Original Article

Food consumption patterns in the economic transition in Vietnam

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This paper investigated Vietnamese food consumption patterns, in terms of food quantity and total energy intake, and examined how these food patterns differ by demography and socio-economic status for the Vietnamese. Data used in this paper were from the Vietnam Living Standards Survey national cross-sectional study in 1997-1998. Descriptive and regression analyses identified different food consumption patterns among 5,999 participating households. Results showed that the traditional diet in Vietnam is high in carbohydrates and low in fat; together with unaccounted eating-out foods, these dietary patterns may contribute to the population's low energy intake. The regression models identified place of residence, family income, household size, education of the head of household, ethnicity, and ecological region to be significantly associated with energy intake. Socio-economic and demographic status must be considered in developing national strategies and implementing plans of action to improve nutrition.

Keywords: **food consumption patterns, energy intake, economic transition, nutrition transition, Vietnam**

Introduction

The estimated Vietnamese population was approximately 81 million in 2001,[1] ranking the twelfth largest in the world. In 1997, more than 75% of the population lived in rural areas and 67% of the labour force was in agriculture.[2] The country consists of the Kinh people, who account for 84% of the population. The Hoa people, who live predominantly in urban areas,[2] are grouped with the Kinh into the Kinh and Hoa majority, comprising 2% of the population. There are 52 other smaller ethnic minority groups, some of which have less than 1000 members.[3] Several studies show that the Northern Upland, the Central Highland and the North Central areas have high population growth rates and are at greater risk of food insecurity.[4] The fact that ethnic minorities are concentrated in these remote regions explains part of the difference in living standards between the Kinh and Hoa majority and the other ethnic minorities.[5] The Kinh and Hoa households have substantially higher living standards than ethnic minority households. According to Baulch *et al.*,[5] the Central Highland minorities had almost no benefit from economic growth in the 1990s. The poorest people are members of the Central Highland minorities, whose average level of expenditure per capita has remained stagnant since 1993.[5]

Food consumption at the household and individual levels is an important factor that influences, and is influenced by, the national economy. With the development of the economy, food consumption patterns also change and affect the nutritional status of the people. However, the experience of many countries has shown that economic growth does not translate automatically into a reduction in poverty and/or food security.[6] Food consumption changes between urban and rural areas in Vietnam have been documented through several studies - from small-scale, such as two pilot surveys in 1984 and in 1994, to a large-scale survey at the national level in 1988 conducted by the National Institute of Nutrition of Vietnam. However, changes between urban and rural areas are inconsistent with respect to the amount of foods consumed at the food group level. For example, fruit and vegetable intake is 71.5kg/ person/ year in rural areas vs. 57.7kg/ person/year in urban areas.[7] This inconsistency may be due to the different study methods and sample sizes,[8] and different incomes, food availability, transportation, and eating habits of the various populations.[9] In countries under-going a nutrition transition, increased saturated fat in the diet may increase the incidence of chronic diseases, such as diabetes, cardiovascular diseases, obesity, and so on, which are public health nutrition problems.[10-14] If food consumption increases adequately with improvements in economy, this will contribute to the improvement of nutritional status and physical growth of the whole population.

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Methods

Subjects

Malnutrition impairs overall economic growth because it affects the ability to become engaged in productive activities and increases the risk of disease.[6] Malnutrition is still prominent in Vietnam; in 2000, 33% of children under five years of age were underweight.[15] Children of ethnic minorities are more likely than other Vietnamese children to be stunted.[16] Thus, understanding food consumption patterns is an important factor for addressing malnutrition through program and policy action.

According to FAO data (1996-1998), about 22% of the Vietnamese population continues to face a daily calorie deficit. A recent FAO study in 2000 revealed that the caloric deficit of undernourished people in Vietnam is large, totalling 280 kilocalories per person per day. The trends of absolute and relative values of total calories from non-stable plant foods as well as animal and fish products have increased from the 1960s to the 1990s.[17] On the other hand, the percentage of total energy provided by staple foods has decreased in the same period.[17] According to World Bank (2002), the Vietnamese diet is dominated by rice, and rice alone is deficient in several important nutrients.

A recent review showed that during the economic transition period, food consumption patterns (e.g quantity and quality of foods, structure of dietary intake) changed slightly. There have been some improvements in dietary intakes from 1984 to 1994, regardless of differing food intake methods and sample sizes employed in the these studies (i.e two pilot surveys in 1984 and 1994 and a national survey in 1988). The per capita daily energy difference by place of residence was 112 kcal in 1984, but there were no significant differences in energy intakes in the surveys conducted in 1988 and 1994. In the 1988 survey, mean energy intake in urban areas was 1,905 kcal versus 1,893 kcal in rural areas; in the 1994 survey, mean energy intake was 1,916 kcal in urban areas versus 1,935 kcal in rural areas.[7,18,19] According to Baulch *et al.*,[5] residents in most ecological regions of Vietnam have benefited from economic growth in the 1990s, except the Central Highland ethnic minorities. Protein and fat intakes have increased in both urban and rural areas. As a result, percentage of energy from carbohydrate has decreased with time. The ratio of animal protein to vegetable protein in urban areas is higher than rural areas (0.57 vs 0.26).[7] However, energy intake in Vietnam has been reported to be lower than 2,100 kcal /capita/day (as recommended by the World Health Organization) in all of the above mentioned surveys.

A change in eating behaviours appears to result from economic development. The results of the Vietnam Living Standard Survey in 1992-1993 showed that 95% of the total amount of money accounted for foods in urban and 57% in rural areas are used for buying food and for bartering. There have been changes in eating behaviours, such as an increase in eating outside the home and a decrease in consumption of rice and cereal.[8] Results of a survey conducted in Hanoi in 1997 by the NIN revealed that the average energy intake was 2202 kcal /capita/day, of which about 30% (662 kcal) was derived from eating outside the home.

This paper aims at identifying and comparing the food consumption patterns (controlling for other socio-economic status factors) between: 1) the rural and the urban, 2) the poor and the rich 3) different ecological regions of Vietnam. This will be achieved through the analysis of a cross-sectional dataset "Vietnam Living Standards Survey" conducted in 1997-1998.[20] The study findings can be used as up-to-date information for policy makers in developing public health nutrition programs to reduce child malnutrition and ultimately improve physical stature of Vietnamese adults.

Data

We analyzed data from the second round of the Vietnam Living Standards Survey, which was conducted by the Vietnam General Statistical Office in 1997-1998[20] with 5,999 households in seven regions across the country. A method of stratified random cluster sampling and weights were used to ensure that the results were not biased between the rural and urban ecological regions. This survey is part of the Living Standards Measurement Study of the World Bank household surveys. These surveys were conducted in a number of developing countries with technical assistance from the World Bank and funded by United Nations Development Program (UNDP), World Bank, and the Swedish International Development Agency.[21] Information was collected on a wide range of issues through a set of questionnaires that included household, community, and individual level queries. Dietary data of the VLSS 97-98 used a standard array of 45 food items to collect the estimated food quantity consumed by the household over the twelve-month period prior to the survey (through a dietary recall interview). Information about food consumption was from household expenditures, home production, and other particular food expenditures for holiday occasions.[20,21]

Analysis method

We used Stata software version 7.0[22] to clean raw data, convert measuring units of food items, and merge individual files. The method for converting the raw data of food items includes the measuring unit, the missing values, and selection of representative food items for grouped foods. However, only the monetary values of unspecified food items - eating-out foods - were used to calculate the extent of underestimated energy in urban and rural areas.

To understand the food consumption patterns of the general population, we used classification of food groups of the “Vietnam Food, Nutrient, Product and Composition, 1999” of the National Institute of Nutrition, adult equivalent scale, and calculated energy from eating-out foods. Six food groups, classified according to their nutrient compositions, included (i) rice, starch and other cereals; (ii) nuts, sesame, oils, fats; (iii) beans and tofu; (iv) animal products; (v) fruit and vegetables; (vi) sweets and drinks. We analyzed food consumption in terms of the average quantity and energy as well as the nutrient composition of each food group per adult equivalent per time unit (day or year). The adult equivalent scale of the National Institute of Nutrition[23] was used for the analysis

Table 1. Quantity of food consumption, energy and macronutrient intake per adult equivalent per day from each main food group in the VLSS1998 Survey (*N*=28,611)

Main Food groups	Quantity of foods (Kg/adult equivalent/year)			Protein (g/adult equivalent/day)		Fat intake (g/adult equivalent/day)		Total energy (kcal/ adult equivalent/day)	
	Urban	Rural	Diff	$\overline{X}$ (Mean)	Standard Deviation	$\overline{X}$ (Mean)	Standard Deviation	$\overline{X}$ (Mean)	Standard Deviation
N	7749	20862		28611		28611		28611	
Rice, other cereals, starch	141.8	194.2	-52.4*	37.9	11.3	7.3	3.9	1630	487
Nut, sesame, oil & fat	4.6	4.2	0.4*	0.7	1.5	10.5	7.8	98	74
Bean & tofu	9.1	5.7	3.4*	2.4	3.1	0.9	1.2	25	34
Vegetables and fruits	72.5	57.7	14.8*	2.6	1.9	0.1	0.1	51	39
Animal products	47.8	36.6	11.2*	17.7	11	13.4	9.0	195	128
Sugar, candies and drinks	14.3	11.0	3.3*	0.3	0.4	0.1	0.3	55	51
Total	290.1	309.4	19.3*	61.6	17.9	32.3	15.1	2055	544

* Statistically significant with $P<0.001$ (t-test); Diff = difference; Kcal = kilocalorie

because it is relevant for the general Vietnamese population according to different age, gender, and physiological status, such as pregnancy and lactation. The estimation of energy from eating-out foods is taken into account to determine the extent of underestimated total energy that is due to the unknown eating-out food items and different eating habits between urban and rural areas. The difference between the price of raw food and the price of ready-to-eat food (referred to as food service fee) ranging from 0% to 50% was used to estimate eating-out energy.

We used t-tests for comparing two group means in the descriptive analysis. The regression analysis was used to find the association of energy from each main food group with the demographic and socio-economic independent variables: place of residence, income quintile, household size, education of household-head, ethnicity, and ecological region. The ecological regions were nominal variables: Northern Mountain and Midland, the Red River Delta, the North Central Coast, the South Central Coast, the Central Highlands, the South East, and the Mekong River Delta regions. The last region, the largest rice production region, was used in comparison with the other six regions in the country. We also examined the ratio of animal to vegetable protein in the diets of rural and urban residents in this VLSS 97–98, and compared them to the 1998 survey.

Results

Food quantity

Rural residents consumed larger total amounts of foods than urban residents (309.4 vs 290.1kg/adult equivalent/ year). Rural areas consumed more rice, starch and other cereals (i.e 194.2 kg vs 141.8 kg/adult equivalent per year), but not other food groups. In general, the largest quantity of protein intake in grams per adult equivalent per day came from the rice and starch group (38g) and the animal product group (18g). The quantity of fat per adult equivalent per day was mainly derived from animal products (13.4g), nuts and edible oils (10.5 g), and the rice and starch groups (7.3 g).

Energy intake

In general, an average energy intake in the Vietnamese diet is 2055 kcal /adult equivalent/day (Table 1). Table 2 shows that without including energy from eating-out foods, the total energy intake in urban areas is less than that of rural areas by 333 kcal. However, rural residents consumed 466 kcal more from the 'rice and starch' group, 14 kcal less from the 'nuts and edible oils' group and 78 kcal less from the 'animal products' group compared with urban residents (all $P<0.001$). The high-income residents consumed 134 kcal more than the poor. The high-income group also consumed more energy from the 'animal products' group (126 kcal), 'fat' group (39 kcal) and the 'sweets and drinks' group (37 kcal), but less energy from the rice and starch group (105 kcal) than the poor (all $P<0.001$). The Kinh and Hoa people consumed 126 kcal less than the ethnic minorities. However, the Kinh and Hoa people still consumed more energy from all food groups, except for the rice and starch group. Both the ethnic minorities in rural areas and the poor in rural areas consumed less protein and fat than other groups of the population. Finally, 46 % of the population consumed less than 2,100 kcal per adult equivalent per day when the food service fee was 30% (data not shown).

Dietary structure

Urban residents consumed higher percentages of protein and fat in their diets compared with rural residents. Urban residents consumed 13% energy from protein while rural residents consumed 11.6% energy from protein, although the former consumed fewer calories and a lower absolute amount of protein than the latter (1,812 kcal vs 2,145 kcal, and 59g vs 62g protein). Calculations from Table 3 show that the percentage of energy derived from protein, fat and carbohydrates in the diets of urban residents was 13.0%, 18.8% and 68.2% respectively. For rural residents

Table 2. Patterns of energy from macronutrient intake and main food group consumption per adult equivalent per day in relation to poverty, ethnicity, and type of residence in the VLSS 1997–1998 (N = 28,611)

		Poverty			Ethnicity			Type of residence			Rural and minority			Rural and poor		
		Yes	No	Diff*	Minor	Major	Diff*	Rural	Urban	Diff*	Yes	No	Diff*	Yes	No	Diff*
N		9768	18843		3832	24779		20862	7749		3750	24861		9086	19525	
Total Energy (kcal) and macronutrients (g)																
Total energy (kcal)		1967	2101	-134*	2164	2038	126*	2145	1812	333*	2164	2039	125*	1992	2084	-92*
Fats	gram	23	37	-14*	25	33	-8*	31	38	-7*	25	33	-8*	23	37	-14*
	kcal	207	333		225	297		279	342		225	297		207	333	
	%	10.5	15.8		10.5	14.6		13.0	18.8		10.5	14.6		10.4	16.0	
Protein	gram	54	65	-11*	58	62	-4*	62	59	3*	58	62	-4*	55	65	-10*
	kcal	216	260		232	248		248	236		232	248		220	260	
	%	11.0	12.4		10.7	12.2		11.6	13.0		10.7	12.2		11.0	12.5	
Carbohydrates		Percentage of energy from carbohydrates is equal to 100% - (% energy from protein + % energy from fat)														
Energy from each food groups (kcal)																
Rice and starch		1700	1595	105*	1879	1592	287*	1757	1291	466*	1882	1592	290*	1727	1586	141*
Nuts, sesame, oils, fats (or the rich fat foods)		73	112	-39*	75	102	-27*	94	108	-14*	74	102	-28*	73	111	-38*
Bean and tofu		17	30	-13*	17	26	-9*	22	33	11*	17	27	-10*	16	29	-13*
Fruits &vegetables		35	59	-24*	38	53	-15*	48	61	-13*	38	53	-15*	36	59	-23*
Animal products		111	237	-126*	121	206	-85*	173	251	-78*	119	206	-87*	111	234	-123*
Sweets and drinks		31	68	-37	34	58	-24	50	68	-18	34	59	-25	31	67	-36

* Differences are statistically significant with P<0.001(t test)

Table 3. Protein profiles in urban and rural areas of Vietnam in the VLSS 1997-1998

Protein profile	Urban		Rural	
	g/AE/day*	%	g/AE/day*	%
Animal protein (AP)	21.7	4.8	16.2	3.0
Vegetable protein (VP)	37.4	8.3	46.3	8.6
Total energy	59.1	13.0	62.5	11.6
AP/ VP Ratio		0.58		0.35

* g/AE/day: gram per adult equivalent per day

they were 11.6%, 13.0% and 75.4% respectively. Protein profile in Table 3 shows that ratio of animal to vegetable protein in the diets of urban residents was 0.58, while the ratio was 0.35 in diets of rural residents. Energy derived from eating-out foods, when the service fee ranges from 0% to 50%, varied between 10.7–19.5% of total energy intake for urban residents and 2.3–4.5% for rural residents.

Regression model

Model 1 shows that urban residents and the Kinh and Hoa people consumed less daily energy intake than rural people and the ethnic minority groups (coefficient = – 431 and –125, respectively). Similarly, the more people in a household and the higher the educational level, the less energy intake is consumed per adult equivalent per day. On the other hand, the higher the family income, the higher the energy intake (coefficient = 123). Among the ecological regions, people in the Southeast region have lower energy intakes than other regions (Table 5). Model 2 reveals the same association of independent variables with energy consumed from the 'rice and starch' group as seen in Model 1 ($P<0.001$). Model 3 shows that urban and rural people, as well as the Kinh and Hoa and the ethnic minority groups, consumed similar amounts of energy from animal products ($P>0.05$). In contrast, the higher the family income, the higher the energy consumption from animal products (coefficient = 50, $P<0.001$). The increase in energy from animal products, per additional year of education, is very small (coefficient = 0.6). People in all other ecological regions consumed less energy from animal products than those in the Mekong River Delta region.

Discussion

Food consumption patterns in the VLSS 97-98 dataset collected from 5,999 households nationwide revealed differences in food quantity, energy intake, dietary structure, and in eating habits between the urban and rural residents in Vietnam during a period of economic transition. Other socio-economic and demographic factors were also taken into account in this analysis.

Results of this study showed that rural residents consumed larger total amounts of food compared to urban residents; but the former consumed less animal products, fat, fruit, and vegetables than the latter. Protein intake came mainly from rice, starch, and animal products. Fat was derived mainly from animal products, nuts, edible oils, and the 'rice and starch' group.

Energy intake in rural areas was higher than in urban areas in 1997-1998. The explanation for this discrepancy is that the 'rice and starch' consumption in 1997–1998 was much higher in rural areas than in urban areas. Rice, starch, and cereals accounted for 75.4% of total energy from carbohydrate in rural areas vs. 68.2% in urban areas. Because rice-derived products, such as rice noodles, are a very popular eating-out food in Vietnam, calculation of calories from these foods may explain partly why a large proportion of the population (46%) consumed less than 2,100 kcal /adult equivalent /day.

Total energy intake may be underestimated if the eating-out energy is not accounted for due to the unknown food items collected in the survey, particularly in urban areas. Total energy intake for urban residents was underestimated by 10.7–19.5% and 2.3–4.5% for rural residents when food service fee ranged from 0% to 50% of the price of raw foods. Although rural residents consumed more energy than urban residents, after adding eating-out calories, the total caloric intakes in both urban and rural areas are not very different (Table 4). Therefore, eating-out food should be studied in the future to evaluate the changes in eating habits in the socio-economic transition.

Urban residents consumed smaller amounts of protein than rural residents (59g vs 62g), but the urban residents obtained more calories from protein than the rural counterparts (13.0% vs 11.6%). Protein intake in the Vietnamese diet is still in the range of 50g to 60g/day. This amount is recommended by the United States Department of Agriculture (USDA). The ratio of animal to vegetable protein in urban areas was higher than in

Table 4. Energy from eating-out foods in relation to total energy intake of Vietnam when service fee ranges from 0% to 50%

Place of Residence	Food service fee[#] (%)	Net Energy (kcal/adult equivalent/day)	Eating out (kcal/adult equivalent/day)	Total (kcal/adult equivalent/day)	Percentage of kcal from eating out (%)
Urban	0% service	1812	437	2249	19.5
	50% service	1812	218	2030	10.7
Rural	0% service	2145	102	2247	4.5
	50% service	2145	51	2196	2.3

Food service fee = Difference between the price of raw food and the price of ready-to-eat food at a restaurant

Table 5. Associations between energy intake from main food groups, macronutrients, and demographic and socio-economic status in Vietnam in 1997-1998 (*N*=28,611)

	Model 1		Model 2		Model 3	
Independent variables	Dependent variables					
	Total energy intake (Kcal/AE/day)[#]		Energy from rice and starch group (Kcal/AE/day)[#]		Energy from animal product group (Kcal/AE/day)[#]	
	Coefficient	Significant	Coefficient	Significant	Coefficient	Significant
Place of residence *(1: urban; 0: rural)*	-431	***	-416	***	0.6	
Ethnicity *(1: Kinh and Hoa people; 0: other ethnic minorities)*	-125	***	-127	***	-0.8	
Income Quintile *(1: poorest; 5: richest)*	123	***	32	***	50	***
Household size *(from 1 to 10)*	-61	***	-37	***	-8.5	***
Education of HH head *(from 0 to 22 years)*	-9	***	-10	***	0.6	***
Region 1 *(1: Northern Mountain and Midland; 0: others)*	254	***	256	***	-23	***
Region 2 *(1: Red River* Delta; *0: others)*	159	***	169	***	-26	***
Region 3 *(1: North Central Coast; 0: others)*	142.5	***	135	***	-20	***
Region 4 *(1: South Central Coast; 0: others)*	22	*	38	***	-17	***
Region 5 *(1: Central Highlands; 0: others)*	66	***	75	***	-9	**
Region 6 *(1: Southeast; 0: others)*	-163	***	-137	***	-31	***
Constant	2238	***	1958	***	101	***

* $P<0.05$; ** $P<0.01$; *** $P< 0.001$; # Kcal/AE/day: kilocalories/adult equivalent/day

rural areas (0.58 vs 0.35). Furthermore, in comparison with the 1988 survey, the ratio in rural areas in this study was higher (0.35 vs 0.26). Due to the improvements in family income through the economic development in Vietnam, people in rural areas can afford and have increasingly more access to animal foods. Another possible way to increase dietary protein intake for low-income rural residents is to encourage them to eat beans and tofu, which are more affordable than meat.

The percentage of energy from dietary fat is about half of the upper level of USDA recommendations, and the percentage from carbohydrates is too high (75.4% in rural areas and 68.2% in urban areas). This may cause an unbalanced diet, given the recommendations of less than 30% fats and 60–65% carbohydrates. Low intakes of fat, especially saturated fat, reduce the risk of developing diseases of 'affluence' (e.g., obesity, cancer, and cardio-vascular diseases). However, a high carbohydrate and low fat diet may contribute to a proportion of the population consuming less energy than the recommended (2,100 kcal/ capita/day), because fat provides more energy than protein and carbohydrates per gram (9 kcal/g of fat vs 4 kcal/g of either protein or carbohydrate). Furthermore, several studies have shown that a high carbohydrate and low fat diet will lower serum high density lipoprotein (HDL), which may increase the risk of heart disease.[24] One of the ways to increase fat intake in the diet is to educate people to eat seeds, nuts, tofu and fatty fish rich in good fatty acids.

Association of energy intake with socio-economic and demographic factors were examined. In 1997-1998, urban residents and the Kinh and Hoa people had lower total energy intake and lower energy derived from the 'rice, starch and cereal' group than rural residents and ethnic minorities, but there were no differences in energy derived from animal products. It may be that the rural residents and ethnic minorities have access to animals and consume animal products when they have the opportunity to do so. Obviously, the richer they are the higher their energy intake (Table 5). Family size negatively affects the coefficient of Model 1 through to Model 3 (Table 5). However, the extent of family size effects is rather small with the addition of a single member. Similarly, the educational level of the head of household had a small negative effect in all 3 Models. People living in the Southeast region (Region 6) consumed less energy than other regions. It is likely that this region is industrialized and undergoing urbanization. Therefore, people may eat out more than people in other regions. Interestingly, the Northern region and the Central Highland region are mountainous, with a high concentration of ethnic minority groups, poor transportation and poor communication, but people in these two regions had higher energy intakes than the other regions. They may consume larger quantities of rice and cereals to meet their higher daily energy requirements due to heavy manual labours.

The energy unit used in this paper is the amount of calories per adult equivalent per day, while the unit of

measure from WHO/FAO is calculated based on the reference population containing 56% adults and 20% adolescents aged 15–19 years.[25] Different measurement units can make the interpretation of the results difficult. Energy intake per adult equivalent per day is likely to be a better measurement unit than energy intake per capita per day. This is because calories per capita vary largely in populations with different age distributions. In contrast, the adult equivalent depends on sex, age, pregnancy status and lactation and thus better reflects the population structure.

One of the limitations of this study was the recall bias of food intake. This was because data on food consumption by individuals were collected over a 12-month period at the household level prior to the survey. Nutrient analysis was therefore only performed on macronutrients (protein, carbohydrates, and fat), but not micronutrients. Intra-household food distribution was not accounted for because the data did not measure the access to food of individuals within households. The calories contributed by foods eaten away from home (eating-out foods) were estimated - this could have contributed to over or under-estimation of daily energy intake. This estimation was primarily based on the assumption of the food service fee ranging from 0% to 50% of the raw food values, and the energy contributed by eating-out foods was highly variable.

Conclusions and implications

In conclusion, the results of this study showed that the traditional Vietnamese diet - high carbohydrate and low fat intake - together with unaccounted energy from eating-out foods - may contribute to the population's low energy intake. Forty-six percent of the whole population consumed less than 2100 kcal/day. Urban residents consumed greater amounts of animal products, fats, fruits and vegetables and sweets and drinks than rural residents. The regression models found the place of residence, family income, household size, education of the head of household, ethnicity, and ecological region to be significantly associated with energy intake. Socio-economic and demographic factors must be considered in developing national strategies and implementing plans of action to improve nutrition at the local level. Diversity in the socio-economic development of the different ethnic minorities indicates the need for a similar diversity in the policy interventions designed to assist them.

In order to reduce the percentage of the population consuming less than 2100 kcal/adult equivalent/day, it is important to establish a food subsidy program to provide more foods, particularly animal products, to the poor, the ethnic minorities and the rural residents. This program will help achieve the current poverty alleviation and the hunger elimination efforts in Vietnam. However, the diet needs to be nutrient dense but not energy dense because excessive calories from nutrient poor foods may cause several diet-related diseases.

A diet with a low fat content is encouraged, but it is necessary to ensure enough energy density to meet daily energy requirement. Nutritionists and other stakeholders, such as policy makers and government agencies, need to understand national food consumption patterns in relation to place of residence, family income, household size, education of the head of household, ethnicity, and ecological regions. This will help in the development of appropriate policies and relevant strategies for health promotion and to improve the nutritional status of the population in the upcoming years. Further studies on food consumption patterns are needed to investigate and monitor the trend of dietary structures and food consumption patterns in each ecological region.

Socio-economic and demographic factors must be considered in developing national strategies and in implementing plans of action to improve nutrition at the local level. Eating-out food should be studied in the future to evaluate the changes in eating habits in the socio-economic transition.

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