Chapter 3

Food transition and food consumption of urban and rural in West Sumatra, Indonesia

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Changing from traditional to a modern food consumption pattern has increased the prevalence of cardiovascular disease in developing countries. Kato et al. (1987) have indicated a strong relationship between consumption of high fat foods such as butter, cheese, bread, ham and sausages with the increasing death due to cardiovascular diseases. In several island countries in the Pacific, changing from high fiber and carbohydrate diet in their original countries to western food pattern in New Zealand and Australia causes body weight gain and cardiovascular disease risk[1]. The shift in food consumption between rural and urban in developing countries reflected nutrition transition. Popkin (2003) reported an example of change in food cunsumption that follows a classic Westernisation pattern between urban and rural in China that summarised the change in a typical fast growing economy of China. Popkin reported that intake of cereals decreased considerably in two decades in both urban and rural areas and among all income groups. There was also an increase in animal products, more so for the rich than the poor, and for the urban than the rural. The result of this change also showed a shift in the diet away from carbohydrates to fat[2]. This study was conducted to investigate the difference of food consumption between urban and rural areas in the Province of West Sumatra, Indonesia.

The present study was approved by the Faculty of Medicine of Andalas University Ethics Committee. Subjects gave written, informed consent before interviewed and undergo anthopometric and blood pressures assessments.

The study was conducted in two urban and two rural municipalities in West Sumatera, Indonesia. For every municipalities, two villages were randomnly selected. Subjects were selected from the list of above 30 years old healthy adults. Data were collected between May and June 2008. Data on demography, life style, food consumption were done by interviewing the subjects.

Anthropometric and blood pressure assessments

Anthropometric assessment include body weight, height, waist circumference were done to all subjects. Anthropometric measurements were made by following standardized procedures.[3] Bodyweight and height were measured for each subject, Body Mass Index was calculated from these values. Waist circumference was measured with an inelastic tape used at the narrowest part of the torso at the end of expiration.[4] Blood pressure for diastolic and systolic pressure were taken twice after 5 minutes sitting in the room.

Sample means and frequencies were calculated separately for the rural and urban subjects. The percentage of subjects who were overweight (BMI: 25–29.99) and obese (BMI: ≥ 30) was calculated with the use of recommended international cutoffs.

To describe food and nutrient intake, mean nutrient intake from selected macronutrients, micronutrients and selected each food group were calculated. Pearson correlation and independent-samples t-tests were done to analyze the correlation between consumption of selected food groups (herbs, fruit and vegetables) with body weight. Multivariate analysis were done in analyzing the correlation controlled by counfounding factors. All analyses were performed with SPSS for WINDOWS software, version 11.5.

This study was conducted to 437 subjects, consisted 298 subjects (68%) from urban and 137 sujects (32%) from rural areas. Most of the subjects (73%) were those above 40 years old, women. 36% of the subjects never attended school or had been in elementary school. Between urban and rural, only 32% of subjects in urban had lower education compare to 38% of subjects in rural. On the contrary, only 5% of subjects in the rural had attended university compared to 17% in the urban. The difference was significant at p=0.008.

Nutritional Status

The average Body Mass Index was found 25.2, no significant difference was found in anthropometric measurements between urban and rural areas. The average waist circumference in women in this study was above normal 89 cm and 90 cm respectively for urban and rural (see table 1). The prevalence of overweight and obesity (BMI>25) was found as high as 50%. Subjects with normal BMI were found 33%.

Table 1: Comparison of anthropometric indices between subjects in urban and rural areas

	Urban	Rural	P
Height (meter)	1.51 ± 0.07	1.49 ± 0.06	**0.81**
Body Weight (kg)	58.29 ± 11.69	55.56 ± 10.84	**0.38**
Body Mass Index (m/kg^2)	25.50 ± 4.60	24.94 ± 4.58	**0.90**
Waist Circumference (cm)	**88.40 ± 11.31**	**89.03 ± 11.05**	**0.74**

Blood Pressure

This study showed that the average systolic and diastolic blood pressure were significantly higher in rural than in urban (see table 2).

Table 2: Comparison of Systolic and Diastolic Blood Pressure between urban and rural

	Urban	Rural	p
Systolic (mm/Hg)	126.68 ± 22.68	132.65 ± 22.81	0.029
Diastolic (mm/Hg)	81.05 ± 9.72	81.79 ± 13.54	0.000

There were 33% of the subjects had systolic and diastolic blood pressure above 140 mmHg and 90 mmHg respectively. In the urban 26% of the subjects were hypertension compared to 47% in the rural, the difference was found significance at p=0.000.

Food and nutrients consumption

This study showed significant differences in macronutrients consumption between subjects in urban and rural. Subjects in the urban had significant higher consumption of total energy (p = 0.013), fat (p = 0.004), carbohydrate (p = 0.02), vitamin C (p =

0.000), vitamin E (p = 0.000), and dietary cholesterol (p=0.03) compared to those in the rural (see table 3). Although subjects in the urban consumed more fat, sodium and calsium compared to those from rural, but no significance difference was found.

Table 3: Comparison of nutrients consumption per day

	Urban	Rural	Total
Energy (kcal)*	1703.25 ± 463.50	1547.43 ± 403.92	1653.13 ± 452.02
Carbohidrat (gram)*	274.27 ± 76.21	267.18 ± 69.07	271.99 ± 74.25
Protein (gram)	46.34 ± 13.42	40.22 ± 15.39	44.37 ± 14.35
Fat (gram)**	45.84 ± 19.85	34.01 ± 14.39	42.04 ± 19.07
Cholesterol (mg)*	122.27 ± 63.37	81.31 ± 59.22	109 ± 65
Vitamin C***	67.42 ± 30.78	38.52 ± 16.28	57.35 ± 29.53
Vitamin E***	18.26 ± 11.06	10.15 ± 7.08	14.99 ± 10.41
Sodium (mg)	228.08 ± 132.41	185.65 ± 121.57	214.43 ± 130.38
Calsium (mg)	1104.67 ± 38.86	1014.91 ± 465.89	1075.79 ± 412.32

*Significant differences between Urban and Rural: * p<0.05; ** p<0.01*

Table 4 showed the average consumption of spices was 39 grams per day. Spices included in this study were onions, garlic, turmeric, ginger and gallanga. No significant difference was found in the consumption of spices between two group subjects. Subjects in the urban had significantly higher consumption of vegetables (p=0.015) and fruits (p=0.000), and so as to the consumption of total spices, fruits and vegetables were significantly higher in urban than subjects in rural (p=0.001).

Table 4: Comparison of certain food group consumption (g/day)

	Urban	Rural	Total
Spices	40.62 ± 17.95	35.86 ± 15.84	39.08 ± 19.06
Vegetables*	91.35 ± 65.19	82.64 ± 48.66	85.55 ± 59.77
Fruits***	71.26 ± 55.67	42.69 ± 33.46	60.34 ± 51.35
Total **	203.24 ± 104.84	161.21 ± 68.39	189.72 ± 96.59

*Significant differences between Urban and Rural: * p<0.05; ** p<0.01; *** p <0.000*

Relationship between Food consumption and Cardiovascular disease risk

Table 5 showed pearson correlation between consumption of spices, fruits, vegetables and total food group with anthropometric indices. Spices consumption had significant positive correlation with body weight and waist circumference. The correlation was still significant after controlled by age, fat and protein consumption, but not significant after controlled by energy and total carbohydrate intake. Although not significant, vegetables consumption had negative correlation with anthropometric indices. Whereas fruit consumption, on the contrary, had positive correlation with body weight, BMI and waist circumference.

Table 5: Pearson correlation between food consumption with anthropometric indices

	Body weight *r(p)*	B M I *r(p)*	Waist Circumference *r(p)*
Spices	0.10 (0.05)*	0.09 (0.06)	0.10(0.04)*
Vegetables	-0.02 (0.56)	-0.02(0.68)	-0.01(0.78)
Fruits	0.09 (0.06)	0.02(0.67)	0.39(0.43)
Total food groups	0.05(0.38)	0.016(0.75)	0.03(0.53)

*Significant difference *p<0.05*

Table 6 showed pearson correlation between consumption of spices, fruits, vegetables and total food group with cardiovascular disease risk. Spices consumption showed a significant and negative correlation with systolic blood pressure. Although not significance, fruits and vegetables consumption showed negative correlation with systolic and diastolic blood pressure.

Table 6: Pearson correlation between certain food consumption with cardiovascular disease risk (r(p))

	Spices *r(p)*	Vegetables *r(p)*	Fruits *r(p)*	Total *r(p)*
Systolic	-0.1 (0.05)*	-0.02 (0.65)	-0.05 (0.34)	-0.06 (0.25)
Diastolic	-0.05 (0.28)	-0.04 (0.40)	-0.02 (0.68)	-0.05 (0.35)

*Significant differences at *p=0.05*

Further analysis was done by dividing subjects into similar quartile consumption of each food group. ANOVA test showed no significant relationship was found between groups of all food group consumption with anthropmetric indices, blood pressure. Comparison of all cardiovascular disease risks between those who were in the highest consumption of each

food group with the lowest consumption showed no significant relationship.

This study was done to two groups of subjects, urban and rural communities, who are undergoing a rapid nutrition transition. The differences between the two groups were shown in differences of length of education, nutritional status, food and nutrient consumption. Subjects were above 30 years old and mostly women (68%).

Nutritional Status and Food Consumption

This study found that 50% of the subjects had Body Mass Index above 25. This was a significant increasing of obesity prevalence, from 14.3% to 39% found from the previous studies in some areas in Indonesia.[5-7] There was no difference in the prevalece of overweight and obesity between rural and urban in this study. In many developing countries, obesity is increasing more rapid among the poor. Between urban and rural, the prevalence is approaching the rates in urban areas.[8] The current levels of overweight in several developing countries as diverse as Mexico, Egypt, and South Africa are shown to be equal to or greater than those in the United States. Moreover, the rate of change in obesity in lower-and middle-income countries is shown to be much greater than in higher-income countries.[9]

The increasing prevalence of obesity is in line with the shift of diet pattern. In China, Popkin revealed some changes in diet pattern. For carbohydrate sources consumption, they found that intake of cereals decreased considerably during 1980's to 1990's in both urban and rural areas and among all income groups. During this period, the total intake of cereals decreased by 127 g per capita per day (67 g for urban residents and 161 g for rural residents). The decrease in the low-income group was the largest, at 196 g per capita, compared with their counter parts in mid- and high-income groups (86 g and 85 g respectively). However, there remains an inverse relationship between income and cereal intake. For example, in 1997, the intake in low-,mid- and high-income groups was 615 g, 556 g and 510 g per capita, respectively. The shift away from coarse grain consumption such as millet, sorghum and corn, is a key component of this change. While in Indonesia, there have been remarkable changes in food intake during the years of 1983 and 2004.[9] It was also reported a decreased in the consumption of rice and cereal significantly from 1007 g/day in 1983, to 512 g/day in 2004.

For the consumption of animal products, Popkin et al also reported the increased in China, especially in the rich than the

poor, and for the urban than the rural. The urban residents intake of animal foods per capita, per day in 1997 was higher than for rural residents (178.2 g for urban vs 116.7 g for rural) and also showed a larger increase (46.7 g vs 36.8 g) from 1989 to 1997. The amount and growth of intake of animal foods were positively associated with income levels. The intake level and the increase in the high-income group from 1989 to 1997 were almost three times those in the low-income group. In Indonesia, consumption of protein sources such as fish consumption remained similar at 52 g/day in 1983 and 54 g/day in 2004. The largest increases were found in soy, and, to a lesser extent, in meat, eggs, and dairy products. In 1983, consumption of soy was 10 g/day, but, in 2004, the consumption increased to 110 g/day. In contrast, To demonstrate the trends in the proportion of dietary nutrient intakes, results from two case studies made in West Sumatra are reported. There was a dramatic change in macronutrient proportion intake (computed as percent contribution of total energy intake) between 1983 to 2004.[10] Although the average total energy intake was not different, the ratio of energy from carbohydrates, proteins, and fats in 1983 was as follows: 82:8:10, indicating that the energy intake was mainly from carbohydrates, and that fat and protein did not contribute much. After 21 years, the ratio shifted to 54:18:28, which

showed that carbohydrate still contributed a great proportion of energy but to a much lesser extent. The ratio also showed an increase in fat and protein consumption. The increase in protein intake paralleled the substantial increase in meat and dairy products consumption. Fat-derived energy intake increased throughout the period, from 10 percent to 28 percent. The change in the energy contribution of carbohydrate, protein, and fat, percentage wise, may give a broad picture of the nutrition transition in Indonesia. Popkin et al also reported a similar pattern in China. There was a shift in the diet away from carbohydrates to fat. Energy from carbohydrates fell for all residents, and by over 20% for urban residents. Energy from fat increased sharply, from 19.3% in 1989 to 27.3% in 1997. Other data show that over 60% of urban residents consumed more than 30% of energy from fat in 1997. Along with the shift in source of energy, there was an upward shift in the energy density of the foods consumed. The kcal of energy intake from foods and alcohol per 100 grams of food in both urban and rural Chinese adult diets increased by 13% between 1989 and 1997.[2]

Nutrition transition

There have been remarkable changes in the Indonesian economy, even as the average economic growth of 7.8 percent

in the 1970s was down to 6.5 percent in the 1980s but went up to 7.2 percent a decade later. Such high economic growth increased food availability and enhanced the purchasing power of the people, which, in turn, accelerated nutrition transition. As in China, in Indonesia there are several linked changes in physical activity occurring jointly. One is a shift away from the high energy expenditure activities such as farming, mining and forestry towards the service sector. A shift from labor-intensive occupations in the rural primary product sectors of agriculture, forestry, and fisheries, to occupations in the services and manufacturing industries was in consonance with the marked increase in the GNP of Indonesia. This transition was linked to a major reduction in energy expenditures at work.

Reduced energy expenditures in the same occupation area second change. Other major changes relate to mode of transportation and activity patterns during leisure hours. Vigorous activity patterns has decreased. In rural areas, however, there has been a shift for some towards increased physical activity linked to holding multiple jobs and more intensive effort. For rural women, there is a shift towards a larger proportion engaged in more energy-intensive work, but there are also sections where light effort is increasing. In

contrast ,for rural men there is a small decrease in the proportion engaged in light work effort.

Life expectancy changed dramatically, from 42 to 67 years old and from 47 to 69 years old, for the men and the women, respectively in 1967 and 2008. Indonesia, like many other developing countries, is experiencing nutrition transition, which is being reflected in the rapid changes in the diet structure and the causes of death.

In Indonesia, consistent with significant improvements in living standards, the proportion of household expenditure on food fell steadily since 1969-1970, with most of the decline accounted for by the cereal and tuberous food groups. Correspondingly, the share of non-food items rose and there was a sharp increase in housing and utilities expenditures. Expenditures for meats, eggs, and milk increased significantly, however

Expenditures for prepared food also increased by 100 percent more than any other food items over the period 1985 to 2007. This was due to more women's entering the labor force. From only 32.60 percent in 1980, they accounted for 39.60 percent in 1985 and 49.93 percent in 1997. This phenomenon might

have resulted in the reduction in their available time to prepare food at home.[12]

Diet Related – Non Communicable Diseases

The rising burden of non-communicable diseases (NCDs) has been the most globally pervasive change among nutrition-related health transitions. This study found that 33% of the subjects had hypertension. The subjects were mostly above 40 years old. Other studies in Indonesia showed the prevalence of hypertension in younger subjects above 18 years old was between 1.8 – 28.6%.[7,12]

In this present study, hypertension was more prevalent in the rural than in the urban. Subjects with hypertension were found 47% in the rural compared to 26% in the urban. Food availability and variability may explain the difference. Nutrients and food consumption of subjects in the rural were less in vitamin C, vitamin E and also fruit and vegetables than subjects in the urban.

For other Diet Related Non Communicable Disease such as diabetes mellitus, some studies have found that there has been rapid increases in diabetes in many developing countries, caused mainly by diet change and inactivity.[8] The prevalence

already covers 4% of Chinese adults and 2% of Indian adults. Together there are more new cases each year in these two countries than in the rest of the world combined. In Indonesia, the prevalence of prediabetes has increased to 10.2 percent.[13] Interestingly, the age-specific prevalence in the developing regions of the world shows a higher proportion of new cases occurring at younger ages than in the higher-income countries.[2]

There has been a report showed that a large number of developing countries already have a greater likelihood that adults residing in lower-income or lower educated households are overweight and obese relative to adults in higher income or education households.[14] This study, based on multi-level analysis of 37 nationally representative data sets, shows that countries with a GNP per capita over about $1700 are prone to have a burden of obesity greater among the poor. It also provides some idea of the set of risk factors causing obesity and other Non Communicable Diseases that are changing rapidly, including poor diets, inactivity, smoking, and drinking.

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Chapter 4

Thanksgiving in Minahasa (North Sulawesi)

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