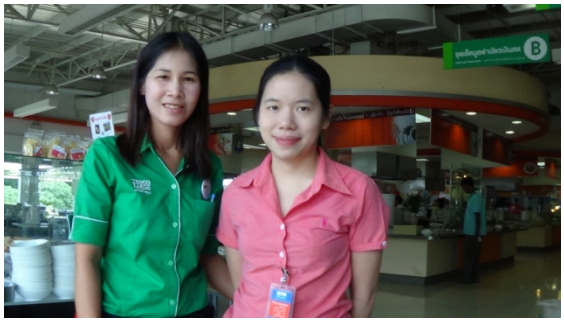
Interview with Bangkok participant at work

Interview with Bangkok participant at home

Interview with Bangkok participant at work

Interview with Bangkok participant at work

Tesco Lotus Supermarket, Ranong



Meet a Tesco Lotus staff member to get a permission card enabling interviews of customers

Interview with Ranong participant at supermarket

Interview with Ranong participant at supermarket

Interview with Ranong participant at supermarket

Thai Cohort Study meeting and data cleaning, Bangkok in 2014

Poster presentation at the 12th Asian Congress of Nutrition in Yokohama, Japan

Oral presentation at the 2016 Biennial Conference of the Asian Studies Association of Australia (ASAA), Australian National University

Oral presentation at Research School of Population Health student conference 2015 in the Finkel Lecture Theatre, John Curtin School of Medical Research, Australian National University

Interview of nutrition label expert (Dr. Hattaya Kongchuntuk)