



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# **Analysis of the Impact of Urbanization and Enhanced Incomes on Demand for Food Quality in Hanoi**

**Mubarik Ali-AVRDC-The World Vegetable Center, Tainan, Taiwan (mubarik@avrdc.org)**

**Nguyen The Quan-General Statistics Office Hanoi Vietnam (ntquan@gso.gov.vn)**

**Ngo Van Nam-Research Institute for Fruits and Vegetables, Hanoi Vietnam (nam0812us@yahoo.com)**

***Poster paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006***

Copyright 2006 by Mubarik Ali, Nguyen The Quan, and Ngo Van Nam. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

## Introduction

When people move from rural areas to the cities they become dependent on market channels for their food supplies. The urbanization and increased income induce qualitative and quantitative changes in consumption patterns (Huang and Bouis, 1996). To meet the changing food needs of a city requires enormous planning that can be facilitated by the accurate knowledge of these demands of the dwellers. This study aims to furnish the quantitative information on how increasing incomes and urbanization have impacted the food quality of Hanoi dwellers.

Not much quantitative research is conducted on the status of food quality in Hanoi. Brider (2000) estimated consumers' perception of vegetable quality in the city. Following qualitative measures of "good vegetable" were listed in the study: i) beautiful appearance, fresh taste, and tender, ii) clean, healthy, and good nutritional quality, iii) locally grown in a healthy environment with only a reasonable or no use of agrochemical input, iv) well-preserved, well-packed, and v) good prices. Figuié (2003) quantified the consumers' perception about safe food in Hanoi. About 81% respondents expressed their concerns about high use of agrochemical in producing and preserving vegetables, meat, fruits, and fish. However, half of the consumers thought that they could more or less protect themselves against these risks, while another half could protect only partly. Consequently, the majority of the interviewees (89%) believed that consuming food they had prepared "did not present" or "hardly present" a health risk. However, choosing, cleaning and cooking of food were considered to be essential links of food quality chain. In the present study, we consider six criteria of food quality: i) supply of major and micronutrients, ii) food diversity, iii) processing stage, iv) prices, v) food sources, and vi) proportion of food eaten outside. We observe the difference in these parameters of food quality across various income and regional groups within and around Hanoi city.

## Data and Analysis

The data for this study were collected through a household consumption survey on 800 households using the 24 hrs recall method. The survey was conducted in the urban and peri-urban areas of Hanoi, and rural provinces of Hatay and Hungyen around Hanoi. To cover seasonality in fruits and vegetable consumption, the survey was repeated three times in a year, representing three distinct seasons of the city.<sup>1</sup> Appropriate representation was given to different income<sup>2</sup> and farm groups<sup>3</sup> in the survey.

---

<sup>1</sup>This survey was carried out in 3 rounds in October-November (represent cold-wet season), February-March (represent cold-dry season) and June-July (represent hot-wet season).

<sup>2</sup> Three income groups as Low, Middle, and Upper were formed based on the income classification in the Vietnam Household Survey for 2002 (VHLSS, 2004). The ranges of monthly per capita income for each income group were separately defined for each surveyed province.

<sup>3</sup> Five types of farms classified in this study were Vegetable farmers, Non-vegetable farmers, Non-farmers in urban, Non-farmers in peri-urban and Non-farmers in rural areas.

Seven food groups were defined as cereals, vegetables, fruits, meats, aquatic products, egg and milk, and others. The data of each food item consumed in each household were converted into available nutrients using the Food Composition Table from Vietnam published by National Nutritional Institute in Hanoi during 1999. Nine nutrients considered important in this study were: calories, protein, calcium, iron, vitamin A, vitamin B<sub>1</sub>, vitamin B<sub>2</sub>, vitamin C, and niacin. The calories were separately estimated for fat and non-fat sources. Food prices were estimated as cost on each item divided by its quantity consumed. In case of home produced food, the average shadow prices for all households in the same commune who bought that food item was assumed. The food diversity was estimated using the following diversity index (Hannah and Kay 1977):

$$DTF = \sum_{i=1}^m (S_i^\alpha)^{1/(1-\alpha)}$$

where DTF is the food diversity index,  $S_i$  is the share of the  $i$ th item in total food, and  $\alpha$  is the diversity parameter, such that  $\alpha \geq 0$  and  $\alpha \neq 1$ .

## Nutrient Availability

### **Overall**

When overall mean values of the sample were compared with the midpoint of the recommended requirement ranges, no serious deficiency in major and micronutrients was detected, except for calcium, B<sub>1</sub>, B<sub>2</sub>, and niacin (Table 1). But when nutrient availability of individual families was compared on daily basis, a significant population fell below the 80% of the requirement of calcium, Vitamin B<sub>1</sub>, B<sub>2</sub>, and niacin and a smaller percentage was also deficient in calories, iron, Vitamin A and Vitamin C as well (Table 1).

Despite the increasing food diversity trend in the diet of Hanoi, cereals were the main sources of calories, protein, Vitamin B<sub>1</sub> and Niacin. About one-fifth of the calories consumed were fat-based and remaining four-fifth came from non-fat sources. Vegetables provided more than three-fourths of each Vitamin A and Vitamin C, and were the major source of calcium. Egg and milk were very small sources while non-traditional sources like “other”, vegetables and cereals were the major sources of calcium. Similarly, iron came from non-traditional sources like cereals and “other” which had low bioavailability, rather than from meats having high bioavailability. Most of the non-fat based calories came from cereals, and fat-based calories from meats.

### **Income group**

Generally, the population deficient in meeting at least 80% of the daily nutrient requirements increased as we moved from upper-income group to low-income group. However, a significant proportion of population remained deficient even in the upper income group especially for the

nutrient deficient at the mean level, suggesting that income is not the only factor in improving the quality of food in terms of nutrient supply (Table 1).

**Table 1. Daily per capita availability and deficiency level of major and micronutrients by income groups**

Nutrient	Unit	Recommended level	Nutrient availability				Deficiency level (>20%)			
			Low	Middle	Upper	Overall	Low	Middle	Upper	Overall
Calories	(kcal)	1800-2400	2183.7 <sup>b</sup>	2250.2 <sup>a</sup>	2276.1 <sup>a</sup>	2226.7	20.3	14.6	14.5	17.0
Non-fat	(kcal)	-	1761.3 <sup>a</sup>	1770.1 <sup>a</sup>	1772.3 <sup>a</sup>	1766.8	-	-	-	-
Fat	(kcal)	-	422.3 <sup>c</sup>	480.1 <sup>b</sup>	503.8 <sup>a</sup>	459.9	-	-	-	-
Protein	(g)	45-65	91.3 <sup>b</sup>	97.0 <sup>a</sup>	96.3 <sup>a</sup>	94.5	10.2	5.2	3.0	6.9
Calcium	(mg)	800-1200	668.9 <sup>b</sup>	719.5 <sup>a</sup>	760.0 <sup>a</sup>	705.1	68.3	66.2	67.3	67.3
Iron	(mg)	10-15	19.6 <sup>a</sup>	20.2 <sup>a</sup>	19.5 <sup>a</sup>	19.8	18.0	12.8	9.6	14.5
Vitamin A	(IU)	4200-5000	5789.1 <sup>c</sup>	6511.6 <sup>b</sup>	7435.9 <sup>a</sup>	6365.7	33.3	28.3	28.5	30.4
Vitamin B <sub>1</sub>	(mg)	1.12	0.71 <sup>c</sup>	0.74 <sup>b</sup>	0.78 <sup>a</sup>	0.7	84.4	79.1	74.9	80.6
Vitamin B <sub>2</sub>	(mg)	1.22	0.48 <sup>c</sup>	0.54 <sup>b</sup>	0.61 <sup>a</sup>	0.5	96.6	94.7	90.9	94.9
Niacin	(mg)	14.66	9.9 <sup>c</sup>	10.3 <sup>b</sup>	11.2 <sup>a</sup>	10.3	79.6	74.5	66.8	75.3
Vitamin C	(mg)	50-70	76.0 <sup>c</sup>	90.8 <sup>b</sup>	106.9 <sup>a</sup>	87.3	30.9	21.2	15.2	24.2

Different superscripts across a row indicate that the figure is statistically different across the groups at the 10% level.

The difference in the availability of nutrients between the upper-income and low-income groups was significant for all nutrients, except iron. However, it was not significant between the middle and upper income groups for calories, protein, calcium, and iron. No significant difference in non-fat based calories was observed across the income groups, but fat-based calories and their shares in total calories increased as one moved from low income to upper income group.

In supplying vitamin A, vegetables played higher role among low-income group while fruits were more important among high and upper-income groups; similarly low bioavailable iron from cereals are more important among low income group and high bioavailable iron from meats are more important source among high income group (table not reported here).

### **Region**

The availability of calcium, Vitamin B<sub>1</sub>, and Vitamin B<sub>2</sub> increased as we moved from rural to urban areas. However, calories and iron consumption was highest in peri-urban areas, protein availability was not statistically different across the urban and peri-urban regions, and niacin consumption was similar across regions. The consumption of Vitamin A and Vitamin C was statistically similar across peri-urban and rural areas, but it was highest in urban areas. More importantly, the fat based calories consumption increased as one moved from rural to urban areas, while non-fat based calories consumption was highest in rural and peri-urban areas (Table 2).

**Table 2. Daily per capita availability and deficiency level of major and micron nutrients by location**

Nutrient	Unit	Recommended level	Nutrient availability			Deficiency level (>20%)		
			Urban	Peri-urban	Rural	Urban	Peri-urban	Rural
Calories	(kcal)	1800-2400	2181.3 <sup>b</sup>	2298.4 <sup>a</sup>	2204.5 <sup>b</sup>	15.7	13.8	20.7
Non-fat	(kcal)	-	1659.1 <sup>b</sup>	1819.9 <sup>a</sup>	1811.7 <sup>a</sup>	-	-	-
Fat	(kcal)	-	522.2 <sup>a</sup>	478.6 <sup>b</sup>	392.8 <sup>c</sup>	-	-	-
Protein	(g)	45-65	99.4 <sup>a</sup>	100.1 <sup>a</sup>	85.9 <sup>b</sup>	3.5	5.1	11.2
Calcium	(mg)	800-1200	776.6 <sup>a</sup>	705.7 <sup>b</sup>	645.6 <sup>c</sup>	62.1	65.2	73.3
Iron	(mg)	10-15	20.2 <sup>b</sup>	21.3 <sup>a</sup>	18.3 <sup>c</sup>	11.0	13.2	18.3
Vitamin A	(IU)	4200-5000	7499.3 <sup>a</sup>	5779.6 <sup>b</sup>	5916.3 <sup>b</sup>	24.5	34.9	31.7
Vitamin B <sub>1</sub>	(mg)	1.12	0.8 <sup>a</sup>	0.73 <sup>b</sup>	0.70 <sup>c</sup>	73.4	81.2	86.1
Vitamin B <sub>2</sub>	(mg)	1.22	0.61 <sup>a</sup>	0.50 <sup>b</sup>	0.48 <sup>c</sup>	91.1	96.4	96.7
Niacin	(mg)	14.66	10.4 <sup>a</sup>	10.2 <sup>a</sup>	10.2 <sup>a</sup>	70.2	76.5	78.7
Vitamin C	(mg)	50-70	108.2 <sup>a</sup>	79.9 <sup>b</sup>	76.3 <sup>b</sup>	12.6	27.8	30.9

Different superscripts across a row indicate that the figure is statistically different across the groups at the 10% level.

General speaking, the deficient populations to meet the 80% daily requirements of micronutrients were highest in rural areas and lowest in urban areas reflecting an improvement in food quality with urbanization, although a high portion of the population is deficient in calcium, Vitamin B<sub>1</sub>, Vitamin B<sub>2</sub> and niacin even in urban areas (Table 2).

## Difference in Prices

Difference in food prices is a composite measure of perceived differences in food quality in terms of nutrient, taste, hygienic and safety conditions, convenience in purchase and preparation, etc. Some of the price differences may also be attributed to transportation and retailing costs, but such differences are usually small if regions are closer to each other, such is the case in this study.

To quantify the extent of price differences across regions and income groups, we run a regression of logarithm of prices of each food item (where number of observation was 100 or more) on region and income dummies. The price differences between urban-rural, urban-peri-urban, and peri-urban-rural were positive and significant for 83%, 78%, and 70% cases, respectively (Table 3). The differences in absolute terms were highest across urban and rural followed by urban and peri-urban areas. Usually, price differences were higher for fresh foods like fish, vegetables, and fruits.

## Processing Stage

Processed foods involve value addition, and reflect better quality not necessarily in terms of nutrient composition or health, but convenience of the consumers.

**Table 3. Food commodity Price difference (%) across region and income group in selected food items**

Commodity	Region			Income group		
	Urban-rural	Urban-peri-urban	Peri-urban-rural	Upper-low	Upper-medium	Medium-low
Rice	38.5*	23.6*	14.8*	9.7*	4.8*	4.9*
Shrimp instant noodle	18.7*	6.1*	12.6*	8.5*	2.1	6.4*
Pork	30.0*	13.0*	17.0*	9.0*	3.5*	5.5*
Fresh fish	59.3*	25.9*	33.5*	23.3*	7.2*	16.2*
Banana	19.8*	1.3	18.5*	5.2	3.8	1.3
Lemon	26.6*	10.5*	16.2*	0.5	-3.4	4.0
Kangkong	61.1*	32.6*	28.5*	15.0*	4.8*	10.2*
Spring onion	18.7*	18.5*	0.2	0.9	1.8	-0.9
Common cabbage	40.7*	18.5*	22.2*	12.0*	0.4	11.6*
Tomato	21.5*	15.7*	5.8*	3.4	-1.4	4.8*
Kohlrabi	48.3*	35.2*	13.1*	10.7*	0.7	10.0*
Hen egg	-1.9	6.6*	-8.5*	7.6*	4.7	3.0
Duck egg	6.1*	5.4*	0.6	1.4	-0.8	2.2
Green tea	23.1*	8.7*	14.4*	8.9*	1.9	6.9*
Pickles	35.0*	17.3*	17.7*	19.1*	12.5*	6.7*
Iodized salt	-2.9*	-1.8*	-1.1	3.1*	2.4*	0.6
Cooking oil	4.9*	0.4	4.5*	4.4*	1.6*	2.8*
Pig fat	-1.8	2.9*	-4.7*	0.7	-0.4	1.1
Soybean cake	14.1*	8.0*	6.1*	-0.3	0.2	-0.5
Other alcohols	34.1*	16.4*	17.7*	19.1*	14.2*	5.0*
Total positive significant (%)	82.6	78.3	69.6	60.9	39.1	56.5

The regression of logarithm in prices on region and income group dummies was estimated for only those commodities where more than 100 observations were available. The star signifies that the difference of the two groups is statistically significant at least at the 10% level.

### Overall

Overall about 7% food was bought as readymade, 8% (mainly fruits) was consumed fresh while the remaining passes through some cooking process in the house. The readymade food was of highest proportion (29.5%) in “other” food category. About 19% egg and milk and surprisingly 6% cereals and 9% meats were purchased readymade in Hanoi (Table 4).

**Table 4. Food purchase at its different processing stage (% of total food) by food group and region**

Food group	Urban			Peri-urban			Rural			Overall		
	HC	RM	TF	HC	RM	TF	HC	RM	TF	HC	RM	TF
Cereals	87.5	12.5	0.0	95.2	4.8	0.0	97.8	2.2	0.0	94.1	5.9	0.0
Vegetables	96.5	0.9	2.7	98.8	0.3	0.9	98.7	0.5	0.8	98.0	0.5	1.4
Fruits	7.7	0.8	91.5	13.4	1.9	84.7	25.9	4.7	69.4	12.2	1.7	86.1
Meats	90.7	9.3	0.0	91.4	8.6	0.0	92.5	7.5	0.0	91.5	8.5	0.0
Aquatic products	98.6	1.4	0.0	99.8	0.2	0.0	99.9	0.1	0.0	99.4	0.6	0.0
Egg and milk	67.6	32.4	0.0	87.1	12.9	0.0	97.4	2.6	0.0	80.6	19.4	0.0
Others	70.8	29.1	0.1	71.2	28.4	0.3	69.0	30.9	0.1	70.3	29.5	0.2
Total	75.7	9.5	14.9	87.0	6.9	6.0	91.1	5.7	3.2	84.7	7.4	8.0

HC= Home cooked; RM= Readymade or processed; TF= Taken fresh.

## **Region**

The proportion of readymade or processed food increased as one move from rural to urban areas (Table 4). More particularly, urbanization will increase the demand of readymade (or processed) cereals, meats, and egg and milk and fresh fruits while it will not affect the demand for processed vegetables and aquatic products which will continuously be demanded mainly as fresh.

## **Income group**

As expected, the shares of readymade (or processed) and fresh foods generally increase as we move from low-income to upper-income groups, while the opposite is true for the food cooked at home (Table 5). This may partly reflect the reduced priority of the housewives for the cooking time, and partly the changing demand for the processed food with increased income.

**Table 5. Food purchase at its different processing stage (% of total food) by food group, income level, and farm type**

Food group	Income group									Farmer type					
	Low income			Middle income			Upper income			Farmer			Non-farmer		
	HC	RM	TF	HC	RM	TF	HC	RM	TF	HC	RM	TF	HC	RM	TF
Cereals	95.8	4.2	0.0	93.1	6.9	0.0	92.3	7.7	0.0	97.3	2.7	0.0	89.4	10.6	0.0
Vegetables	98.7	0.3	1.0	98.0	0.6	1.4	96.6	1.1	2.3	98.9	0.4	0.7	97.0	0.7	2.3
Fruits	14.9	1.7	83.4	11.5	1.4	87.1	10.6	2.4	87.0	21.5	4.5	74.0	8.7	0.7	90.6
Meats	92.0	8.0	0.0	91.1	8.9	0.0	91.4	8.6	0.0	92.1	7.9	0.0	90.9	9.1	0.0
Aquatic products	99.6	0.4	0.0	99.5	0.5	0.0	98.8	1.2	0.0	100.0	0.0	0.0	98.9	1.1	0.0
Egg and milk	86.5	13.5	0.0	79.8	20.2	0.0	73.0	27.0	0.0	94.5	5.5	0.0	71.4	28.6	0.0
Others	73.1	26.6	0.3	69.7	30.2	0.1	65.0	34.9	0.1	70.7	29.2	0.1	69.8	29.9	0.3
Total	88.3	6.2	5.5	83.5	7.9	8.6	80.0	8.5	11.9	90.5	6.0	3.5	78.0	8.9	13.1

HC= Home cooked; RM= Readymade or processed; TF= Taken fresh.

## **Farm based group**

Farmers consumed noticeably higher share of food that was cooked at home and less proportion of readymade and fresh food compared to their counterpart non-farmer group (Table 5). The main difference came in cereals, fruits, and egg and milk where farmers consumed a significantly higher home cooked food, while they consumed a lower proportion of readymade cereals and egg and milk.

## **Sources of Food**

### **Overall**

Foods came from various sources but temporary market, retail market, and owned farm were the major sources. Street vendors, home gardens and gifts also contributed 2-6% in food supply, while night markets, supper markets, and vegetable shops had less than 1% share (Table 6).



Surprisingly, most individual food items (except cereals) in and around Hanoi were bought from temporary markets. Figuié (2003) also speculated these temporary street markets as the main source of fresh vegetable supply. The temporary market in this study is defined as a place which does not belong to the market system established by the authorities, nor recognized by the authorities as temporary or permanent market place. Most of the goods sold here are foods and it is usually located at a convenient place (for example road side). On the other hand, prices of foods in the temporary market were usually lower than in other markets because the shop-owners did not have to pay market fees (although they may have to pay bribe to local police) and hygienic condition were usually poor.

**Table 6. Source of food supply (% of quantity) by food group**

Food group	Owned farm	Home garden	Street vendors	Retail market	Night market	Vegetable shops	Super-market	Gift	Temporary market
Cereals	48.65	0.16	4.09	20.48	0.00	0.00	0.00	0.30	26.31
Vegetables	6.46	7.57	6.98	35.58	0.01	0.04	0.09	3.65	39.62
Fruits	1.60	5.17	9.18	33.67	0.00	0.03	0.04	4.22	46.10
Meats	1.77	3.29	5.29	40.26	0.00	0.04	0.02	0.61	48.72
Aquatic products	9.89	0.93	7.87	37.13	0.00	0.02	0.00	4.11	40.05
Egg and milk	1.40	10.16	3.06	34.62	0.00	0.12	0.00	0.38	50.26
Others	1.42	1.27	6.48	36.96	0.00	0.06	0.02	0.24	53.55
Total	21.69	3.01	5.78	30.10	0.003	0.03	0.03	1.63	37.72

About one half of the cereal supply came from owned farm, while other foods mostly from temporary market and retail market. Street vendors were the third important source for fruits, meats, and other foods. The home garden was the fourth important food source in most items, while its contribution in supplying vegetables and egg and milk (8% and 10%, respectively) surpassed that of street vendor. About 3-4% of fruits, vegetables and aquatic products were exchanged as gifts among consumers. Supermarkets supplied less than 1% of vegetables and 0.5% of fruits. Tan Loc (2002) reported less than 2% of all fresh vegetables came from stores and supermarkets. Vegetable shops, considered to be providing quality vegetables such as pesticide-residue free, currently contributed only an insignificant share of total vegetable supply.

### **Region**

Urbanization tends to increase the share of food bought from temporary markets, retail markets and vegetable shops, while an opposite was true for owned farm, home garden and gifts (Table 7). One-fifth of aquatic products and fruits, one-fourth of eggs and milk (mostly eggs), and 14% of vegetable consumed by farm families in rural area came from home garden. In fact, the importance of home garden for farm families in rural areas was higher than of farm production in supplying vegetables, fruits, meats, and egg and milk.

**Table 7. Food sources (% of quantity) by region and food group**

Region & food group	Own-farm	Home garden	Street vendors	Retail market	Gift	Temporary market
<b>Urban</b>						
Cereals	0.48	0.01	7.62	38.14	0.33	53.42
Vegetables	0.78	0.07	9.72	39.90	0.31	48.78
Fruits	0.01	0.00	10.91	35.55	1.92	51.50
Meats	0.68	0.00	1.01	40.76	0.31	57.18
Aquatic products	0.00	0.00	0.83	45.88	2.58	50.64
Egg and milk	0.18	0.55	3.05	35.17	0.27	60.50
Others	0.02	0.00	1.54	37.10	0.13	61.20
Total	0.42	0.03	6.82	38.61	0.66	53.32
<b>Peri-urban</b>						
Cereals	44.51	0.01	3.63	25.39	0.25	26.19
Vegetables	8.98	7.47	0.39	42.91	4.38	35.86
Fruits	0.41	6.85	3.59	35.48	5.51	48.15
Meats	0.13	2.88	0.33	47.82	0.58	48.13
Aquatic products	5.34	2.62	0.15	42.09	2.92	46.88
Egg and milk	0.00	9.32	0.77	44.93	0.37	44.61
Others	0.97	2.75	0.36	44.80	0.08	50.87
Total	20.79	3.19	1.92	35.92	1.72	36.41
<b>Rural</b>						
Cereals	80.74	0.37	2.31	6.18	0.31	10.09
Vegetables	9.20	14.16	10.32	25.50	5.92	34.90
Fruits	8.52	20.09	10.97	24.97	10.13	25.32
Meats	4.44	7.41	14.44	33.19	0.99	39.54
Aquatic products	20.86	0.73	18.27	26.87	6.09	27.18
Egg and milk	4.69	25.34	5.47	22.96	0.57	40.97
Others	2.91	0.86	15.89	29.62	0.47	50.20
Total	40.88	5.44	8.08	17.91	2.40	25.28

The night market, supermarket, and vegetable shop columns were deleted in this and subsequent tables because of their small importance for all regions and groups. This implies that the sum across a row will not add up to 100.

Even in peri-urban area, the importance of home garden was more than farm production in supplying fruits, meats, egg and milk and “others”, while both have similar contributions in supplying vegetables. Surprisingly, street vendors were more or equally important food source in rural area to that in urban and peri-urban areas, except in supplying cereals.

### **Income group**

Overall, temporary markets and retail markets were the two major sources of food supply among all the three income groups. The importance of owned farms, home gardens and gifts as overall food sources is much higher on the low-income group compared to the upper income group but an opposite is true for temporary markets, retail markets, street vendors and vegetable shops (Table 8).

**Table 8. Source of food supply (% of quantity) by income and food groups**

Income & food group	Own farm	Home garden	Street vendors	Retail market	Gift	Temporary market
<b>Low</b>						
Cereals	63.73	0.18	2.50	16.11	0.17	17.31
Vegetables	12.34	9.79	3.89	36.33	7.08	30.53
Fruits	1.96	15.08	5.01	32.11	6.77	39.07
Meats	2.01	5.88	3.74	40.99	1.16	46.22
Aquatic products	9.31	3.72	5.91	43.63	8.92	28.50
Egg and milk	1.84	20.64	1.27	38.58	0.19	37.38
Others	1.72	2.16	6.01	42.16	0.13	47.82
Total	33.21	4.32	3.59	28.18	2.54	28.14
<b>Middle</b>						
Cereals	44.67	0.20	4.51	21.49	0.33	28.81
Vegetables	5.20	7.64	7.47	34.67	2.98	41.86
Fruits	1.40	4.33	9.58	34.05	4.28	46.30
Meats	1.28	2.31	4.81	40.58	0.57	50.40
Aquatic products	12.00	0.06	8.66	34.68	3.39	41.17
Egg and milk	1.19	8.33	4.25	33.39	0.53	52.14
Others	1.45	1.18	6.30	35.64	0.22	55.17
Total	19.45	2.80	6.13	30.19	1.48	39.89
<b>Upper</b>						
Cereals	37.76	0.00	5.26	24.22	0.40	32.37
Vegetables	2.64	4.27	9.57	37.67	1.21	44.46
Fruits	1.95	2.83	10.02	33.41	2.92	48.74
Meats	3.01	4.13	7.86	38.77	0.30	45.82
Aquatic products	3.01	1.44	6.86	39.77	2.25	46.67
Egg and milk	1.65	5.41	1.01	34.56	0.11	57.26
Others	0.89	0.29	7.86	34.31	0.50	55.79
Total	14.43	2.04	7.46	32.29	0.99	42.67

However, the importance of various markets varied across food items and income groups. For cereal supply, own-farm was the most important source followed by temporary and retail markets for all income groups. For vegetables and aquatic products supplies, own-farm was the third important source for low-income group and for aquatic products for middle-income group.

The home garden was the third important source for fruits, meats and egg and milk for the low-income group, and for egg and milk for the middle and upper income groups. Although the share of vegetable shop was insignificant for all groups, it was more important for the upper income groups.

### **Farm based group**

About 38% of the food of farm families, mainly cereals, came from own-farm production. The temporary and retail markets were the next two major important sources of food purchases, and a significant percentage of aquatic products, “others” and meats were purchased from street vendors. Additional 5% came from home gardens, and its share in egg and milk, fruits, and vegetables was much higher. More than 10% fruits were shared as gift by farm families. Temporary markets were the single major source of food purchases followed by retail markets among non-farm families (Table 9).

**Table 9. Source of food supply (% of quantity) by farm based and food groups**

Farm type & food group	Own-farm	Home garden	Street vendor	Retail market	Gift	Temporary market
<b>Farmer</b>						
Cereals	75.91	0.18	2.21	10.08	0.12	11.51
Vegetables	11.34	12.08	6.50	31.21	5.76	33.11
Fruits	4.87	15.25	5.20	28.82	10.62	35.24
Meats	2.98	6.54	9.58	38.60	0.77	41.46
Aquatic products	18.01	1.69	13.57	30.22	5.79	30.72
Egg and milk	2.90	20.50	3.38	30.92	0.50	41.81
Others	2.56	2.11	9.98	36.11	0.27	48.95
Total	38.13	4.80	5.51	22.90	2.24	26.41
<b>Non-farmer</b>						
Cereals	0.00	0.89	7.42	38.85	0.61	52.23
Vegetables	0.00	1.80	7.54	41.42	0.91	48.04
Fruits	0.00	1.24	10.13	35.25	1.83	51.45
Meats	0.00	0.68	1.07	41.95	0.46	55.80
Aquatic products	0.00	0.00	0.91	45.69	2.07	51.28
Egg and milk	0.00	1.55	2.79	37.82	0.28	57.33
Others	0.00	0.37	2.10	38.16	0.23	58.96
Total	0.00	1.04	6.13	39.50	0.85	52.36

## Food Eaten Outside

We estimated that about 9% of foods were eaten outside the house in and around Hanoi, which was directly related to income and urbanization. The highest proportion of food consumed outside was by urban families while the rural non-farm group consumed the lowest proportion (Table 10).

**Table 10. Food eaten outside (%) and food diversity index (%) by region and income and farmer group**

Income/region/farming group/	Food taken outside (% of total quantity)	Food diversity (index)
<b>Income group</b>		
Low	7.7 <sup>b</sup>	4.45 <sup>a</sup>
Middle	9.5 <sup>a</sup>	5.09 <sup>b</sup>
Upper	10.1 <sup>a</sup>	5.26 <sup>c</sup>
<b>Locality group</b>		
Urban	13.4 <sup>a</sup>	5.86 <sup>a</sup>
Peri-urban	9.0 <sup>b</sup>	4.69 <sup>b</sup>
Rural	5.0 <sup>c</sup>	4.15 <sup>c</sup>
<b>Professional group</b>		
Farmer	5.9 <sup>b</sup>	4.22 <sup>a</sup>
Vegetable farmer	5.8 <sup>a</sup>	4.29 <sup>a</sup>
Non -vegetable farmer	6.0 <sup>a</sup>	4.19 <sup>a</sup>
Non -farmer	9.5 <sup>a</sup>	5.64 <sup>b</sup>
Non -farmer in urban	13.6 <sup>a</sup>	5.88 <sup>a</sup>
Non -farmer in peri-urban	11.3 <sup>a</sup>	5.26 <sup>b</sup>
Non -farmer in rural	4.7 <sup>b</sup>	4.38 <sup>c</sup>
<b>Overall</b>	<b>8.9</b>	<b>4.85</b>

Similar superscripts among sub-groups of a group imply that the figures are statistically same at the 10% level among sub-groups.

## Food Diversity

The diversity in food is now recognized as a key component of healthy and quality diet (Hoddinott and Yohanne 2002; Ali and Farooq, 2004). In Hanoi, the consumption of cereals decreased but all other foods increased at higher levels of diversity, thus enhancing the availability of micronutrient and to some extent major nutrient such as carbohydrates and protein as well. Food diversity increased with urbanization and enhanced incomes. The farmer had lower food diversity than non-farmer group as the latter had better access to diversified food from the market. The difference in diversity was not significant among vegetable and non-vegetable farm households (Table 10).

## Policy Implications

Our analysis suggests that urbanization and enhanced incomes will bring qualitative changes in food consumption pattern, as consumers have capacity and willingness to pay higher prices for food. They will demand more diversified and micronutrient dense foods. The demand for readymade and restaurant foods and fat-based calories will increase dramatically in the near future. Moreover, the sources of food will drift away from the freshly produced farms and home gardens. These trends will require changes in the farming system in the urban and peri-urban areas, and create a space for public policies to maintain the hygienic conditions of food and public health.

A large number of families fell below the daily recommended-level of micronutrients. All the regions and income levels have these deficiencies, although to a small extent it improves with urbanization and enhanced incomes. Therefore, encouraging the micronutrient dense foods such as vegetables and improving the nutrient-related knowledge will greatly help to tackle these deficiencies.

Temporary markets are the major source of food supply in Hanoi. Recognizing their importance in supplying food and employment, they should be integrated into formal markets by providing appropriate space and skills to handle food which will also enhance food safety. Farm is another major source in peri-urban and rural areas of Hanoi, especially for the farm and poor families. Therefore, strengthening food supplies from urban and peri-urban agriculture production and home gardens will not only contribute in food security but also food quality especially of low-income group.

## References

- Ali, M. and U. Farooq. 2004. Dietary diversity to enhance rural labor productivity: evidence from Pakistan. Paper presented in the Annual Meeting of American Agricultural Economic Association (AAEA) in Denver during July 1-4.
- Bridier, B. E. 2000. Etude de la perception de la qualité des légumes per les consommateurs de Hanoi (Vietnam). Cas paertculie de la qualite sanitairé. Esat Development Agricole Tropical. Valorisation des productions. Montpellier, CNEARC: 149.

- Figuié, M. 2003. Vegetable consumption behavior in Vietnam. FSP Project 2000-56 funded by Ministry of Foreign Affairs of France, SUSPER Project, Hanoi [http://www.cipotato.org/urbanharvest/documents/CIRAD\\_Susper.pdf](http://www.cipotato.org/urbanharvest/documents/CIRAD_Susper.pdf) downloaded July 13, 2005.
- Hannah, L. and J.A. Kay. 1997. *Concentration in modern industry: theory, measurement, and UK experience*. London: Macmillan Press (1977).
- Hoddinott, J. and Y. Yohanne. 2002. Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. FCND Discussion Paper Brief No. 140. IFPRI, Washington DC.