



UNIVERSITI PUTRA MALAYSIA

***HOUSEHOLD FOOD INSECURITY AND ITS ASSOCIATION WITH DIET
QUALITY AND WEIGHT STATUS AMONG ORANG ASLI (MAH MERI)
WOMEN IN KUALA LANGAT, SELANGOR, MALAYSIA***

CHONG SU PEI

FPSK(M) 2018 36



**HOUSEHOLD FOOD INSECURITY AND ITS ASSOCIATION WITH DIET
QUALITY AND WEIGHT STATUS AMONG ORANG ASLI (MAH MERI)
WOMEN IN KUALA LANGAT, SELANGOR, MALAYSIA**

By

CHONG SU PEI

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfillment of the Requirements for the Degree of Master of Science**

May 2018

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia



DEDICATION

This thesis is dedicated to the memory of my beloved mother Lee Thian Yin, a strong woman whom I still miss every day.



© COPYRIGHT UPM

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

HOUSEHOLD FOOD INSECURITY AND ITS ASSOCIATION WITH DIET QUALITY AND WEIGHT STATUS AMONG ORANG ASLI (MAH MERI) WOMEN IN KUALA LANGAT, SELANGOR, MALAYSIA

By

CHONG SU PEI

May 2018

Chair: Associate Professor Norhasmah binti Sulaiman, PhD
Faculty: Medicine and Health Sciences

Socio-economic status was the main contributor of food insecurity, which was shown to be associated with poor nutritional outcomes among women. This cross-sectional study was designed to determine characteristics of household food insecurity and its association with diet quality and weight status among 222 Mah Meri women in Kuala Langat, Selangor. Respondents in this study were selected using cluster sampling method. Household food insecurity was assessed using Radimer/Cornell Hunger and Food Insecurity Instrument. Malaysian Healthy Eating Index (HEI) was used to measure the overall diet quality of the population. Data on socio-demographic, environmental sanitation and personal hygiene practices, nutrition knowledge, food security status and 24-hour dietary recalls were obtained through face-to-face interview with the respondents. Anthropometric measurements including weight, height, Body Mass Index (BMI), waist circumference and body fat percentage were conducted.

In this study, majority of the Orang Asli households experienced some form of food insecurity, which were household food insecurity (29.3%), individual food insecurity (23.4%), and child hunger (30.2%). The overall diet quality of the respondents was poor, with a mean Malaysian HEI score of 45.3%. While 57.2% of the respondents were found to be overweight and obese, 53.6% were abdominally obese and 54.1% possess an overfat and obese level of body fat percentage. Child-hunger group had significantly more children ($p<0.05$) and larger household size ($p<0.05$) compared to food-secure group. There was a significant decrease in the mean household income, income per capita, total expenditure and food expenditure as food insecurity worsened ($p<0.001$). In addition, the child-hunger group had significantly lower mean environmental sanitation score compared to food-secure and household food-insecure groups respectively ($p<0.001$). The mean score of nutrition knowledge of child-hunger group was significantly lower than household food-insecure group ($p<0.05$).

In terms of Malaysian HEI, individual food-insecure group and child-hunger group had significantly lower mean scores for components grains and cereals ($p<0.01$) and meat, poultry and eggs ($p<0.001$) as compared to food-secure and individual food-insecure groups. On the contrary, child hunger group had significantly higher mean scores of total fat ($p<0.05$) and sodium ($p<0.001$) than food-secure group. Compared to the individual food-insecure and child-hunger groups, MANCOVA showed that the food-secure group was significantly associated with a higher Malaysian HEI score while the household food-insecure group was significantly associated with a higher BMI after controlling for age and marital status ($p<0.025$).

In conclusion, this study indicated that the majority of Mah Meri households were food insecure. The overall diet quality of the respondents was poor and more than half of them were either overweight or obese. Respondents from individual insecure and child hunger groups were associated with lower diet quality. While respondents from household insecure group were associated with higher body weight. These findings suggest a pressing need for nutrition interventions to enhance dietary intake among the low income households in the Mah Meri community in the district of Kuala Langat, Selangor.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**TIADA JAMINAN KEDAPATAN MAKANAN ISI RUMAH DAN
PERKAITANNYA DENGAN KUALITI DIET DAN STATUS BERAT BADAN
DALAM KALANGAN WANITA ORANG ASLI (MAH MERI)
DI KUALA LANGAT, SELANGOR, MALAYSIA**

Oleh

CHONG SU PEI

Mei 2018

Pengerusi: Profesor Madya Norhasmah binti Sulaiman, PhD
Fakulti: Perubatan dan Sains Kesihatan

Status sosioekonomi merupakan penyumbang utama tiada jaminan kedapatan makanan isi rumah dan telah dibuktikan berkait dengan status pemakanan yang kurang baik dalam kalangan wanita. Kajian keratan rentas ini telah direka untuk menentukan ciri-ciri tiada jaminan kedapatan makanan isi rumah dan perkaitannya dengan kualiti diet dan status berat badan dalam kalangan 222 wanita Mah Meri di Kuala Langat, Selangor. Responden dalam kajian ini telah dipilih dengan menggunakan kaedah persampelan kelompok. Tiada jaminan kedapatan makanan isi rumah telah diukur dengan menggunakan *Radimer/Cornell Hunger and Food Insecurity Instrument. Malaysian Healthy Eating Index (HEI)* telah digunakan untuk mengukur kualiti keseluruhan diet penduduk. Data sosiodemografi, sanitasi persekitaran dan amalan kebesihan diri, pengetahuan pemakanan, status jaminan kedapatan makanan dan ingatan diet 24 jam telah diperolehi melalui temubual secara bersemuka dengan responden. Pengukuran antropometri bagi berat, ketinggian, *Body Mass Index (BMI)*, ukurlilit pinggang dan peratus lemak tubuh telah dijalankan.

Majoriti isi rumah mengalami beberapa tahap masalah tiada jaminan kedapatan makanan (82.9%), antaranya tiada jaminan kedapatan makanan pada tahap isi rumah (29.3%), tiada jaminan kedapatan makanan pada tahap individu (23.4%) dan kumpulan kelaparan kanak-kanak (30.2%). Keseluruhan kualiti diet responden adalah teruk, dengan min skor *Malaysian HEI* 45.3%. Manakalan 57.2% responden adalah berat badan berlebihan dan obes, 53.6% adalah obesiti sentral dan 54.1% mempunyai tahap peratus lemak tubuh yang lebih dan obes. Kumpulan kelaparan kanak-kanak mempunyai lebih ramai anak ($p<0.05$) dan saiz isi rumah yang lebih besar ($p<0.05$) secara signifikan berbanding dengan kumpulan jaminan kedapatan makanan. Terdapat penurunan yang signifikan dalam min pendapatan isi rumah, pendapatan per kapita, jumlah perbelanjaan dan perbelanjaan makanan ($p<0.001$) apabila masalah tiada jaminan kedapatan makanan semakin teruk. Selain itu, kumpulan kelaparan kanak-kanak mempunyai skor sanitasi persekitaran yang

lebih rendah daripada kumpulan jaminan kedapatan makanan dan kumpulan tiada jaminan kedapatan makanan pada tahap isi rumah masing-masing ($p < 0.05$). Skor pengetahuan pemakanan bagi kumpulan kelaparan kanak-kanak adalah lebih rendah daripada kumpulan tiada jaminan kedapatan makanan pada tahap isi rumah ($p < 0.05$).

Dari segi *Malaysian HEI*, kumpulan yang tiada jaminan kedapatan makanan pada tahap individu dan kumpulan kelaparan kanak-kanak mempunyai min skor yang lebih rendah bagi komponen bijirin ($p < 0.01$) dan daging, ayam dan telur ($p < 0.001$) berbanding dengan kumpulan jaminan kedapatan makanan dan kumpulan tiada jaminan kedapatan makanan pada tahap isi rumah. Selain itu, kumpulan kelaparan kanak-kanak mempunyai min skor lemak dan natrium yang lebih tinggi daripada kumpulan jaminan kedapatan makanan dan kumpulan tiada jaminan kedapatan makanan pada tahap isi rumah ($p < 0.001$). Berbanding dengan kumpulan tiada jaminan kedapatan makanan pada tahap individu dan kelaparan kanak-kanak, *MANCOVA* menunjukkan status jaminan kedapatan makanan adalah berkait dengan lebih tinggi skor *Malaysian HEI* manakala kumpulan tiada jaminan kedapatan makanan pada tahap isi rumah adalah berkait dengan lebih tinggi *BMI* selepas mengawal umur dan status perkahwinan ($p < 0.025$).

Secara kesimpulannya, kajian ini menunjukkan bahawa majoriti isi rumah Mah Meri mengalami masalah tiada jaminan kedapatan makanan. Keseluruhan kualiti diet responden adalah teruk dan antara mereka lebih separuh adalah sama ada berat badan berlebihan atau obes. Dalam kajian ini, responden dari isi rumah yang mengalami masalah tiada jaminan kedapatan makanan pada tahap individu dan kumpulan kelaparan kanak-kanak adalah berkait dengan kualiti diet yang lebih rendah. Manakala responden yang mengalami masalah tiada jaminan kedapatan makanan pada tahap isi rumah adalah berkait dengan berat badan yang lebih tinggi. Keputusan ini mencadangkan keperluan intervensi pemakanan yang mendesak untuk memperbaiki pengambilan makanan dalam kalangan isi rumah yang berpendapatan rendah.

ACKNOWLEDGEMENTS

First and foremost, I want to thank God, who has guided me through every stage of this study. I acknowledge that He provided for all my needs, gave me the strength to study and finally granted me the wisdom to finish this thesis. He has brought people into my life that have helped me achieve my goals. I would like to express my great attitude to my supervisor Assoc Prof Dr Norhasmah binti Sulaiman without whom this thesis would not be possible. Despite the business in work, she has devoted time and effort to teach me in this research. She listened to my problem and guided me to solve it. The biggest lesson I have learnt from her is never escape the problem.

My special gratitude also goes to my co-supervisor, Dr Geeta Appannah whose guidance, suggestion and vast experiences, have assisted me in the completion of this thesis. I would like to acknowledge all the lecturers and staff of the Department of Nutrition and Health Sciences specifically and Faculty of Medicine and Health Sciences in general for providing all the necessary support and help during various stages of the thesis preparation. Equally I wish to thank Siti Farhana Mesbah and Fadilah Mohd Nor for sharing your ideas and providing help when I was in need.

I would also like to thank staff of the Department of Orang Asli Development (JAKOA), the chairman and members of Village Security and Development Committee (JKKK) and village headman (Tok Batin) for giving permission and help to make this research in Orang Asli possible. My thanks will not be complete if I did not mention my church members and friends - your prayer and encouragement kept me focused and sustained me through. Everything that I have accomplished in life can be traced to having a loving and supportive family.

I certify that a Thesis Examination Committee has met on 16 May 2018 to conduct the final examination of Chong Su Pei on her thesis entitled "Household Food Insecurity and its Association with Diet Quality and Weight Status among Orang Asli (Mah Meri) Women in Kuala Langat, Selangor, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Zuriati binti Ibrahim, PhD

Senior Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Siti Nur Asyura binti Adznam, PhD

Senior Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Internal Examiner)

Norimah A. Karim, PhD

Professor
Universiti Kebangsaan Malaysia
Malaysia
(External Examiner)



NOR AINI AB. SHUKOR, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 28 June 2018

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Norhasmah binti Sulaiman, PhD

Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Geeta Appannah, PhD

Senior Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

ROBIAH BINTI YUNUS, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

Declaration by Graduate Student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and Innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/ fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature: _____ Date: _____

Name and Matric No.: _____

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: _____
Name of Chairman of
Supervisory
Committee: _____

Signature: _____
Name of Member of
Supervisory
Committee: _____

TABLE OF CONTENTS

	Page
ABSTRACT	i
ABSTRAK	iii
ACKNOWLEDGEMENTS	v
APPROVAL	vi
DECLARATION	viii
LIST OF TABLES	xiii
LIST OF FIGURES	xvi
LIST OF APPENDICES	xvii
LIST OF ABBREVIATIONS	xviii
CHAPTER	
1. INTRODUCTION	1
1.1. Background of Study	1
1.2. Problem Statement	2
1.3. Research Questions	3
1.4. Objectives of Study	3
1.4.1. General Objective	3
1.4.2. Specific Objectives	4
1.5. Null Hypothesis	4
1.6. Significance of Study	4
1.7. Conceptual Framework	5
1.8. Research Framework	5
1.9. Definition of Variable	8
1.9.1. Household Food Security Status	8
1.9.2. Diet Quality	8
1.9.3. Anthropometric Status	8
2. LITERATURE REVIEW	9
2.1. Food Insecurity	9
2.1.1. Definition and Concept of Food Insecurity	9
2.1.2. Food Security Status in the World	11
2.1.3. Food Security Status in Malaysia	14
2.2. Diet Quality	16
2.2.1. Diet Quality Index	16
2.2.2. Dietary Intake Patterns	19
2.2.3. Physical Activity Level	21
2.2.4. Diet Quality in Malaysia	21
2.3. Anthropometric status	23
2.3.1. Anthropometric Measurements	23
2.3.2. Anthropometric status of Orang Asli in Malaysia	24
2.4. Characteristics of Food Insecurity	25
2.4.1. Socio-demographic Characteristics	25
2.4.2. Environmental Sanitation and Personal Hygiene Practices	26
2.4.3. Nutrition Knowledge	26
2.5. Association between Food Insecurity and Diet Quality	27

2.6	Association between Food Insecurity and Anthropometric Status	29
3.	METHODOLOGY	33
3.1.	Introduction	33
3.2.	Study Design and Population	33
3.3.	Study Location	33
3.4.	Sampling Design	34
3.5.	Sample Size Estimation	36
3.6.	Inclusion and Exclusion Criteria	37
3.7.	Pre-test	38
3.8.	Data Collection	38
3.9.	Instruments	40
3.9.1.	Socio-demographic Characteristics	40
3.9.2.	Environmental Sanitation and Personal Hygiene Practices	40
3.9.3.	Nutrition Knowledge	40
3.9.4.	Household Food Security Status	41
3.9.5.	Two days 24-hour Diet Recall	42
3.9.6.	Dietary Misreporting	43
3.9.7.	Physical Activity Level	45
3.9.8.	Malaysian Healthy Eating Index Scoring	46
3.9.9.	Anthropometric Measurements	50
3.10.	Statistical Analysis	52
4.	RESULTS	53
4.1.	Introduction	53
4.2.	Socio-demographic Characteristics	53
4.3.	Environmental Sanitation and Personal Hygiene Practices	55
4.4.	Nutrition Knowledge	56
4.5.	Household Food Security Status	58
4.6.	Diet Quality	58
4.6.1.	Dietary Misreporting	58
4.6.2.	Energy and Nutrient Intakes	59
4.6.3.	Physical Activity Level	60
4.6.4.	Diet Quality based on Malaysian Healthy Eating Index	61
4.7.	Anthropometric Status	63
4.8.	Characteristics of Food Insecurity	64
4.8.1	Socio-demographic Characteristics according to Food Security Status	64
4.8.2	Environmental Sanitation and Personal Hygiene Practices according to Food Security Status	67
4.8.3	Nutrition Knowledge according to Food Security Status	67
4.9.	Components of Malaysian Healthy Eating Index according to Food Security Status	69
4.10.	Association between Food Security Status, Diet Quality and Weight Status	72

5. DISCUSSION	76
5.1. Introduction	76
5.2. Sociodemographic Characteristics	76
5.3. Environmental Sanitation and Personal Hygiene Practices	77
5.4. Nutrition Knowledge	78
5.5. Household Food Security Status	78
5.6. Diet Quality (Healthy Eating Index)	80
5.6.1. Dietary Misreporting	80
5.6.2. Energy and Nutrient Intakes	80
5.6.3. Physical Activity Level	81
5.6.4. Diet Quality based on Malaysian Healthy Eating Index	81
5.7. Anthropometric Status	83
5.8. Characteristics of Food Insecurity	84
5.8.1. Socio-demographic Characteristics	84
5.8.2. Environmental Sanitation and Personal Hygiene Practices	85
5.8.3. Nutrition Knowledge	85
5.9. Components of Malaysian Healthy Eating index according to Food Security Status	85
5.10. Association between Food Security Status, Diet Quality, and Weight Status	86
6. CONCLUSION, LIMITATIONS AND RECOMMENDATIONS	88
6.1. Introduction	88
6.2. Conclusion	88
6.3. Limitations	89
6.4. Recommendations	90
REFERENCES	92
APPENDICES	111
BIODATA OF STUDENT	137
PUBLICATIONS	138

LIST OF TABLES

Table		Page
2.1	Levels and components of the concept of food insecurity	10
2.2	Radimer/Cornell Hunger and Food Insecurity items according to level and components	10
2.3	Countries that met the target of Millennium Development Goal	12
2.4	Countries that met both the targets of Millennium Development Goal and World Food Summit	12
2.5	Countries that maintained undernourishment below or close to 5 percent since 1990–92	13
2.6	Studies of food insecurity using Radimer/ Cornell Hunger and Food Insecurity Scale	15
2.7	Nutrient-based indexes of overall diet quality	17
2.8	Food-group-based indexes of overall diet quality	18
2.9	Nutrient and food-group-based indexes combined of overall diet quality	18
2.10	Studies of diet quality using Healthy Eating Index	22
2.11	Studies of association between food insecurity and diet quality	28
2.12	Studies of association between food insecurity and anthropometric status	31
3.1	Distribution of households based on sub-districts and villages	36
3.2	Input and output parameters from G*Power calculation	37
3.3	Inclusion and exclusion criteria of respondents	37
3.4	Classification of nutrition knowledge	41
3.5	Classification of food security level	41
3.6	Serving size for each food group	42
3.7	Basal metabolic rate standard formula for women	45
3.8	Classification of physical activity level	45

3.9	Recommended serving sizes according to food groups based on total energy intake	46
3.10	Criteria scoring for Malaysian Healthy Eating Index Components	48
3.11	Malaysian Healthy Eating Index scoring for total fat and sodium	48
3.12	Classification of body weight based on Body Mass Index	51
3.13	Body fat cut-off points for women	51
4.1	Socio-demographic characteristics of respondents (n=222)	53
4.2	Socio-demographic characteristics of respondents (n=218)	54
4.3	Responses of environmental sanitation and personal hygiene practices of respondents (n=222)	55
4.4	Sanitation and hygiene scores of respondents (n=222)	56
4.5	Nutrition knowledge responses of the respondents (n=222)	57
4.6	Nutrition knowledge score of respondents (n=222)	57
4.7	Prevalence of household food security status (n=222)	58
4.8	Validity of reported energy intake (n=222)	58
4.9a	Energy and nutrients intake of respondents (n=222)	59
4.9b	Energy and nutrients intake of respondents (n=152)	60
4.10	Physical activity level of respondents (n=222)	61
4.11a	Average serving size and scores of Malaysian Healthy Eating Index components (n=222)	61
4.11b	Average serving size and scores of Malaysian Healthy Eating Index components (n=152)	62
4.12a	Diet quality of respondents (n=222)	62
4.12b	Diet quality of respondents (n=152)	63
4.13	Anthropometric measures of respondents (n=222)	63
4.14	Socio-demographic characteristics of respondents according to food security status (n=222)	65
4.15	Socio-demographic characteristics of respondents according to food security status (n=218)	66

4.16	Environmental sanitation, personal hygiene practices, and nutrition knowledge according to food security status (n=222)	68
4.17a	Component scores of Malaysian Healthy Eating Index according to food security status (n=222)	70
4.17b	Component scores of Malaysian Healthy Eating Index according to food security status (n=152)	71
4.18a	Indicators of Multivariate Analysis of Covariance model (n=222)	73
4.18b	Indicators of Multivariate Analysis of Covariance model (n=152)	75
4.19a	Malaysian Healthy Eating Index and Body Mass Index according to food security status (n=222)	73
4.19b	Malaysian Healthy Eating Index and Body Mass Index according to food security status (n=152)	75

LIST OF FIGURES

Figure		Page
1.1	Conceptual framework	6
1.2	Research framework	7
3.1	Location of study	34
3.2	Flow chart of sampling	35
3.3	Flow chart of study	39
3.4	Malaysian Healthy Eating Index components scoring formula	46
3.5	Malaysian Healthy Eating Index composite score formula	47
3.6	Malaysian Healthy Eating Index scoring steps	49
3.7	Body Mass Index formula	50

LIST OF APPENDICES

Appendix		Page
A	Ethics Committee for Research involving Human Subjects of Universiti Putra Malaysia (JKEUPM)	111
B	Application letter for Department of Orang Asli Development (JAKOA)	112
C	Approval letter from Department of Orang Asli Development (JAKOA)	114
D	Information sheet and consent form	116
E	Questionnaire	119

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BMI	Body Mass Index
BMR	Body Metabolic Rate
DDS	Diet Diversity Score
DFHG	Deep Forest Hunter Gatherers
DOSM	Department of Statistics Malaysia
DQI	Diet Quality Index
EI	Energy Intake
FAO	Food Agriculture Organisation
HEI	Healthy Eating Index
HFIAS	Household Food Insecurity Access Scale
HFSSM	Household Food Security Survey Module
INMU	Institute of Nutrition, Mahidol University
IPH	Institute for Public Health
JAKOA	Department of Orang Asli Development
JKKK	Village Security and Development Committee
IASO	International Association for the Study of Obesity
IFAD	International Fund for Agricultural Development
IOTF	International Obesity Task Force
IPAQ-SF	International Physical Activity Questionnaire Short Form
MANCOVA	Multivariate Analysis of Covariance
MANS	Malaysia Adult Nutrition Survey
MDG	Malaysian Dietary Guidelines
MET	Metabolic Equivalent of Tasks
MOH	Ministry of Health
NAR	Nutrient Adequacy Ratio
NCCFN	National Coordinating Committee on Food and Nutrition
NHMS	National Health and Morbidity Survey
NPANM	National Plan of Action for Nutrition of Malaysia
NQI	Nutritional Quality Index
RC	Resettled Communities
RDA	Recommended Daily Allowances
RNI	Recommended Nutrient Intake
SDGs	Sustainable Development Goals
TWG-R	Technical Working Group on Research
UCFD	Urbanized City Fringe Dwellers
UNDP	United Nations Development Programmes
UNICEF	United Nations Children's Fund
WFP	World Food Programme
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Indigenous people in Peninsular Malaysia are called Orang Asli. As defined by the United Nations Development Programme, “Indigenous people are social groups that share similar characteristics such as occupation within defined ancestral territories, maintenance of cultural, social, economic, and political institutions within the territories that are distinct from those of dominant societies and self identification of tribal group” (UNDP, 2006). They are officially classified into three main ethnic groups namely, Negrito, Senoi and Proto-Malay; each with several dialectic sub-groups and diverse cultures (Jais, 2010). Mah Meri is one of the tribesmen of the main ethnic group of Senoi, which could only be found within the state of Selangor. Mah Meri is known as “forest people” or “sea people” because they live near the forest and sea, and engage in agricultural and fishing jobs (Jais, 2010).

According to the Rome declaration on world food security, “poverty is a major cause of food insecurity, and food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1996). This definition entails two dimensions of food insecurity at household level which are insufficient nutritionally and safe food supply at any given time, and secondly inadequate utilization of these foods. The anxiety and uncertainty about household food supply, having deficiencies in quantity and quality of food are the main factors which causes the Orang Asli people to have insufficient amount of nutritional food and food supply at any given time. The reason why the Orang Asli people suffer from inadequate utilization of these food are due to practices of healthcare, water and sanitation, personal hygiene, and as well as nutrition knowledge and beliefs (FAO, 1996; Wolfe & Frongillo, 2001).

According to the National Plan of Action for Nutrition of Malaysia III (NPANM III), 2016-2025, food and nutrition security is the new focus area in the next decade. Food and nutrition related policies and action plan included the Sustainable Development Goals (SDGs) 2030, an inter-governmental agreed set of targets to end poverty and hunger, improving health and education. The second of the 17 proposed SDGs is “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture” and is linked directly with nutrition (MOH, 2016). Poverty and food insecurity are usually the main causes of malnutrition, where malnourished is defined as having poor or inadequate diet that lead to undernutrition. On the contrary, a new paradox is that poverty and food insecurity can lead to overnutrition, causing overweight and obesity (Tanumihardjo et al., 2007).

Globalisation and industrialisation accompanied by rapid urbanisation has brought about changes in dietary intake and physical activity patterns in developing countries (Kennedy

et al., 2004). As a country that undergo major demographic, epidemiological and socio-economic transitions, Orang Asli in Malaysia have also experienced nutrition transition, in which their traditional dietary patterns have been influenced by the development of processed foods that are high in refined carbohydrates, saturated fat, sugar and salt but low in fiber (Kuhnlein et al. 2004; Nurfaizah et al., 2009). In Malaysia, only few studies were conducted to study the dietary intake and physical activity patterns of Orang Asli (Haemamalar et al., 2010; Hayati et al., 2007; Lim & Chee, 1998; Nurfaizah et al., 2009; Zalilah & Tham, 2002).

Collectively, several studies report an association of food insecurity with nutrient inadequacies (Egeland et al., 2011; Kirkpatrick et al., 2015), decreased dietary intake (Dharod et al., 2013; Robaina & Martin, 2013), and increased body weight and waist circumference (Dharod et al., 2013; Leyna et al., 2010; Pan et al., 2012). In Malaysia, previous studies have identified intake of expensive food groups such as meat, poultry, fish, and legumes reduced as food insecurity worsened (Mohamadpour et al., 2012; Norhasmah et al., 2011). That is why food insecurity will directly affect a person's diet quality because higher diet quality is associated with higher dietary cost (Dharod et al., 2013; Pondor et al., 2017). Recent studies have found food insecurity was associated with diet quality as measured by two widely used indicators, Healthy Eating Index (HEI) (Leung et al., 2014) and Diet Diversity Score (DDS) (Ihab et al., 2012).

Traditionally, single nutrients or food groups was used in studies examining diet and health associations, however, realizing that an individual's complete diet comprised of variety of foods, a new approach of studying the dietary pattern and consequently diet quality was emerged to better capture the interactions and synergistic effects of foods and nutrients on health (Champagne et al., 2007). HEI is one of the indexes of overall diet quality based on nutrients and food groups, unlike indexes that are based on either nutrients or food groups only, example Nutrient Adequacy Ratio and DDS respectively (Kant, 1996). Malaysian HEI is a summary measure of overall diet quality and compliance of dietary intake patterns to Malaysian Dietary Guidelines and Malaysian Food Pyramid (Lee et al., 2011).

1.2 Problem Statement

According to studies by Baer (1999) and (Khor& Zalilah, 2008), "a high proportion of the Orang Asli community subsists on a level that is below the government's poverty line income". Similar to indigenous people around the world, almost every social indicator, the Orang Asli were lagged behind other Malaysians, they were among the most marginalized community (Nicholas & Baer, 2007). According to the Malaysia Millennium Development Goals Report 2015, Orang Asli has been identified as the poorest group with a higher rate of poverty (34%) compared to the national average of 0.6% (United Nations Malaysia, 2016). Various studies among the Orang Asli communities in Malaysia have have reported that more than 35% of Orang Asli were struggling in poverty and experiencing household food insecurity which had resulted in malnutrition and chronic energy deficiency among women (Lim & Chee, 1998; Zalilah & Tham, 2002).

However, a study conducted by Wong et al. (2015) on dual burden of malnutrition among Orang Asli in Krau Wildlife Reserve, Pahang reported 28% of the women were either overweight or obese. A higher prevalence of overweight and obesity was shown among Orang Asli women in Carey Island and Sepang districts of Selangor where half of them were either overweight or obese (51%) (Nurfaizah et al., 2009). This result was supported by the idea that poverty and food insecurity are paradoxically linked to overnutrition (Tanumihardjo et al., 2007). In light of the high burden of malnutrition and its consequences, the SDGs in the NPANM III, 2016-2025 have highlighted that food security is a human right and needs to be tackled urgently (MOH, 2016).

Food insecurity has been inversely associated with diet quality for low-income adults (Leung et al., 2014). Research between food insecurity and diet quality as measured by HEI were limited in the rural areas of America and Canada (Champagne et al., 2007; Huet et al., 2012). Besides, various studies report an association of food insecurity with body weight, but discrepancies exist between the severity level of food insecurity and the complex inter-relationships with ethnicity, culture, socio-economic and nutritional transition (Dharod et al., 2013; Hanson et al., 2007; Isanaka et al., 2007; Leyna et al., 2010). In Malaysia, there are a lack of studies on food insecurity, diet quality, and weight status among the Orang Asli community. Therefore, this study aims to determine the association between food insecurity, diet quality, and weight status among Orang Asli (Mah Meri) women in Kuala Langat, Selangor.

1.3 Research Questions

1. What are the socio-demographic characteristics, environmental sanitation and personal hygiene practices, nutrition knowledge and household food security status of the respondents?
2. What is the diet quality (Malaysian HEI) and anthropometric status (Body Mass Index, waist circumference and body fat percentage) of the respondents?
3. Are there significant differences in socio-demographic characteristics, environmental sanitation and personal hygiene practices, and nutrition knowledge according to food security status?
4. Are there significant mean differences in components of Malaysian HEI according to food security status?
5. Are there significant associations between food security status and nutritional outcomes (Malaysian HEI and Body Mass Index), after controlling for the covariates?

1.4 Objectives of the Study

1.4.1 General Objective

To determine the characteristics of household food insecurity and its association with diet quality and weight status among Orang Asli (Mah Meri) women in Kuala Langat, Selangor.

1.4.2 Specific Objectives

1. To identify socio-demographic characteristics, environmental sanitation and personal hygiene practices, nutrition knowledge and household food security status of the respondents.
2. To assess diet quality (Malaysian HEI) and anthropometric status (Body Mass Index, waist circumference and body fat percentage) of the respondents.
3. To determine significant differences in socio-demographic characteristics, environmental sanitation and personal hygiene practices, and nutrition knowledge according to food security status.
4. To determine significant mean differences in components of Malaysian HEI according to food security status.
5. To determine significant association between food security status and nutritional outcomes (Malaysian HEI and Body Mass Index), after controlling for the covariates.

1.5 Null Hypotheses

Ho: There are no significant differences in socio-demographic characteristics, environmental sanitation and personal hygiene practices, and nutrition knowledge according to food security status.

Ho: There are no significant association between food security status and nutritional outcomes (Malaysian HEI and Body Mass Index), after controlling for the covariates.

1.6 Significance of Study

This study will provide the baseline data for household food security status, diet quality and anthropometric status among Orang Asli (Mah Meri) women in Selangor. The diet quality measured using Malaysian HEI score also provide comprehensive information about the compliance of food consumption to the Malaysia Dietary Guidelines. Besides, this study also examined the mean differences in socio-demographic characteristics, environmental sanitation and personal hygiene practices, and nutrition knowledge according to food security status. Understanding the characteristics of food insecurity at different levels (food security, household food insecurity, individual food insecurity and child hunger) are important to reduce the prevalence of food insecurity among Orang Asli women.

The objective of NPANM III, 2016-2025 goes beyond improving household food insecurity whereby the element of nutrition security is given greater emphasis to effectively address the multiple challenges of malnutrition including underweight and overweight. Many studies have argued whether food insecurity is associated with underweight or overweight. Thus, this study aims to determine whether the mean differences of diet quality and weight status are associated with different levels of food

security status. The information provided in this study is fundamental to adequately direct new and available nutrition intervention through the platforms of nutrition education and health promotion campaigns or outreach activities to Orang Asli as the targeted population. Information obtained can also be used as a reference for researchers in the future.

1.7 Conceptual Framework

Figure 1.1 shows the conceptual framework adopted from Campbell (1991). In this framework, the risk factors and consequences of household food insecurity were clearly presented. There were two sets of risk factor of food insecurity, which are risk factors for a poor diet and risk factors for secondary malnutrition. The risk factor for secondary malnutrition could directly or indirectly linked to nutritional status (measured by anthropometric, biochemical, clinical and dietary assessment) through the mechanisms of food insecurity. Besides, there were also two sets of potential consequences of food insecurity. These included nutritional status (a classic measure of malnutrition), and health (physical, social and mental well-being) and quality of life. Food insecurity can directly or indirectly affect health through a physiological mechanism of nutritional status.

1.8 Research Framework

As shown in Figure 1.2, the research framework of this study was designed based on the theory from the Campbell's conceptual framework (1991). Food security status was the main focus of this study and can be categorized into four groups, food security, household food insecurity, individual food insecurity and child hunger. The research framework comprised of two parts according to the third and fifth specific objectives proposed in this study. The first part of the framework was to identify the characteristics of food insecurity, so independent variables were socio-demographic characteristics, sanitation and hygiene, and nutrition knowledge whereas food security status was the dependent variable.

In addition, this study also aims to determine the associations between food insecurity and nutritional outcomes. Therefore, in the second part, food security status was the independent variable while the nutritional outcomes including diet quality and anthropometric status were the dependent variables. Diet quality was measured using Malaysian Healthy Eating Index whereas anthropometric status was assessed by Body Mass Index, waist circumference, and body fat percentage.

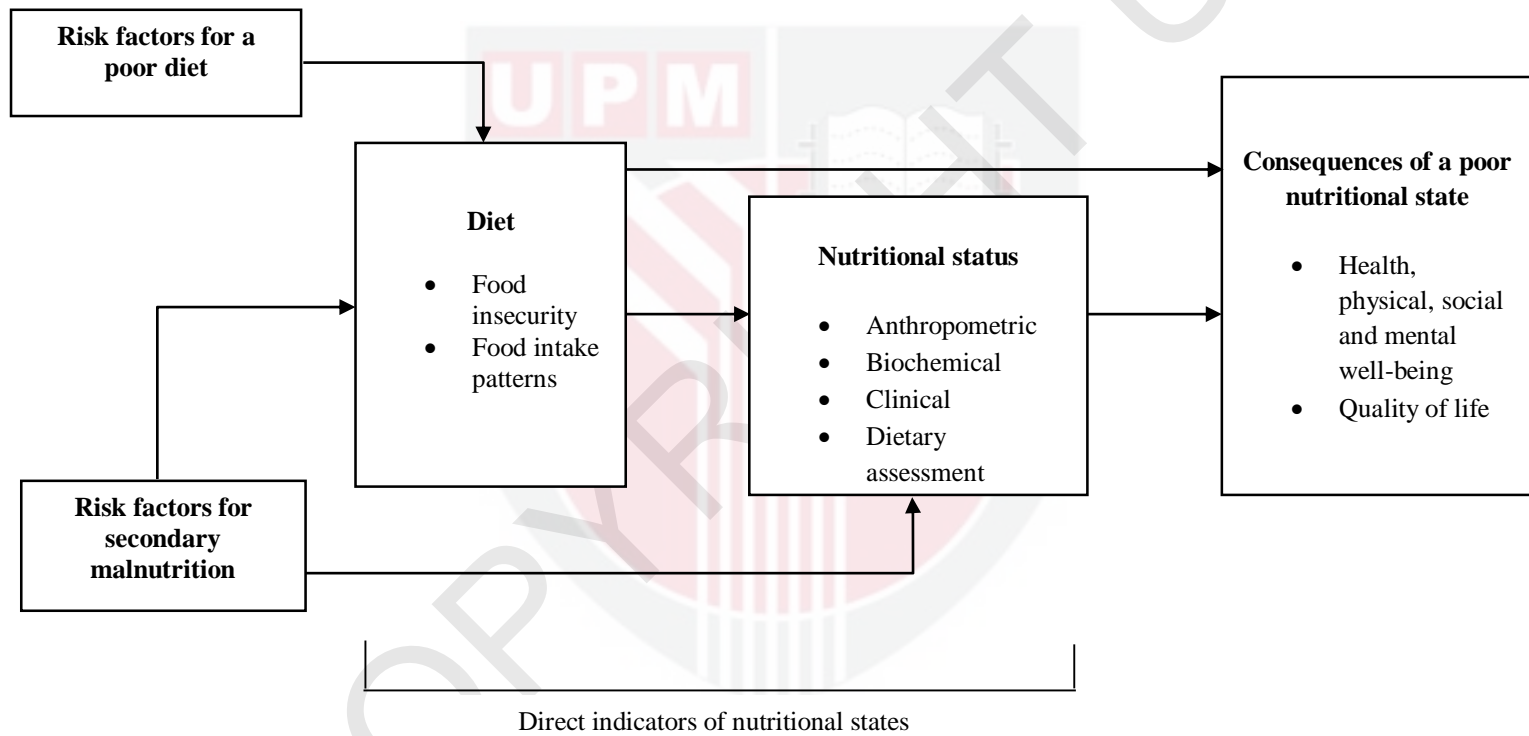


Figure 1.1 Conceptual framework

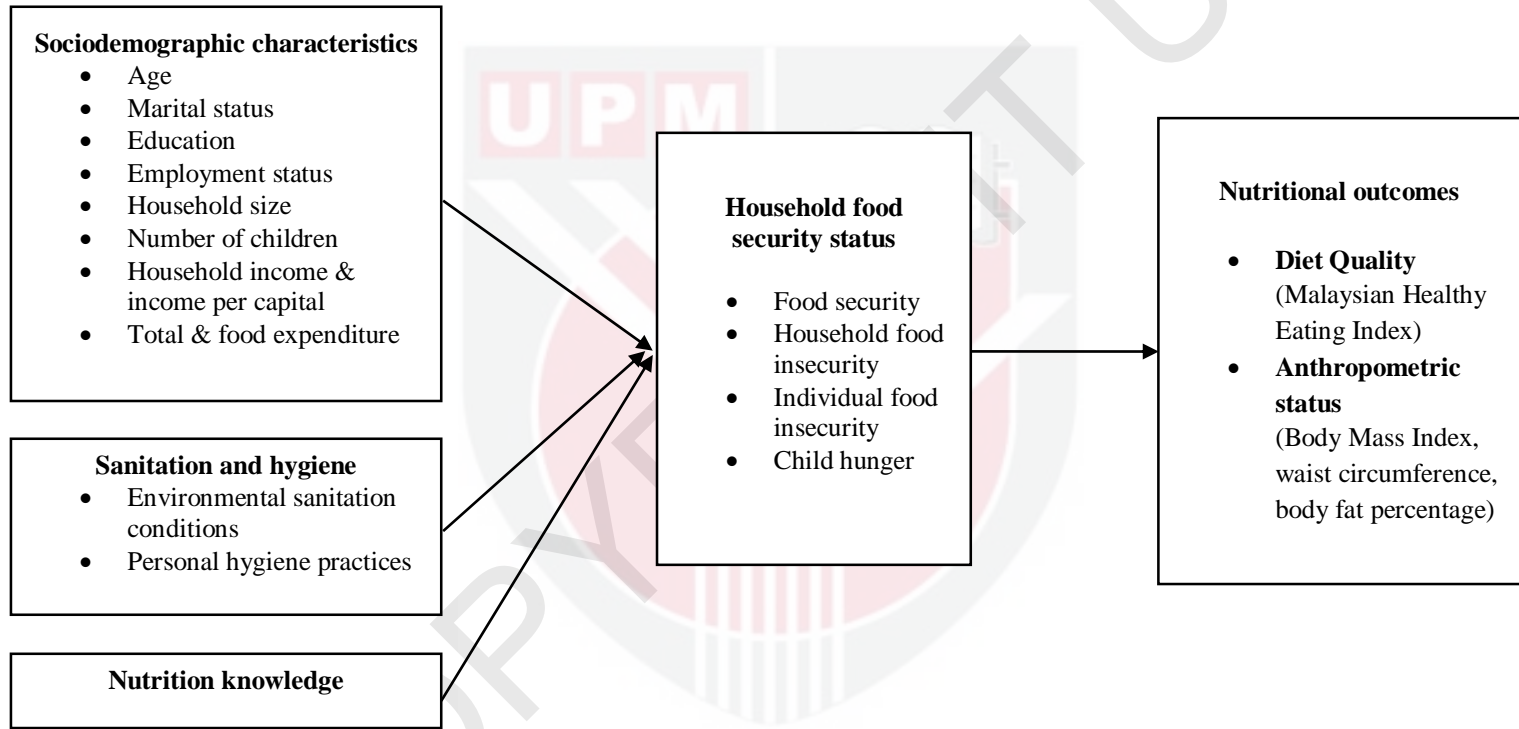


Figure 1.2 Research framework

1.9 Definition of Variables

1.9.1 Household Food Security Status

Conceptual: Household food security exists “when people at all times can acquire safe, nutritionally adequate, and culturally acceptable foods in a manner that maintains human dignity” (FAO, 2002; Gregory et al., 2005).

Operational: Household food security status was measured through the Radimer/ Cornell and Hunger Food Insecurity Instrument which can be categorized into four groups, food secure, household food insecure (mild level), individual food insecure (moderate level and child hunger (severe level).

1.9.2 Diet Quality

Conceptual: There is no precise definition of diet quality concept due to the lack of consensus regarding the construct of existing diet quality indicators and the uncertainty regarding their relevance as predictors of disease risk (Alkerwi, 2014). However, according to study Kant (1996), the definition of diet quality depends on the attributes selected by the investigators, for example, dietary attributes associated with reduction of chronic diseases risks - low-fat diet high in vegetables, fruits and grains intake might be defined as high quality.

Operational: Diet quality was measured by Malaysian Healthy Eating Index which consisted of seven components based on food groups and two components based on nutrients. Diet quality can be categorized into poor diet, diet require improvement and good diet.

1.9.3 Anthropometric Status

Conceptual: Anthropometric status is the outcome of anthropometry, which has been defined as the branch of anthropology that studies the physical measurements of the human body, particularly with measurement of body size, shape, strength and working capacity to determine differences in individuals and groups (Pheasant, 2014; Winter, 2009).

Operational: Anthropometric status was determined through anthropometric measurements which consists of Body Mass Index, waist circumference and body fat percentage.

REFERENCES

- Acheampong, I., & Haldeman, L. (2013). Are nutrition knowledge, attitudes, and beliefs associated with obesity among low-income Hispanic and African American women caretakers?. *Journal of obesity*, 2013.
- Adams E. J., Grummer-Strawn, L. & Chavez, G. (2003). Food insecurity is associated with increased risk of obesity in California women. *Journal of Nutrition*, 133(4), 1070-1074.
- Ahmad, B., Khalid, B. A. K., Quek, K. F., Zaini, A., & Phipps, M. E. (2013). Knowledge of diabetes and lifestyle behaviour amongst indigenous population in Peninsular Malaysia. *Medical Journal of Malaysia*, 68(4), 309.
- Ahmed, A., Al-Mekhlafi, H. M., Al-Adhroey, A. H., Ithoi, I., Abdulsalam, A. M. & Surin, J. (2012). The nutritional impacts of soil-transmitted helminths infections among Orang Asli schoolchildren in rural Malaysia. *Parasites and Vectors*, 5(1), 119.
- Ahmed, A., Al-Mekhlafi, H. M., Choy, S. H., Ithoi, I. & Al-Adhroey, A. H. (2011). The burden of moderate-to-heavy soil-transmitted helminth infections among rural Malaysian aborigines: an urgent need for an integrated control program. *Parasites and Vectors*, 4, 242.
- Aidoo, R., Mensah, J. O., & Tuffour, T. (2013). Determinants of household food security in the Sekyere-Afram plains district of Ghana. *European Scientific Journal*.
- Ajao, K. O., Ojofeitimi, E. O., Adebayo, A. A., Fatusi, A. O., & Afolabi, O. T. (2010). Influence of family size, household food security status, and child care practices on the nutritional status of under-five children in Ile-Ife, Nigeria. *African journal of reproductive health*, 14(4).
- Al-Delaimy, A. K., Al-Mekhlafi, H. M., Nasr, N. A., Sady, H., Atroosh, W. M., Nashiry, M., Anuar, T. S., Moktar, N., Lim, Y. A. L. & Mahmud, R. (2014). Epidemiology of intestinal polyparasitism among Orang Asli school children in rural Malaysia. *PLOS Neglected Tropical Diseases*, 8(8), e3074.
- Ali, D., Saha, K. K., Nguyen, P. H., Diressie, M. T., Ruel, M. T., Menon, P., & Rawat, R. (2013). Household food insecurity is associated with higher child undernutrition in Bangladesh, Ethiopia, and Vietnam, but the effect is not mediated by child dietary diversity. *The Journal of nutrition*, 143(12), 2015-2021.
- Alkerwi, A. A. (2014). Diet quality concept. *Nutrition*, 30(6), 613-618.
- Anderson, S. A. (1990). Core indicators of nutritional state for difficult-to-sample populations. *Journal of Nutrition*, 120 (Supplement 11), 1559-1600.

- Arene, C. J., & Anyaeji, J. (2010). Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria. *Pakistan Journal of Social Sciences*, 30(1), 9-16.
- Azmi, M. Y., Junidah, R., Siti Mariam, A., Safiah, M. Y., Fatimah, S., Norimah, A. K., Poh, B. K., Kandiah, M., Zalilah, M. S., Wan Abdul Manan, W. M., Siti Haslinda, M. D. & Tahir, A. (2009). Body Mass Index (BMI) of adults: findings of the Malaysian Adult Nutrition Survey (MANS). *Malaysian Journal of Nutrition*, 15(2), 97-119.
- Azuwani, A. R., Noor Khairiah, K., Cheong, Y. Z., Kok, C. C., Aw, N. S. L., Nadiyah Mhd, S., & Abdul Rashid, K. (2013). Body fat percentage distribution of an Orang Asli group (aborigines) in Cameron Highlands, Malaysia. *Malaysia Journal of Nutrition*, 19(2), 205-214.
- Baer, A. (1999). *Health disease and survival: A biomedical and genetic analysis of the Orang Asli of Malaysia*. Subang Jaya, Malaysia: Center for Orang Asli Concerns. Retrieved from <https://www.coac.org.my/dashboard/modules/cms/cms~file/5d103c4647b20335b98482084cc9c26a.pdf>
- Barrett, C. B., & Sahn, D. E. (2001). Food policy in crisis management.
- Basiotis, P. P., & Lino, M. (2003). Food insufficiency and prevalence of overweight among adult women. *Family Economics and Nutrition Review*, 15(2), 55.
- Bawadi, H. A., Tayyem, R. F., Dwairy, A. N., & Al-Akour, N. (2012). Prevalence of food insecurity among women in northern Jordan. *Journal of health, population, and nutrition*, 30(1), 49.
- Black, A. E. (2000). Critical evaluation of energy intake using the Goldberg cut-off for energy intake: basal metabolic rate. A practical guide to its calculation, use and limitations. *International journal of obesity*, 24(9), 1119.
- Bowering, J. Morrison, M. A., Lowenberg, M. A. & Tiraso, N. (1977). Evaluating 24-hour recalls. *Journal of Nutrition Education*, 9, 20-25.
- Briefel, R. R., Sempos, C., McDowell, M. A., Chien, S., & Alaimo, K. (1997). Dietary methods research in the third National Health and Nutrition Examination Survey: underreporting of energy intake. *The American journal of clinical nutrition*, 65(4), 1203S-1209S.
- Campbell, C. C. (1991). Food insecurity: a nutritional outcome or a predictor variable? *Journal of Nutrition*, 121, 408-415.
- Central Bank of Malaysia. (2015). *Inflation and the Cost of Living*. Kuala Lumpur, Malaysia: Central Bank Malaysia. Retrieved from https://www.bnm.gov.my/files/publication/ar/en/2015/cp01_003_box_updated.pdf
- Champagne, C. M., Casey, P. H., Connell, C. L., Stuff, J. E., Gossett, J. M., Harsha, D. W., McCabe-Sellers, B., Robbins, J. M., Simpson, P. M., Weber, J. L. & Bogle, M. L. (2007). Poverty and food intake in rural America: diet quality is lower in

food insecure adults in the Mississippi Delta. *Journal of the American Dietetic Association*, 107(11), 1886-1894.

- Chan, C. N., Malik, V., Jia, W., Kadowaki, T., Yajnik, C. S., Yoon, K. H. & Hu, F. B. (2009). Diabetes in Asia: epidemiology, risk factors, and pathophysiology. *Journal of the American Medical Association*, 301(20), 2029-2140.
- Chin, Y. T., Lim, Y. A. L., Chong, C. W., Teh, C. S. J., Yap, I. K. S., Lee, S. C., Tee, M. Z., Siow, V. W. Y. & Chua, K. H. (2016). Prevalence and risk factors of intestinal parasitism among two indigenous sub-ethnic groups in Peninsular Malaysia. *Infectious Diseases of Poverty*, 5(1), 77.
- Chinnakali, P., Upadhyay, R. P., Shokeen, D., Singh, K., Kaur, M., Singh, A. K., Goswami, A., Yadav, K. & Pandav, C. S. (2014). Prevalence of household-level food insecurity and its determinants in an urban resettlement colony in north India. *Journal of health, population, and nutrition*, 32(2), 227.
- Choy, S. H., Al-Mekhlafi, H. M., Mahdy, M. A., Nasr, N. N., Sulaiman, M., Lim, Y. A., & Surin, J. (2014). Prevalence and associated risk factors of Giardia infection among indigenous communities in rural Malaysia. *Scientific Reports*, 4, 6909.
- Chua, E. Y., Zalilah, M. S., Chin, Y. S., & Norhasmah, S. (2012). Dietary diversity is associated with nutritional status of Orang Asli children in Krau Wildlife Reserve, Pahang. *Malaysian Journal of Nutrition*, 18(1).
- Clement, K. (2006). Genetics of human obesity. *Comptes Rendus Biologies*, 329(8), 608-622.
- Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F. & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, 195(9131/03), 3508-1381.
- Dachner, N., Ricciuto, L., Kirkpatrick, S. I., & Tarasuk, V. (2010). Food purchasing and food insecurity: among low-income families in Toronto. *Canadian Journal of Dietetic Practice and Research*, 71(3), e50-e56.
- Darmon, N., Briand, A., & Drewnowski, A. (2004). Energy-dense diets are associated with lower diet costs: a community study of French adults. *Public health nutrition*, 7(1), 21-27.
- Darmon, N. & Drewnowski, A. (2008). Does social class predict diet quality? *American Journal of Clinical Nutrition*, 87, 1107-1117.
- De Muro, P., & Burchi, F. (2007). *Education for rural people and food security. A Cross Country Analysis*. Rome, Italy: Food and Agricultural Organization. Retrieved from <ftp://ftp.fao.org/docrep/fao/010/a1434e/a1434e.pdf>
- Dennison, D., Dennison, K. F. & Frank, C. C. (1994). The DINE system improving food choice of the public. *Journal of Nutrition Education*, 26, 87-92.

- Department of Orang Asli Development (JAKOA). (2015). *Profile of Orang Asli in Kuala Langat/Klang*. Kuala Lumpur, Malaysia: Department of Orang Asli Development.
- Department of Orang Asli Development (JAKOA). (2014). *Structured settlement programme*. Kuala Lumpur, Malaysia: Department of Orang Asli Development. Retrieved from <http://www.jakoa.gov.my/en/program-pembangunan-penempatan-tersusun>
- Department of Statistics Malaysia (DOSM). (2006). *Profile of Orang Asli in Peninsular Malaysia*. Kuala Lumpur, Malaysia: Department of Statistics Malaysia.
- Department of Statistics Malaysia (DOSM). (2010). *Report on Characteristics of Household 2010*. Kuala Lumpur, Malaysia: Department of Statistics Malaysia. Retrieved from https://www.dosm.gov.my/v1/images/stories/files/LatestReleases/population/Web_Release_Ciri_IR2010.pdf
- Department of Statistics Malaysia (DOSM). (2010). *Preliminary count report, Population and Housing Census of Malaysia 2010*. Kuala Lumpur, Malaysia: Department of Statistics Malaysia. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cthemedByCat&cat=117&bul_id=Wk81WnBvbXdtQzdJRjdmM2hSNHM3Zz09&menu_id=L0pheU43NWJwRWVSzk1WdzQ4TlhUUT09
- Department of Statistics Malaysia (DOSM). (2014). *Report on Household Expenditure Survey 2014*. Kuala Lumpur, Malaysia: Department of Statistics Malaysia. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cthem&menu_id=amVoWU54UT10a21NWmdhMjFMMWcyZz09&bul_id=cGpPdWw3REhucFZPdXRpek1Jd3FZUT09
- Department of Statistics Malaysia (DOSM). (2016). *Consumer Price Index Malaysia January 2016*. Kuala Lumpur, Malaysia: Department of Statistics Malaysia. Retrieved from <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=bU5BZTdaUFdZTXRIYkRBSmJFa1Exdz09>
- Devereux, S. (2006). Desk review: Distinguishing between chronic and transitory food insecurity in emergency needs assessments. Rome Italy: United Nations World Food Program. Retrieved from <http://www.livestock-emergency.net/userfiles/file/assessment-review/Institue-Development-Studies-2006.pdf>
- Dewey, K. G., & Mayers, D. R. (2011). Early child growth: how do nutrition and infection interact?. *Maternal & child nutrition*, 7(s3), 129-142
- Dharod, J. M., Croom, J. E. & Sady, C. G. (2013). Food insecurity: its relationship to dietary intake and body weight among Somali refugee women in the United States. *Journal of Nutrition Education and Behavior*, 45(1), 47-53.
- Drewnowski, A. (2009). Obesity, diets, and social inequalities. *Nutrition reviews*, 67(s1).

- Drewnowski, A. & Specter, S. E. (2004). Poverty and obesity: the role of energy density and energy costs. *The American Journal of Clinical Nutrition*, 79(1), 6-16.
- Economic Planning Unit. (2014). *Brief Household Income & Poverty Statistics Newsletter, 2012 & 2014*. Putrajaya, Malaysia: Economic Planning Unit. Retrieved from <http://epu.gov.my/sites/default/files/Perangkaan%20Pendapatan%20%26%20Kemiskinan%20Isi%20Rumah%20Sepintas%20Lalu%2C%202012%20%26%202014.pdf>
- Egeland, G. M., Johnson-Down, L., Cao, Z. R., Sheikh, N. & Weiler, H. (2011). Food insecurity and nutrition transition combine to affect nutrient intakes in Canadian Arctic communities. *Journal of Nutrition*, 141(9), 1746-1753.
- Endale, W., Mengesha, Z. B., Atinafu, A., & Adane, A. A. (2014). Food insecurity in Farta District, Northwest Ethiopia: a community based cross-sectional study. *BMC research notes*, 7(1), 130.
- Ervin, R. B. (2008). Healthy Eating Index scores among adults, 60 years of age and over, by sociodemographic and health characteristics: United States, 1999–2002. *Advance Data*, 395, 1-16.
- Ervin, R. B. (2011). Healthy eating index-2005 total and component scores for adults aged 20 and over: National Health and Nutrition Examination Survey, 2003–2004. *National Health Statistics Reports*, 44, 1-9.
- Fara, W. R., Chin, Y. S., Zalilah, M. S., Barakatun Nisak, M. Y., Kaartina, S., & Woon, F. C. (2015). Evaluation of diet quality and its associated factors among adolescents in Kuala Lumpur, Malaysia. *Nutrition Research and Practice*, 9(5), 511-516.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175-191.
- Food and Agriculture Organization (FAO). (2013). *Food balance sheet from 1990 to 2013*. Rome, Italy: Food and Agriculture Organization. Retrieved from <http://www.fao.org/faostat/en/#data/FBS>
- Food and Agriculture Organization (FAO). (2001). *The state of food insecurity in the world 2001*. Rome, Italy: Food and Agriculture Organization. Retrieved from <http://www.fao.org/docrep/003/y1500e/y1500e00.htm>
- Food and Agriculture Organization (FAO). (2002). *The State of Food Insecurity in the World 2002*. Rome, Italy: Economic and Social Department, Food and Agriculture Organization of the United Nations. Retrieved from <http://www.fao.org/docrep/005/y7352e/y7352e00.htm>
- Food and Agriculture Organization (FAO). (2008). *Food Security Information for Action. Practical guides*. Rome, Italy: European Commission, FAO food security programme. Retrieved from <http://www.fao.org/docrep/013/al936e/al936e00.pdf>

- Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), The United Nations Children's Fund (UNICEF), World Food Programme (WFP) & World Health Organisation (WHO). (2017). *The State of food security and nutrition in the World. Building resilience for peace and food security*. Rome, Italy: Food and Agriculture Organization. Retrieved from <http://www.fao.org/3/a-I7695e.pdf>
- Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD) & World Food Programme (WFP). (2015). *The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress*. Rome, Italy: Food and Agriculture Organization. Retrieved from <http://www.fao.org/3/a-i4646e.pdf>.
- Food and Agriculture Organization (FAO). (1996). *Rome declaration on world food security and world food summit plan of action*. Rome, Italy: Food and Agriculture Organization. Retrieved from <http://www.fao.org/docrep/003/w3613e/w3613e00.HTM>.
- Fernandez, E., D'Avanzo, B., Negri, E., Franceschi, S., La Vecchia, C. (1996). Diet diversity and the risk of colorectal cancer in northern Italy. *Cancer Epidemiology, Biomarkers & Prevention*, 5, 433-436.
- Freedman, L. S., Guenther, P. M., Krebs-Smith, S. M., Dodd, K. W. & Midthune, D. (2010). A population's distribution of healthy eating index-2005 component scores can be estimated when more than one 24-hour recall is available. *Journal of Nutrition*, 140(8), 1529-1534.
- Gage, T. B. & O'Connor, K. (1994). Nutrition and the variation in level and age patterns of mortality. *Human Biology*, 66, 77-103.
- Gallagher, D., Heymsfield, S. B., Heo, M., Jebb, S. A., Murgatroyd, P. R. and Sakamoto, Y. (2000). Health percentage body fat ranges: an approach for developing guidelines based on body mass index. *American Journal of Clinical Nutrition*, 72(3), 694-701.
- Gibson, R. S. (2005). *Principles of Nutritional Assessment* (2nd ed.). New York, NY: Oxford University Press.
- Goh, H. W. & Norimah, A. K. (2012). *Validation of Healthy Eating Index (HEI) for Malaysian adults*. Paper presented at 27th Scientific Conference of the Nutrition Society of Malaysia, Kuala Lumpur. Retrieved from <http://nutriweb.org.my/downloads/Program%20and%20abstract%20combined.pdf>
- Goldberg, G. R., Black, A. E., Jebb, S. A., Cole, T. J., Murgatroyd, P. R., Coward, W. A., & Prentice, A. M. (1991). Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording. *European Journal of Clinical Nutrition*, 45(12), 569-581.

- Gregory, P. J., Ingram, J. S., & Brklacich, M. (2005). Climate change and food security. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360(1463), 2139-2148.
- Guo, X., Warden, B. A., Paeratakul, S. & Bray, G. A. (2004). Healthy eating index and obesity. *European Journal of Clinical Nutrition*, 58(12), 1580-1586.
- Gustafson, D. J. (2013). Rising food costs & global food security: key issues & relevance for India. *The Indian journal of medical research*, 138(3), 398.
- Hackett, M., Melgar-Quiñonez, H. & Álvarez, M. C. (2009). Household food insecurity associated with stunting and underweight among preschool children in Antioquia, Colombia. *Revista Panamericana de Salud Pública*, 25(6), 506-510.
- Hadley, C., & Patil, C. L. (2008). Seasonal changes in household food insecurity and symptoms of anxiety and depression. *American Journal of Physical Anthropology*, 135(2), 225-232.
- Haemamalar, K., Zalilah, M. S., & Neng, A. A. (2010). Nutritional status of Orang Asli (Che Wong tribe) adults in Krau wildlife reserve, Pahang. *Malaysia Journal of Nutrition*, 16(1), 55-68.
- Hanson, K. L., Sobal, J. & Frongillo, E. A. (2007). Gender and marital status clarify associations between food insecurity and body weight. *The Journal of Nutrition*, 137(6), 1460-1465.
- Hassen, K., Zinab, B., & Belachew, T. (2016). Gender and education as predictors of food insecurity among coffee farming households of the Jimma zone, Southwest of Ethiopia. *BMC Nutrition*, 2(1), 75.
- Hayati, M. Y., Ching, T. S., Roshita, I. & Safiih, L. (2007). Anthropometric indices and lifestyle practices of the indigenous (Orang Asli) adults in Lembah Belum, Grik of Peninsular Malaysia. *Asia Pacific Journal of Clinical Nutrition*, 16 (1), 49-55.
- Hazizi, A. S., Aina Mardiah, B., Mohd Nasir, M. T., Zaitun, Y., Hamid Jan, J. M. & Tabata, I. (2012). Accelerometer-determined physical activity level among government employees in Penang, Malaysia. *Malaysian Journal of Nutrition*, 18(1), 57-66.
- Heady, J. A. (1961). Diets of bank clerks: development of a method for classifying the diets of individuals for use in epidemiologic studies. *Journal of Royal Statistical Society Series A*, 124, 336-361.
- Hirvonen, T., Männistö, S., Roos, E., & Pietinen, P. (1997). Increasing prevalence of underreporting does not necessarily distort dietary surveys. *European journal of clinical nutrition*, 51(5), 297-301.

- Hinton, P. R., McMurray, I. & Brownlow, C. (2014). *SPSS Explained* (2nd ed.). New York, NY: Routledge, Taylor & Francis Group. Retrieved from <http://www.fb4all.com/download/ebooks/statistics/SPSS%20Explained2014.pdf>.
- Hoddinott, J., & Yohannes, Y. (2002). Dietary diversity as a food security indicator. *Food Consumption and Nutrition Division Discussion Paper, 136*, 2002.
- Huet, C., Rosol, R. & Egeland, G. M. (2012). The prevalence of food insecurity is high and the diet quality poor in Inuit Communities. *The Journal of Nutrition, 142*(3), 541-547.
- Ihab, A. N., Rohana, A. J., Manan, W. W., Suriati, W. W., Zalilah, M. S., & Rusli, A. M. (2012). Food expenditure and diet diversity score are predictors of household food insecurity among low income households in rural district of Kelantan Malaysia. *Pakistan Journal of Nutrition, 11*(10), 869-875.
- Ihab, A. N., Rohana, A. J., Manan, W. W., Suriati, W. W., Zalilah, M. S., & Rusli, A. M. (2013). Nutritional outcomes related to household food insecurity among mothers in rural Malaysia. *Journal of Health, Population, and Nutrition, 31*(4), 480.
- Ihab, A. N., Rohana, A. J., Manan, W. W., Suriati, W. W., Zalilah, M. S., & Rusli, A. M. (2014). Association between household food insecurity and nutritional outcomes among children in Northeastern of Peninsular Malaysia. *Nutrition Research and Practice, 8*(3), 304-311.
- Institute for Public Health (IPH). (2006). *National Health and Morbidity Survey 2006: Nutritional status*. Kuala Lumpur, Malaysia: Institute for Public Health. Ministry of Health, Malaysia. Retrieved from <http://www.iku.gov.my/images/IKU/Document/REPORT/2006/NutritionalStatus.pdf>
- Institute for Public Health (IPH). (2011). *National Health and Morbidity Survey 2011: Non-communicable diseases*. Kuala Lumpur, Malaysia: Institute for Public Health. Ministry of Health Malaysia. Retrieved from <http://www.iku.gov.my/images/IKU/Document/REPORT/NHMS2011-VolumeII.pdf>
- Institute for Public Health (IPH). (2014). *National Health and Morbidity Survey 2014: Malaysian Adult Nutrition Survey (MANS)*. Kuala Lumpur, Malaysia: Institute for Public Health. Ministry of Health Malaysia. Retrieved from <http://www.iku.gov.my/images/IKU/Document/REPORT/NHMS2014MANS VOLUME-2-SurveyFindings.pdf>
- Institute for Public Health (IPH). (2015). *National Health and Morbidity Survey 2015: Non-communicable diseases, risk factors & other health problems*. Kuala Lumpur, Malaysia: Institute for Public Health. Ministry of Health Malaysia. Retrieved from <http://www.iku.gov.my/images/IKU/Document/REPORT/nhmsreport2015vol2.pdf>

- Institute of Nutrition, Mahidol University (INMU). (2014). *ASEAN Food Composition Database 2014*. Thailand: ASEANFOODS Regional Centre and INFOODS Regional Database Centre, Institute of Nutrition, Mahidol University. Retrieved from http://www.inmu.mahidol.ac.th/aseanfoods/doc/Online_ASEAN_FCD_V1_2014.pdf
- Iram, U., & Butt, M. S. (2004). Determinants of household food security: An empirical analysis for Pakistan. *International Journal of Social Economics*, 31(8), 753-766.
- Isanaka, S., Mora-Plazas, M., Lopez-Arana, S., Baylin, A. & Villamor, E. (2007). Food insecurity is highly prevalent and predicts underweight but not overweight in adults and school children from Bogota, Colombia. *The Journal of Nutrition*, 137(12), 2747-2755.
- Ismail, M. N., Ng, K. K., Chee, S. S., Roslee, R. & Zawiah, H. (1998). Predictive equations for the estimation of basal metabolic rate in Malaysian adults. *Malaysian Journal of Nutrition*, 4, 81-90.
- Jais, A. (2010). The Mahmeri sculpture heritage in Malaysia: An exploratory study.
- Jennifer, A. M., Kim, M. G., Patricia, M. R., Usree, K., Leslie, O. S. Leanne, F. (2010). How is food insecurity associated with dietary behaviors? An analysis with low-income, ethnically diverse participants in a nutrition intervention study. *Journal of the American Dietetic Association*, 110(12), 1906-1911.
- Kant, A. K. (1996). Indexes of overall diet quality: a review. *Journal of American Dietetic Association*, 96, 785-791.
- Kant, A. K. & Graubard, B. I. (2007). Secular trends in the association of socio-economic position with self-reported dietary attributes and biomarkers in the US population: National Health and Nutrition Examination Survey (NHANES) 1971-1975 to NHANES 1999-2002. *Public Health Nutrition*, 10(2), 158-167.
- Kant, A. K., Schatzkin, A., & Ziegler, R. G. (1995). Dietary diversity and subsequent cause-specific mortality in the NHANES I epidemiologic follow-up study. *Journal of the American College of Nutrition*, 14(3), 233-238.
- Kant, A. K., Block, G., Schatzkin, A., Ziegler, R. G. & Nestle, M. (1991). Dietary diversity in the US population, National Health and Nutrition Examination Survey II, 1976-1980. *Journal of American Dietetic Association*, 91, 1532-1537.
- Kant, A. K., Schatzkin, A., Harris, T. Ziegler, R. G. & Block, G. (1993). Dietary diversity and subsequent mortality in the first National Health and Examination Survey Epidemiologic Follow-up Study. *American Journal of Clinical Nutrition*, 57, 434-440.
- Kardooni, R., Kari, F. B., Yahaya, S. R. B., & Yusup, S. H. (2014). Traditional knowledge of orang asli on forests in peninsular Malaysia. *Indian Journal of Traditional Knowledge*, 13(2), 283-291.

- Karupaiyah, T., Chee, W. S. S., Liew, S. Y., Ng, B. K. & Chinna, K. (2013). Dietary health behaviors of women living in high rise dwellings: a case study of an urban community in Malaysia. *Journal of Community Health*, 38(1), 163-171.
- Katona, P. & Katona-Apte, J. (2008). The interaction between nutrition and infection. *Clinical Infectious Diseases*, 46(10), 1582-1588.
- Kendall, A., Olson, C. M., & Frongillo Jr, E. A. (1995). Validation of the Radimer/Cornell measures of hunger and food insecurity. *The Journal of Nutrition*, 125(11), 2793.
- Kennedy G, Nantel G, Shetty P. (2004). Globalization of food systems in developing countries: a synthesis of country case studies. In *Globalization of food systems in developing countries: impact on food security and nutrition* (pp. 1-25). Rome: Food and Agriculture Organization of the United Nations.
- Kennedy, E. T., Ohls, J., Carlson, S. & Fleming, K. (1995). The healthy eating index: design and applications. *Journal of the American Dietetic Association*, 95(10), 1103-1108.
- Khor, G. L. (2008). Food-based approaches to combat the double burden among the poor: challenges in the Asian context. *Asia Pacific Journal of Clinical Nutrition*, 17(S1), 111-115.
- Khor, G. K. & Zalilah, M. S. (2008). The ecology of health and nutrition of Orang Asli (Indigenous people) women and children in Peninsular Malaysia. *Tribes and Tribals*, 2, 66-77.
- Kim, S., Haines, P. S., Siega-Riz, A. M. & Popkin, B. M. (2003). The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. *Journal of Nutrition*, 133, 3476-3484.
- Kirkpatrick, S. I., Dodd, K. W., Parsons, R., Ng, C., Garriguet, D. & Tarasuk, V. (2015). Household food insecurity is a stronger marker of adequacy of nutrient intakes among Canadian compared to American youth and adults. *Journal of Nutrition*, 145(7), 1596-1603.
- Kirkpatrick, S. I., & Tarasuk, V. (2008). Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *The Journal of nutrition*, 138(3), 604-612.
- Kopelman, P. (2007). Health risks associated with overweight and obesity. *The International Association for the Study of Obesity*, 8(S1), 13-17.
- Krebs-Smith, S. M., Smicklas-Wright, H., Guthrie, H. A. & Krebs-Smith, J. (1987). The effects of variety in food choices on dietary quality. *Journal of American Dietetic Association*, 87, 897-903.

- Kuhnlein, H. V., Receveur, O. & Chan, H. M. (2001). Traditional food systems research with Canadian Indigenous Peoples. *International Journal of Circumpolar Health*, 60(2), 112-122.
- Kuhnlein, H. V., Receveur, O., Soueida, R. & Egeland, G. M. (2004). Arctic Indigenous Peoples experience the nutrition transition with changing dietary patterns and obesity. *Journal of Nutrition*, 134, 1447-53.
- Kune, S., Kune, G. A. & Watson L. F. (1987). Case-control study of dietary etiological factors: the Melbourne Colorectal Cancer Study. *Nutrition and Cancer*, 9, 21-42.
- Lachapelle, D. Gouture, C., Brodeur, J. & Sevigny, J. (1990). The effects of nutritional quality and frequency of consumption of sugary foods on dental caries increment. *Canadian Journal of Public Health*, 81, 370-375.
- Ledikwe, J. H., Blanck, H. M., Khan, L. K., Serdula, M. K., Seymour, J. D., Tohill, B. C. & Rolls, B. J. (2006). Low-energy-density diets are associated with high diet quality in adults in the United States. *Journal of American Dietetic Association*, 106, 1172-80.
- Lee, T. T. (2011). *Pembentukan Indeks Pemakanan Sihat untuk orang dewasa Malaysia* (Bachelor of Nutrition Science Thesis). Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia.
- Lee, T. T., Norimah A. K. & Safiah, M. Y. (2011). *Development of Healthy Eating Index (HEI) for Malaysian adults*. Paper presented at 26th Scientific Conference of the Nutrition Society of Malaysia, Kuala Lumpur. Retrieved from <http://www.nutriweb.org.my/downloads/NSM%2026%20Conference%20Prog%20&%20Abstr%20Book.pdf>
- Leung, C. W., Epel, E. S., Ritchie, L. D., Crawford, P. B. & Laraia, B. A. (2014). Food insecurity is inversely associated with diet quality of lower-income adults. *Journal of the Academy of Nutrition and Dietetics*, 114(12), 1943-1953.
- Leyna, G. H., Mmbaga, E. J., Mnyika, K. S. Hussain, A. & Knut-Inge, K. (2010). Food insecurity is associated with food consumption patterns and anthropometric measures but not serum micronutrient levels in adults in rural Tanzania. *Public Health Nutrition*, 13(9), 1438 -1444.
- Lim, H. M. & Chee, H. L. (1998). Nutritional status and reproductive health of Orang Asli women in two villages in Kuantan, Pahang. *Malaysian Journal Nutrition*, 4, 31-54.
- Lipoeto, N. I., Lin, K. G., & Angeles-Agdeppa, I. (2013). Food consumption patterns and nutrition transition in South-East Asia. *Public health nutrition*, 16(9), 1637-1643.
- Lisa, M. S. M. & Diana, L. C. (2015). The effects of nutrition knowledge on food label use. A review of the literature. *Appetite*, 92, 207-216.

- Loopstra, R., & Tarasuk, V. (2013). Severity of household food insecurity is sensitive to change in household income and employment status among low-income families. *The Journal of Nutrition*, 143(8), 1316-1323.
- Macdiarmid, J. I. & Blundell, J. E. (1997). Dietary under-reporting: what people say about recording their food intake. *European Journal of Clinical Nutrition*, 51(3), 199-200.
- Madden, J. P. & Yoder, M. D. (1972). Program evaluation: food stamps & commodity distribution in rural areas of central Pennsylvania. *Pennsylvania Agricultural Experiment Station Bulletin*, 78, 1-119.
- Masron, T., Masami, F. & Ismail, N. (2013). Orang Asli in Peninsular Malaysia: Population, spatial distribution and socio-economic condition. *Journal of Ritsumeikan Social Sciences and Humanities*, 6, 75-115.
- McCullough, M. L., Feskanich, D., Stampfer, M. J., Giovannucci, E. L., Rimm, E. B., Hu, F. B., Spiegelman, D., Hunter, D. J., Colditz, G. A. & Willett, W. C. (2002). Diet quality and major chronic disease risk in men and women: moving toward improved dietary guidance. *The American Journal of Clinical Nutrition*, 76(6), 1261-1271.
- McCullough, M. L. & Willett, W. C. (2006). Evaluating adherence to recommended diets in adults: the alternate healthy eating index. *Public Health Nutrition*, 9(1a), 152-157.
- McDonald, C. M., McLean, J., Kroeun, H., Talukder, A., Lynd, L. D., & Green, T. J. (2015). Household food insecurity and dietary diversity as correlates of maternal and child undernutrition in rural Cambodia. *European journal of clinical nutrition*, 69(2), 242.
- Mirsanjari, M., Muda, W. A. M. W., Ahmad, A., Othman, M. S., Mosavat, M., & Mirsanjari, M. M. (2016). Relationship between nutritional knowledge and healthy attitude and practice during pregnancy. *Borneo Science*, 31.
- Ministry of Health (MOH). (2011). *Panduan penyajian hidangan sihat semasa mesyuarat*. Putrajaya, Malaysia: Department of Nutrition, Ministry of Health. Retrieved from <http://docs.jpa.gov.my/docs/se/2012/panduan.pdf>
- Ministry of Health (MOH). (2014). *Malaysia Food Album*. Kuala Lumpur, Malaysia: Institute for Public Health, Ministry of Health Malaysia.
- Ministry of Health (MOH). (2016). *National Plan of Action for Nutrition of Malaysia III 2016-2025*. Putrajaya, Malaysia: National Coordinating Committee on Food and Nutrition, Ministry of Health. Retrieved from http://nutrition.moh.gov.my/wp-content/uploads/2016/12/NPANM_III.pdf
- Mohamadpour, M., Sharif, Z. M. & Keysami, M. A. (2012). Food Insecurity, health and nutritional status among sample of palm-plantation households in Malaysia. *Journal of Health, Population and Nutrition*, 30(3), 291-302.

- Nasr, N. A., Al-Mekhlafi, H. M., Ahmed, A., Roslan, M. A., Bulgiba, A. (2013). Towards an effective control program of soil-transmitted helminth infections among Orang Asli in rural Malaysia. Part 1: Prevalence and associated key factors. *Parasites & Vectors*, 6, 27.
- National Coordinating Committee on Food and Nutrition (NCCFN). (2010). *Malaysian Dietary Guidelines*. Malaysia: Atlas Cetak Sdn Bhd. Putrajaya, Malaysia: National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia.
- National Coordinating Committee on Food and Nutrition (NCCFN). (2017). *Recommended Nutrient Intakes for Malaysia*. Putrajaya, Malaysia: National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia.
- Ng, S.T. & Norimah A.K. (2013). *Relationship between Healthy Eating Index (HEI) and weight status among older adults*. Paper presented at 28th Scientific Conference of the Nutrition Society of Malaysia, Kuala Lumpur. (pp. 56). Kuala Lumpur, Malaysia: Nutrition Society of Malaysia.
- Ng, W. C., Zalilah, M. S., Khor, G. L., Wan Norlida, W. N., Haslinah, A., Shashikala, S., Mirnalini, K., Nawalyah, A. G. & Hejar, A. R. (2005). A qualitative study on perceptions and knowledge of orang asli mothers on child health and nutrition. *Malaysia Journal of Nutrition*, 11(2), 75-88.
- Ngui, R., Aziz, S., Chua, K. H., Aidil, R. M., Lee, S. C., Tan, T. K., Sani, M. M., Arine, A. F., Rohela M. & Lim, Y. A. (2015). Patterns and risk factors of soil-transmitted Helminthiasis among Orang Asli subgroups in Peninsular Malaysia. *The American Journal of Tropical Medicine and Hygiene*, 93(2), 361-370.
- Ngui, R., Ishak, S., Chuen, C. S., Mahmud, R., & Lim, Y. A. (2011). Prevalence and risk factors of intestinal parasitism in rural and remote West Malaysia. *PLoS Neglected Tropical Diseases*, 5(3), e974.
- Nicholas, C. & Baer, A. (2007). Health care for the Orang Asli: Consequences of paternalism and non-recognition. In H. L. Chee & S. Barraclough (Ed.), *Health care in Malaysia: The dynamics of provision, financing and access* (119-136). New York, NY: Routledge, Taylor & Francis Group.
- NikNadia, N. M. N., Sam, I. C., Khaidir, N., Ngui, R., Lim, Y. A., Goh, X. T., Choy, S. H. & Chan, Y. F. (2016). Risk factors for enterovirus A71 seropositivity in rural indigenous populations in West Malaysia. *PloS One*, 11(2), e0148767.
- Nnakwe, N. E. (2008). Dietary patterns and prevalence of food insecurity among low-income families participating in community food assistance programs in a Midwest Town. *Family and Consumer Sciences Research Journal*, 36(3), 229-242.

- Nord, M., Andrews, M. & Carlson, S. (2009). *Household Food Security in the United States, 2008*. Washington, DC: United States Department of Agriculture, Economic Research Service. Retrieved from <http://www.ers.usda.gov/publications/err-economic-research-report/err83.aspx>
- Norhasmah, S., Zalilah, M. S., Mohd Nasir, M. T., Kandiah, M., & Asnarulkhadi, A. S. (2010). A qualitative study on coping strategies among women from food insecurity households in Selangor and Negeri Sembilan. *Malaysian Journal of Nutrition*, 16(1).
- Norhasmah, S., Zalilah, M. S., Kandiah, M., Mohd Nasir, M. T. & Asnarulkhadi, A. S. (2012). Household food insecurity among urban welfare recipient households in Hulu Langat, Selangor. *Pertanika Journal of Social Sciences and Humanities*, 20(2), 405-420.
- Norhasmah, S., Zalilah, M. S., Rohana, M. S., Mohd Nasir, M. T., Mirnalini, K., & Asnarulkhadi, A. S. (2011). Validation of the Malaysian Coping Strategy Instrument to measure household food insecurity in Kelantan, Malaysia. *Food & Nutrition Bulletin*, 32(4), 354-364.
- Norimah, A. K. & Haja Mohaideen, M. K. (2003). Nutritional status and food habits of middle-aged adults in selected areas of Selangor. *Malaysian Journal of Nutrition*, 9(2), 125-136.
- Norimah, A. K., Hwong, C. S., Liew, W. C., Ruzita, A. T., Siti Saadiah, H. N., & Ismail, M. N. (2010). Messages of the Newly Proposed Malaysian Dietary Guidelines (MDG): Do Adults in Kuala Lumpur Understand Them?. *Malaysian journal of nutrition*, 16(1).
- Norimah A. K., Nik, S. S., Safiah M. Y., Norazliana, M. N, Zawiaha, A. & Tee E. S. (2008). Nutrition knowledge among Malaysian elderly. *Journal of Health Sciences Malaysia*, 6(2), 43-54.
- Norimah, A. K., Safiah, M., Jamal, K., Haslinda, S., Zuhaida, H., Rohida, S., Fatimah, S., Siti Norazlin, Poh, B. K., Kandiah, M., Zalilah, M. S., Wan Manan, Fatimah, S. & Azmi, M. Y. (2008). Food Consumption Patterns: Findings from the Malaysian Adult Nutrition Survey (MANS). *Malaysian Journal of Nutrition*, 14(1), 25-39.
- Nurfahilin, T. & Norhasmah, S. (2015). Factors and coping strategies related to food insecurity and nutritional status among Orang Asli women in Malaysia. *International Journal of Public Health and Clinical Sciences*, 2(2), 55-66.
- Nurfaizah, S. Zalilah, M. S., Khor, G. L., Mirnalini, K., Nawalyah, A. G. & Hekar, A. R. (2009). Food variety score is associated with dual burden of malnutrition in Orang Asli (Malaysian indigenous peoples) households: implications for health promotion. *Asia Pacific Journal of Clinical Nutrition*, 18(3), 412-422.
- Oh, S. Y., & Hong, M. J. (2003). Food insecurity is associated with dietary intake and body size of Korean children from low-income families in urban areas. *European Journal of Clinical Nutrition*, 57(12), 1598-1604.

- Osei, A., Pandey, P., Spiro, D., Nielson, J., Shrestha, R., Talukder, Z., Quinn, V. & Haselow, N. (2010). Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. *Food and Nutrition Bulletin*, 31(4), 483-494.
- Osman, A. & Zaleha, M. I. (1995). Nutritional status of women and children in Malaysian rural populations. *Asia Pacific Journal of Clinical Nutrition*, 4, 319–324.
- Pan, L., Sherry, B., Njai, R. & Blanck, H. M. (2012). Food insecurity is associated with obesity among US adults in 12 States. *Journal of the Academy of Nutrition and Dietetics*, 112(9), 1403-1409.
- Patterson, R. E., Haines, P. S. & Popkin, B. M. (1994). Diet quality index: capturing a multidimensional behaviour. *Journal of American Dietetic Association*, 94, 57-64.
- Pérez-Escamilla, R., Dessalines, M., Finnigan, M., Pachón, H., Hromi-Fiedler, A. & Gupta, N. (2009). Household food insecurity is associated with childhood malaria in rural Haiti. *The Journal of Nutrition*, 139(11), 2132-2138.
- Pheasant, S. (2014). *Bodyspace: Anthropometry, Ergonomics And The Design Of Work: Anthropometry, Ergonomics And The Design Of Work*. CRC Press.
- Phipps, M. E., Chan, K. K., Naidu, R., Mohamad, N. W., Hoh, B. P., Quek, K. F., Ahmad, B., Harnida, S. M., Zain, A. Z. M. & Kadir, K. A. (2015). Cardio-metabolic health risks in indigenous populations of Southeast Asia and the influence of urbanization. *BMC public health*, 15(1), 47.
- Poh, B. K., Safiah, M. Y., Tahir, A., Siti Haslinda, N., Siti Norazlin, N., Norimah, A. K., Wan Manan, W. M., Mirnalini, K., Zalilah, M. S., Azmi, M. Y. & Fatimah, S. (2010). Physical Activity Pattern and Energy Expenditure of Malaysian Adults: Findings from the Malaysian Adult Nutrition Survey (MANS). *Malaysian Journal of nutrition*, 16(1).
- Pon, L. W., Ong, F., Adeeb, N., Seri, S., Shamsuddin, K., Mohamed, A., & Hapizah, N. (2006). Diet, nutritional knowledge and health status of urban middle-aged Malaysian women. *Asia Pacific Journal of Clinical Nutrition*, 15(3), 388.
- Pondor, I., Gan, W. Y., & Appannah, G. (2017). Higher Dietary Cost Is Associated with Higher Diet Quality: A Cross-Sectional Study among Selected Malaysian Adults. *Nutrients*, 9(9), 1028.
- Poslusna, K., Ruprich, J., de Vries, J. H., Jakubikova, M., & van't Veer, P. (2009). Misreporting of energy and micronutrient intake estimated by food records and 24 hour recalls, control and adjustment methods in practice. *British Journal of Nutrition*, 101(S2), S73-S85.
- Radimer, K. L., Olson, C. M., & Campbell, C. C. (1990). Development of indicators to assess hunger. *The Journal of Nutrition*, 120, 1544-1548.

- Radimer, K. L., Olson, C. M., Greene, J. C., Campbell, C. C., & Habicht, J. P. (1992). Understanding hunger and developing indicators to assess it in women and children. *Journal of Nutrition Education*, 24(1), 36S-44S.
- Randall, E., Marshall, J. R., Graham, S. & Brasure, J. (1990). Patterns in food use and their associations with nutrient intakes. *American Journal of Clinical Nutrition*, 52, 739-745.
- Rao, M., Afshin, A., Singh, G., & Mozaffarian, D. (2013). Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ open*, 3(12), e004277.
- Robaina, K.A. & Martin, K.S. (2013). Food insecurity, poor diet quality, and obesity among food pantry participants in Hartford, CT. *Journal of Nutrition Education and Behavior*, 45(2), 159-164.
- Roddin, R., Yusof, Y. & Sidi, N. S. S. (2015). Factors that influence the success of Mah Meri tribe in tourism sector. *Procedia-Social and Behavioral Sciences*, 204, 335-342.
- Ruel, M. T. (2003). Operationalizing dietary diversity: a review of measurement issues and research priorities. *The Journal of Nutrition*, 133(11), 3911S-3926S.
- Sacks, F. M., Svetkey, L. P., Vollmer, W. M., Appel, L. J., Bray, G. A., Harsha, D., Obarzanek, E., Conlin, P. R., Miller, E. R., Simons-Morton, D. G., Karanja, N., Lin, P. H., Aickin, M., Most-Windhauser, M. M., Moore, T. J., Proschan, M. A. & Cutler, J. A. (2001). Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. *The New England Journal of Medicine*, 344(1), 3-10.
- Suganya, L. (2013, October 25). Budget 2014: GST, sugar subsidy removal foremost on Malaysians' minds. The Star Online. Retrieved from <http://www.thestar.com.my/News/Nation/2013/10/25/Budget-2014-reax-GST-sugar/>
- Satia, J. A., Galanko, J. A. & Neuhouser, M. L. (2005). Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *Journal of the American Dietetic Association*, 105(3), 392-402.
- Schmidhuber, J., & Tubiello, F. N. (2007). Global food security under climate change. *Proceedings of the National Academy of Sciences*, 104(50), 19703-19708.
- Seligman, H. K., Laraia, B. A., & Kushel, M. B. (2009). Food insecurity is associated with chronic disease among low-income NHANES participants. *The Journal of nutrition*, 140(2), 304-310.
- Shahril, M. R., Sulaiman, S., Shaharudin, S. H., & Akmal, S. N. (2013). Healthy eating index and breast cancer risk among Malaysian women. *European Journal of Cancer Prevention*, 22(4), 342-347.

- Slovan, J. & Wride, A. (2009). *Economics* (7th ed.). Essex, UK: Pearson Education Limited.
- Soon, J. M. & Tee, E. S. (2014). Changing trends in dietary pattern and implications to food and nutrition security in association of Southeast Asian Nations (ASEAN). *International Journal of Nutrition and Food Sciences*, 3(4), 259-69.
- Speirs, K. E., Messina, L. A., Munger, A. L. & Grutzmacher, S. K. (2012). Health literacy and nutrition behaviors among low-income adults. *Journal of Health Care for the Poor and Underserved*, 23(3), 1082-1091.
- Stevens, J. P. (2012). *Applied Multivariate Statistics for the Social Sciences* (5th ed.). New York, NY: Routledge, Taylor & Francis Group.
- Subar, A. F., Kipnis, V., Troiano, R. P., Midthune, D., Schoeller, D. A., Bingham, S., Sharbaugh, C. O., Trabulsi, J., Runswick, S., Ballard-Barbash, R., Sunshine, J. & Schatzkin, A. (2003). Using intake biomarkers to evaluate the extent of dietary misreporting in a large sample of adults: the OPEN study. *American journal of epidemiology*, 158(1), 1-13.
- Suzana, S., Noor Aini, M. Y., Nik Shanita, S., Rafidah, G. & Roslina, A. (2009). *Atlas of Food Exchanges & Portion Sizes* (2nd ed.). Kuala Lumpur, Malaysia. MDC Publishers Sdn. Bhd.
- Tabachnick, B. G. & Fidell, L. S. (2007). *Using Multivariate Statistics* (5th ed.). Boston, MC: Pearson Education, Inc.
- Taechangam, S., Pinitchun, U., & Pachotikarn, C. (2008). Development of nutrition education tool: healthy eating index in Thailand. *Asia Pacific Journal of Clinical Nutrition*, 17(S1), 365-367.
- Tanumihardjo, S. A., Anderson, C., Kaufer-Horwitz, M., Bode, L., Emenaker, N. J., Haqq, A. M., Satia, J. A., Silver, H. J. & Stadler, D. D. (2007). Poverty, obesity, and malnutrition: an international perspective recognizing the paradox. *Journal of American Dietetic Association*, 107, 1966-1972.
- Tarasuk, V., Mitchell, A., Dachner, N. (2015). *Household food insecurity in Canada, 2013*. Toronto, Canada: Research to identify policy options to reduce food insecurity (PROOF). Retrieved from <http://proof.utoronto.ca/wp-content/uploads/2015/10/foodinsecurity2013.pdf>
- Tardivo, A. P., Nahas-Neto, J., Nahas, E. A., Maesta, N., Rodrigues, M. A., & Orsatti, F. L. (2010). Associations between healthy eating patterns and indicators of metabolic risk in postmenopausal women. *Nutrition Journal*, 9(1), 64.
- Tee, E. S., Mohd Ismail, N, Mohd Nasir, A. & Khatijah, I. (1997). *Nutrient Composition of Malaysian Foods* (4th ed.). Kuala Lumpur, Malaysia: Institute for Medical Research.

- Teh, C. H., Lim, K. K., Chan, Y. Y., Lim, K. H., Azahadi, O., Akmar, A. H., Nadiyah, Y. U., Syafinaz, M. S., Kee, C. C., Yeo, P.S. & Fadhli, Y. (2014). The prevalence of physical activity and its associated factors among Malaysian adults: findings from the National Health and Morbidity Survey 2011. *Public health*, 128(5), 416-423.
- Tirado, M. C., Cohen, M. J., Aberman, N., Meerman, J. & Thompson, B. (2010). Addressing the challenges of climate change and biofuel production for food and nutrition security. *Food Research International*, 43(7), 1729-1744.
- Torres, S. J. & Nowson, C. A. (2007). Relationship between stress, eating behavior, and obesity. *Nutrition*, 23(11), 887-894.
- Townsend, M. S., Peerson, J., Love, B., Achterberg, C. & Murphy, S. P. (2001). Food insecurity is positively related to overweight in women. *Journal of Nutrition*, 131, 1738-1745.
- United Nations Development Programme (UNDP). (2006). *UNDP and indigenous peoples: A policy of engagement*. Retrieved from <http://www.undp.org/poverty/docs.civilsociety/IPPolicyEnglish.pdf>
- United Nations Malaysia (2016). *Malaysia Millennium Development Goals Report (2015)*. Kuala Lumpur, Malaysia: United Nations Malaysia. Retrieved from http://un.org.my/upload/undp_mdg_report_2015.pdf
- Warr, S., Rodriguez, G., & Penn, J. (2008). *Changing food consumption and imports in Malaysia: Opportunities for Australian agricultural exports*. Canberra, ACT: ABARE.
- Whitaker, R. C., & Sarin, A. (2007). Change in food security status and change in weight are not associated in urban women with preschool children. *Journal of Nutrition*, 137(9), 2134-2139.
- Willows, N. D., Veugelers, P., Raine, K., & Kuhle, S. (2009). Prevalence and sociodemographic risk factors related to household food security in Aboriginal peoples in Canada. *Public health nutrition*, 12(8), 1150-1156.
- Winter, D. A. (2009). Anthropometry. *Biomechanics and Motor Control of Human Movement, Fourth Edition*, 82-106.
- Wolfe, W. S., & Frongillo, E. A. (2001). Building household food-security measurement tools from the ground up. *Food and Nutrition Bulletin*, 22(1), 5-12.
- Wong, C. Y., Zalilah, M. S., Chua, E. Y., Norhasmah, S., Chin, Y. S., & Nur'Asyura, A. S. (2015). Double-burden of malnutrition among the indigenous peoples (Orang Asli) of Peninsular Malaysia. *BMC public health*, 15(1), 680.
- World Health Organisation (WHO). (2003b). *Diet, nutrition and the prevention of excess weight gain and obesity: report of a joint WHO/FAO expert consultation*. (WHO technical report series 916). Geneva, Switzerland: World Health Organization.

- World Health Organisation (WHO). (1998). *Obesity: preventing and managing the global epidemic: report of a WHO consultation on obesity*. (WHO technical report series 894). Geneva, Switzerland: World Health Organization.
- World Health Organisation (WHO). (2000). *The Asia-Pacific perspective: Redefining Obesity and its Treatment*. Retrieved from http://iris.wpro.who.int/bitstream/handle/10665.1/5379/0957708211_eng.pdf
- Zalilah, M. S. & Ang, M. (2001). Assessment of food insecurity among low income households in Kuala Lumpur using the Radimer/Cornell food insecurity instrument—a validation study. *Malaysian Journal of Nutrition*, 7(1&2), 15-32.
- Zalilah, M. S. & Khor, G. L. (2004). Indicators and nutritional outcomes of household food insecurity among a sample of rural Malaysian women. *Journal of Nutrition*, 30, 50-55.
- Zalilah, M. S. & Khor, G. L. (2005). Obesity and household food insecurity: evidence from a sample of rural households in Malaysia. *European Journal of Clinical Nutrition*, 59(9), 1049-1058.
- Zalilah, M. S. & Khor, G. L. (2008). Household food insecurity and coping strategies in a poor rural community in Malaysia. *Nutrition Research and Practice*, 2(1), 26-34.
- Zalilah M. S., Norhasmah, S., Rohana, A. J., Wong, C. Y., Yong, H. Y., Taib, Mohd Nasir, M. T., Mirmalini, K. & Khor, G. L. (2014). Food insecurity and the metabolic syndrome among women from low income communities in Malaysia. *Asia Pacific Journal of Clinical Nutrition*, 23(1), 138-147.
- Zalilah, M. S. & Tham, B. L. (2002). Food security and child nutritional status among Orang Asli (Temuan) households in Hulu Langat, Selangor. *Medical Journal of Malaysia*, 57(1), 1-6.
- Ziegelbauer, K., Speich, B., Mäusezahl, D., Bos, R., Keiser, J. & Utzinger, J. (2012). Effect of sanitation on soil-transmitted helminth infection: systematic review and meta-analysis. *PLoS Medicine*, 9(1), e1001162.
- Zienczuk, N., Young, T. K., Cao, Z. R. & Egeland, G. M. (2012). Dietary correlates of an at-risk BMI among Inuit adults in the Canadian high arctic: cross-sectional international polar year Inuit health survey, 2007-2008. *Nutrition Journal*, 11(1), 73.
- Zimmet, P. Z. & Alberti, K. G. M. M. (2006). Introduction: globalization and the non-communicable disease epidemic. *Obesity*, 14(1), 1-3.