



**UNIVERSITI PUTRA MALAYSIA**

**FOOD SECURITY, AND HEALTH AND NUTRITIONAL STATUS OF  
INDIAN WOMEN FROM OIL PALM PLANTATIONS IN NEGERI  
SEMBILAN, MALAYSIA**

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STATUS OF INDIAN WOMEN FROM OIL PALM  
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**By**

**MASOUMEH MOHAMADPOUR KLDEH**

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

**February 2007**



## **DEDICATION**

**To my most beloved husband, Mehran**

**For all his understanding, patience, encouragement and support during  
all difficulties of my study**

**To my dearest parents,**

**For their true love, favour, effort and principle guide and  
encouragement since my childhood**

**To my dear children, Romina, Amir Mahdi and Amir Ali**

**For making everything worthwhile**

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

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**February 2007**

**Chairman: Associate Professor Zalilah Mohd Shariff, PhD**

**Faculty: Medicine and Health Sciences**

A cross sectional study was conducted to determine the relationship between food security and health and nutritional status among 169 Indian women (19-49 years, non-pregnant and non-lactating) from selected oil palm plantations in Negeri Sembilan. The women were interviewed for socio-economic, demographic, physical activity, household food security and dietary intake information and measured for weight, height, waist circumference and blood pressure. Blood samples were collected from 147 women and analyzed for total cholesterol (TC), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C), triglyceride (TG) and plasma glucose (FPG) levels. For data analysis, descriptive statistics, ANOVA and logistic regression were conducted. Using the Radimer/Cornell Hunger and Food Insecurity Instrument, a majority of the households experienced household insecurity (24.9%), individual insecurity (19.5%) or child hunger (40.8%). About 39.1% and 26.0% of the women were overweight and obese, respectively. More than half (68.6%) of the women had at risk waist



circumference ( $\geq 88$  cm). While 70.4% of the women were in the highly active category, 29.6% were either sufficiently active or insufficiently active. The mean intake of energy and most nutrients were lower than the recommended values. Similarly, the mean number of servings for all food groups was less than the recommended servings. The mean diet diversity score was  $10.10 \pm 10.00$  (maximum=29) with most women (89.4%) had diet diversity less than 10. The percentages of women with  $TG \geq 2.3$  mmol/L,  $TC \geq 6.2$  mmol/L,  $LDL-C > 4.1$  mmol/L,  $HDL-C < 1.03$  mmol/L,  $FPG \geq 6.1$  mmol/L and  $BP \geq 130/85$  mmHg were 14.3%, 2.8%, 12.2%, 32%, 12.9% and 19.7%, respectively. There were significantly decreasing patterns in mean household income, income per capita, year of schooling, diet diversity, vitamin A intake and number of serving from meat/fish/legumes and increasing patterns in mean number of children and prevalence of women with at risk waist circumferences with severity of food insecurity ( $p < 0.05$ ). For physical activity, women experiencing household food insecurity significantly spent higher minutes/day ( $333.13 \pm 178.36$ ) for moderate activities than women in food secure and child hunger households. In addition, women experiencing household food insecurity significantly spent higher minutes/day ( $343.70 \pm 185.65$ ) for vigorous activities than child hunger households ( $p < 0.05$ ). There was no significant difference in TG, HDL-C, FPG and blood pressure by food security levels. The mean number of health risks was significantly higher in child hunger ( $2.27 \pm 1.20$ ) than in individual food insecure ( $1.48 \pm 1.05$ ) groups. While the prevalence of people with more than 3 health risks was highest in child hunger group (42.9%), a majority (82.4%) of food secure women had less than 3 health risks. The logistic regression showed that housewives,

higher age, higher waist circumference, lower years of education and lower duration of physical activity significantly increased the risk for the women to have health problems. In addition, women who had higher intake of milk and dairy products, meat/fish/poultry/legumes and higher diet diversity were more likely to be protected against health problems. In the present study, the effect of food insecurity on health risks is through dietary intakes, which may have impact on waist circumference. As households become food insecure, the ability to obtain variety of foods will be compromised and consequently put the women at risk of having high waist circumference and other health problems. The present study showed that food insecurity among the Indian women from selected palm plantations is indirectly associated with poor health and nutritional status. Therefore, appropriate community-based intervention programs should be developed and implemented to address the problem of food insecurity and possible health and nutritional outcomes.

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

**JAMINAN KEDAPATAN MAKANAN SERTA STATUS  
KESIHATAN DAN PEMAKANAN DI KALANGAN  
WANITA INDIA DI ESTET KELAPA SAWIT DI NEGERI  
SEMBILAN, MALAYSIA**

Oleh

**MASOUMEH MOHAMADPOUR KLDEH**

**Februari 2007**

**Pengerusi : Associate Professor Zalilah Mohd Shariff, PhD**

**Fakulti : Perubatan dan Sains Kesihatan**

Satu kajian keratan rentas telah dijalankan untuk menentukan perkaitan di antara tiada jaminan kedapatan makanan, status kesihatan dan pemakanan di kalangan 169 wanita India (19-49 tahun, tidak hamil dan tidak menyusukan anak) dari estet kelapa sawit yang terpilih di Negeri Sembilan. Wanita-wanita tersebut telah ditemuramah untuk mendapatkan maklumat sosio-ekonomi, demografi, aktiviti fizikal, tiada jaminan kedapatan makanan isirumah dan pengambilan diet, serta diukur untuk berat, tinggi, lilitan pinggang dan tekanan darah. Sampel darah telah dikumpulkan daripada 147 wanita dan dianalisis untuk mendapatkan paras jumlah kolesterol (TC), lipoprotein-kolesterol ketumpatan tinggi (HDL-C), lipoprotein-kolesterol ketumpatan rendah (LDL-C), trigliserida (TG) dan plasma glukosa. Bagi analisis data, statistik deskriptif, ANOVA dan ujian regresi logistik telah dijalankan. Dengan menggunakan *Radimer/Cornell Hunger and Food Insecurity Instrument*, sebahagian besar isi rumah didapati mengalami sama ada tiada jaminan

kedapatan makanan peringkat isirumah (24.9%), peringkat individu (19.5%) atau kelaparan kanak-kanak (40.8%). Lebih kurang 39.1% dan 26.0% daripada wanita masing-masing mengalami masalah berlebihan berat badan dan obesiti. Lebih separuh (68.6%) daripada wanita berkenaan mempunyai lilitan pinggang berisiko ( $\geq 88$  cm). Sementara itu, 70.4% daripada wanita ini tergolong dalam kumpulan sangat aktif manakala sebanyak 29.6% pula adalah cukup aktif atau tidak cukup aktif. Min pengambilan tenaga dan kebanyakan nutrien adalah lebih rendah daripada nilai yang dicadangkan. Begitu juga dengan min bilangan sajian bagi kesemua kumpulan makanan adalah lebih rendah daripada bilangan sajian yang dicadangkan. Min bagi skor kepelbagaian makanan adalah sebanyak  $10.10 \pm 10.00$  (maksimum=29) dengan kebanyakan wanita (89.4%) mempunyai kepelbagaian makanan lebih rendah daripada 10. Peratus wanita yang mempunyai paras TG  $\geq 2.3$  mmol/L, TC  $\geq 6.2$  mmol/L, LDL-C  $> 4.1$  mmol/L, HDL-C  $< 1.03$  mmol/L, FPG  $\geq 6.1$  mmol/L dan BP  $\geq 130/85$  mmHg adalah sebanyak 14.3%, 2.8%, 12.2%, 32%, 12.9% dan 19.7%, masing-masing. Terdapat penurunan yang signifikan dalam min pendapatan isi rumah, pendapatan per kapita, bilangan tahun persekolahan, kepelbagaian makanan, pengambilan vitamin A dan bilangan sajian daripada kumpulan daging/ikan/ kekacang. Peningkatan yang signifikan pula dapat dilihat bagi min bilangan anak dan prevalens wanita dengan lilitan pinggang berisiko, dengan keterukan tiada jaminan kedapatan makanan ( $p < 0.05$ ). Bagi aktiviti fizikal, wanita yang mengalami tiada jaminan kedapatan makanan peringkat isirumah menghabiskan lebih banyak masa ( $333.13 \pm 178.36$  minit/hari) untuk aktiviti sederhana berbanding wanita dalam isirumah yang mengalami tiada jaminan kedapatan makanan dan



kelaparan kanak-kanak. Tambahan pula, wanita yang mengalami tiada jaminan kedapatan makanan peringkat isi rumah, secara signifikannya menghabiskan lebih banyak masa ( $343.70 \pm 185.65$  minit/hari) untuk melakukan aktiviti-aktiviti berat berbanding isi rumah yang mengalami kelaparan kanak-kanak ( $p < 0.05$ ). Tiada perbezaan yang signifikan untuk TG, HDL-C, FPG dan tekanan darah di antara paras tiada jaminan kedapatan makanan. Min bilangan risiko kesihatan lebih tinggi secara signifikan pada peringkat kelaparan kanak-kanak ( $2.27 \pm 1.20$ ) berbanding tiada jaminan kedapatan makanan isirumah ( $1.48 \pm 1.05$ ). Prevalens individu dengan  $\geq 3$  risiko kesihatan adalah paling tinggi dalam kumpulan kelaparan kanak-kanak (42.9%) sementara sebahagian besar (82.4%) daripada golongan wanita yang mengalami sekuriti makanan mempunyai  $< 3$  risiko kesihatan. Ujian regresi logistik menunjukkan bahawa surirumah, umur yang meningkat, lilitan pinggang yang besar, bilangan tahun persekolahan yang rendah dan aktiviti fizikal yang kurang secara signifikan meningkatkan lagi risiko golongan wanita mengalami masalah kesihatan. Sebaliknya, golongan wanita yang mengambil susu dan produk tenusu serta mengambil daging/ikan/ayam/kekacang yang tinggi dan mempunyai kepelbagaian diet yang lebih tinggi adalah lebih berkemungkinan untuk dilindungi daripada masalah kesihatan. Dalam kajian ini, kesan tiada jaminan kedapatan makanan ke atas risiko kesihatan adalah menerusi pengambilan makanan yang mungkin memberikan impak ke atas lilitan pinggang. Apabila makanan isi rumah tidak mencukupi, kebolehan untuk mendapatkan makanan yang pelbagai akan terjejas dan seterusnya meletakkan golongan wanita berisiko mempunyai lilitan pinggang yang lebih besar dan mengalami masalah

kesihatan yang lain. Kajian ini menunjukkan bahawa tiada jaminan kedapatan makanan di kalangan wanita India dari estet kelapa sawit yang terpilih mempunyai perkaitan secara tidak langsung dengan status kesihatan dan pemakanan yang kurang baik. Oleh itu, program-program intervensi peringkat komuniti yang bersesuaian perlu dibentuk dan diimplementasikan untuk mengatasi masalah tiada jaminan kedapatan makanan yang mungkin boleh menjejaskan status kesihatan dan pemakanan.

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## LIST OF ABBREVIATIONS

BMI	Body Mass Index
CCHIP	Community Childhood Hunger Identification Project
CED	Chronic Energy Deficiency
CH	Child Hunger
CI	Confidence Interval
DDS	Diet Diversity Score
DRVs	Daily Reference Values
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FFQ	Food Frequency Questionnaire
FPG	Fasting Plasma Glucose
FS	Food Security
FSCM	Food Security Core Module
JNC	Joint National Committee
HDL-C	High Density Lipoproteins Cholesterol
HIS	Household Insecure
IIS	Individual Insecure
IPAQ	International Physical Activity Questionnaires
ISH	International Society of Hypertension
LDL-C	Low Density Lipoproteins Cholesterol
NCCFN	National Coordinating Committee on Food and Nutrition
NCEP ATP III	National Cholesterol Education Program Adult Treatment Panel III

NHLBI	National Health Lung and Blood Institute
NHMS I	National Health and Morbidity Survey I
NHMS II	National Health and Morbidity Survey II
NIH	National Institute of Health
OR	Odds Ratio
RDA	Recommended Dietary Allowance
RNI	Recommended Nutrient Intake
S.D	Standard Deviation
TC	Total cholesterol
TG	Triglyceride
USA	United States of America
WC	Waist Circumference
WHO	World Health Organization

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

Food insecurity is a worldwide problem with 852 million food insecure and undernourished people in the world. This figure includes 9 million in the industrialized countries, 28 million in countries in transition and 815 million in developing countries (FAO, 2004). Food insecurity is not just a problem in the developing countries but also in developed countries. A high prevalence of food insecurity (94.2%) was reported in a survey of 1423 mothers with children <5 years old in East Java, Indonesia (Studdert *et al.*, 2001). The prevalence of food insecurity in a sample of 199 households was 55.8% compared to 44.2% food secure in Thailand (Piaseu and Mitchell, 2004). The prevalence of food insecurity in the rural households of Sabak Bernam was 58% (Zalilah and Khor, 2004). Olson and Holben (2002) reported that more than 33 million people in the United States (10% of population) experienced food insecurity. About 1 in 10 or 3 million people in Canada lived in food insecure households in 1999 (Che and Chen, 2003).

Food security is defined as access by all people, at all times to sufficient food for an active and healthy life (World Bank, 1986). Access to food includes the ready availability of nutritionally adequate safe foods and the assured ability to acquire them in socially acceptable ways (Life Science Research Office, 1990). However, the definition of food security should not only relate to food supply at global, regional, national, community, household or individual levels



but also encompasses accessibility, adequacy, stability and sustainability of the food supply (Gittelsohn *et al.*, 1998).

At the micro level, food security is concerned with food availability and access by households and individuals. The ability of households to access food is determined by household income that includes the value of goods produced (e.g. food) and services provided (e.g. child care) that do not enter to the market, as well as in-kind transfers of goods and services. Access to food may be gained through production or gathering of food, purchase of food from the market with cash income and receipts of in-kind transfer (whether from private citizens, national or foreign government). At the individual level, food security is defined as an individual's access to a nutritionally adequate diet for physical work, disease prevention, adequate growth and during pregnancy and lactation (Frankenberger *et al.*, 1997a; Frankenberger *et al.*, 1997b).

Global and national food availability stands at the most macro level of food security. While global food availability is determined by the total world food production, national food availability is influenced by the country's own food production, food stocks, net food imports (imports minus exports) and food aids. However, even if national food security is achieved, food insecurity may still occur at the household and individual levels (Savage-King and Burgess, 1993; Frankenberger *et al.*, 1997a; Frankenberger *et al.*, 1997b).