

PN-AAP-039

Consumption Patterns in Five Cities of Taiwan



About this report

Data in this report are presented in metric units. Monetary values have been converted to U.S. dollars at the current (May, 1978) exchange rate.

A double asterisk (**) means significant at the 1% level; a single asterisk (*) means significant at the 5% level; and a cross (+) means significant at the 10% level.

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Vegetable Consumption Patterns in Five Cities of Taiwan

Peter H. Calkins^a

Introduction

In fall, 1977, the agricultural economics group of the Asian Vegetable Research and Development Center (AVRDC) interviewed 1000 households in 5 Taiwan cities. These were Taipei and Kaohsiung, large cities at the north and south of the island; Taichung and Taitung, of intermediate size on the west and east; and Changhua, of intermediate size near a major vegetable production area (Fig. 1).

We conducted the survey from Oct 1-20. Consumers were asked about their buying patterns during the preceding week. The results show that in the summer, high prices and lack of supply reduce vegetable purchases, while in the winter people buy unusually high volumes of inexpensive, plentiful vegetables. Thus, fall purchasing patterns may approximate yearly averages.^b

The objectives of the survey were to:

1. Identify food consumption patterns in urban households.
2. Measure consumption of individual food groups by city and income class.
3. Portray the role of vegetables in the diets of various income classes, and how this role changes as income increases.
4. Identify purchase and consumption locations for food by city and income class.
5. Determine consumption trends of selected vegetables.
6. Show which income groups would most increase their purchases of target commodities if improvements in marketing led to lower prices.

We set out the following hypotheses:

1. Income is more evenly distributed in smaller than larger cities.
2. As income increases, the percentage of food expenditures on vegetables declines as those to meat, fish, fruit, and milk increase.

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^bStill, the findings strictly apply only to the fall, and further studies would be necessary to examine seasonal trends.

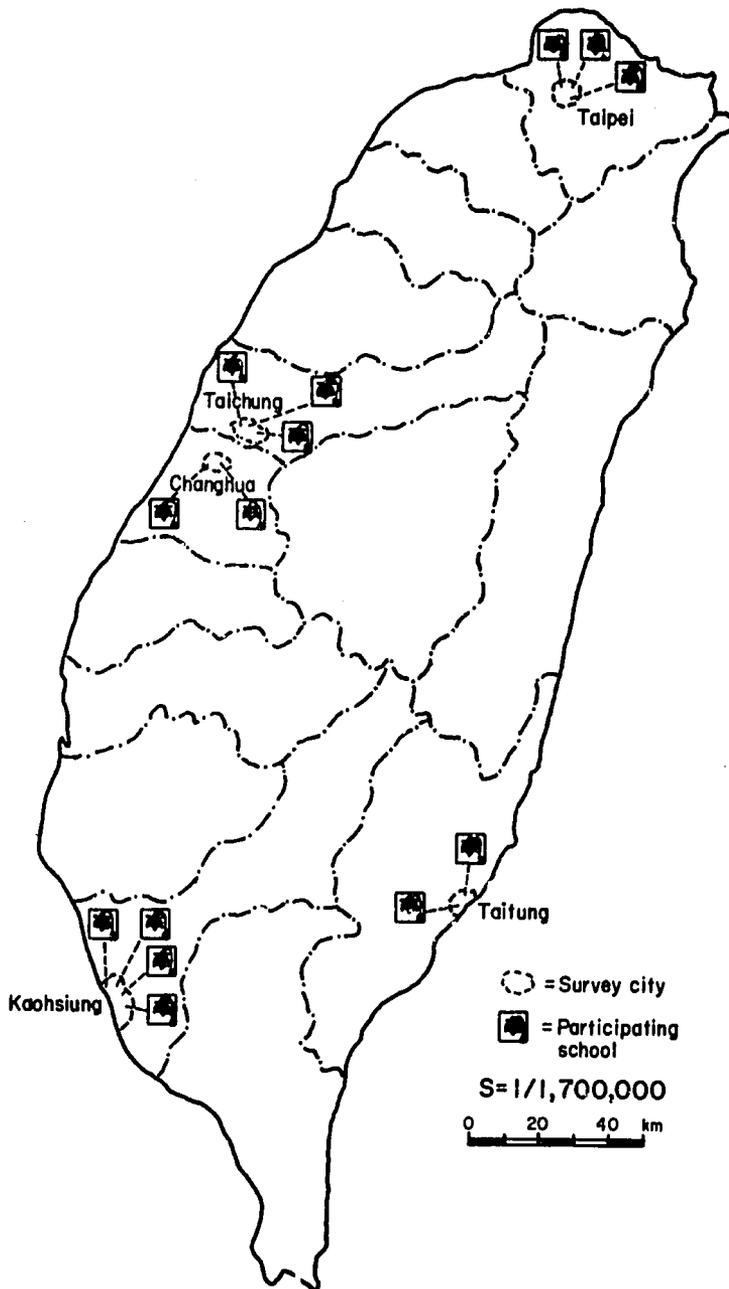


Fig. 1. Sample locations of the AVRDC Consumer Survey, 1977.

3. As income rises, the amount spent on vegetables increases, but at a declining rate.

4. Vegetable consumption levels are less variable from household to household within all income categories than those of any major food category except rice.

5. Food consumption patterns are similar from city to city.

6. Soymilk is decreasing while cow's milk is increasing in Taiwan diets.

7. Sweet potato is consumed most by low income people and fresh market tomato, especially in the summer, by those with high incomes.

Sample Design

We selected 2-4 primary and lower-middle schools in each city (Table 1), and assigned questionnaires to 6-8th graders. School location was random and sample size reflected relative populations. Thirty households for each of 5 income categories per city were provided but, because some questionnaires were not completed and some rejected, the final sample size was 913.

Students were asked to complete questionnaires with help from their parents. Omissions on the forms were noted so that the students could correct them.

Table 1. Sample distribution of the consumer survey, 1977; AVRDC, 1978^a

	Actual population, 1977 (1000)	No. of participating schools	Households surveyed	Samples retained
Taipei	1757 ^b	3	300	288
Kaohsiung	1020	4	250	237
Changhua	1118 ^b	2	150	136
Taichung	561	3	150	132
Taitung	290 ^b	2	150	120
Total	-	14	1000	913

^aRef. 3. ^bData for counties; city population unavailable.

Results and Discussion

Income Distribution in the Five Cities

The lowest income category was less than US\$132/month and the highest more than \$500/month. Because the real range of incomes in these two categories was not known, we assumed that all those in the lowest category had an income of the maximum value (\$132) and all those in the highest had an income of \$553.^a

Table 2 shows the percentage of the population in each income class in a given city and the percentage of the total income it received. Most households in each city fell into classes II and III. By plotting cumulative income percentages against cumulative percentage households, we derived Lorenz curves (Fig. 2). From these we computed Gini coefficients, defined as the ratio of the area between the diagonal and the Lorenz curve to the entire area of the triangle. The lower the Gini coefficient, the more equal the distribution of income. Fig. 2 depicts Lorenz curves for 3 cities to show the range in Gini values for our sample.^a

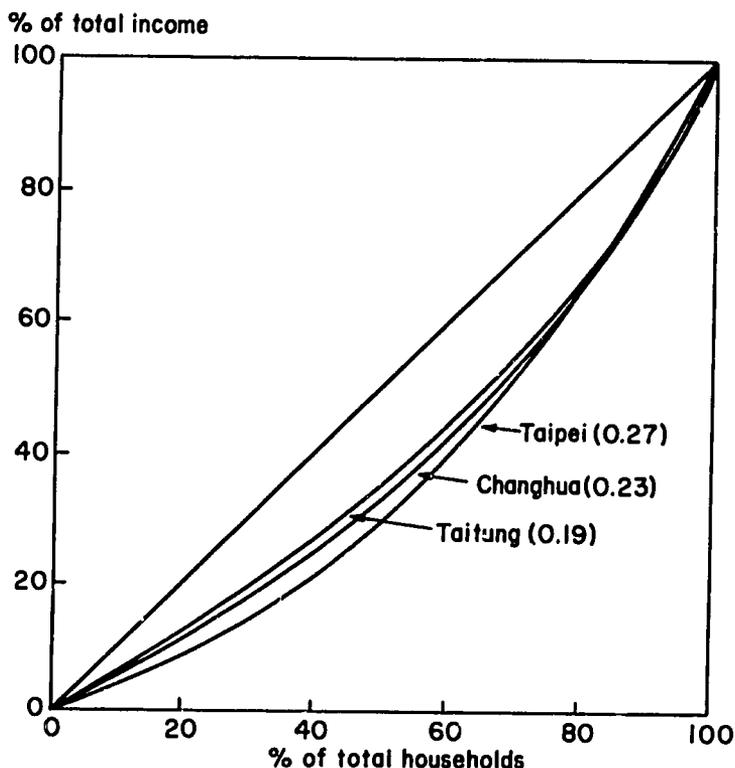


Fig. 2. Lorenz curves for income distribution in 3 cities, Taiwan (figures in parentheses represent the Gini coefficients), 1977; AVRDC, 1978.

We concluded that the larger the city the higher the average income. However, as city size increases, the distribution of income becomes more

^aBecause of these assumptions, there may be a bias toward equality in our sample.

Table 2. Income distribution in 5 cities of Taiwan, 1977; AVRDC, 1978.

City and income group ^a	% of households	% of city total income	Avg. household income/mo. (US\$)	Gini coefficient
Taipei			330	26.7
I	10.8	4.3		
II	24.3	13.6		
III	24.3	21.3		
IV	18.1	23.0		
V	22.6	37.8		
Kaohsiung			300	24.1
I	5.5	2.4		
II	32.1	19.4		
III	53.8	32.6		
IV	17.3	24.3		
V	11.4	21.0		
Changhua			262	23.3
I	8.8	4.4		
II	41.2	29.0		
III	33.8	37.5		
IV	10.3	16.6		
V	5.9	12.4		
Taichung			254	23.6
I	11.4	5.9		
II	43.9	32.0		
III	27.3	31.2		
IV	3.6	22.7		
V	3.8	8.3		
Taitung			213	19.2
I	19.2	11.9		
II	52.5	45.5		
III	22.5	30.6		
IV	5.0	9.9		
V	0.8	2.2		

^aHousehold income/mo. : I = less than US\$132, II = US\$132-237, III = US\$237-343, IV = US\$343-500, V = US\$500+.

skewed. Thus, we accepted hypothesis 1, that income is more evenly distributed in smaller than larger cities.

Percentage Food Expenditures

Because we lacked accurate estimates of household income, we could not compute Engel coefficients (the percentage of income spent on a given commodity). Instead, we measured the percentage of total food expenditures spent on food subgroups.

These percentages varied by income group and location (Table 3). As income increased, the percentage expenditure to fruit, fish, meat, and milk increased while that to total vegetables declined (except for a slight increase in income category V). Expenditures to wheat products and eggs showed a declining trend while those to rice rose and then fell. Thus, we accepted hypothesis 2, that, as income increases, the percentage of food expenditures to vegetables declines as those to meat, fish, fruit, and milk increase.

Within the broad category of vegetables, people consumed lower percentages of green, root, flower, and leguminous species as income increased. Leafy, fruit, and other vegetables increased in importance for income group V over income group IV.

Table 3. Food expenditure coefficients (% total food expenditure), 913 urban households, Taiwan, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
Vegetables:					
Leafy	7.7	7.0	6.5	6.0	6.4
Green	5.1	4.0	3.7	3.7	3.5
Root	4.5	4.1	4.1	3.9	3.8
Flower	5.8	4.8	4.9	3.7	3.5
Fruit	8.5	7.2	6.8	5.7	6.2
Legume	4.9	4.8	3.7	3.7	3.2
Other	6.8	4.7	3.6	3.6	4.6
Subtotal	43.2	36.6	33.9	30.2	31.1
Fruit	12.8	15.3	15.1	16.0	16.1
Fish	9.9	11.2	12.4	13.7	13.6
Meat	15.8	17.9	18.8	21.4	22.3
Milk	4.1	4.6	4.4	5.4	5.2
Egg	5.7	5.1	5.4	5.1	4.6
Rice	6.0	6.7	7.6	6.0	5.3
Wheat products	2.5	2.6	2.5	2.4	2.0

Real Food Expenditures

As income increased, consumers increased overall real food expenditures and those to fruit, fish, meat, and milk (Fig. 3). They spent less on vegetables in real terms except, as with percentage values, for group V consumers. We rejected hypothesis 3, that the amount spent on vegetables increases at a declining rate as income rises.

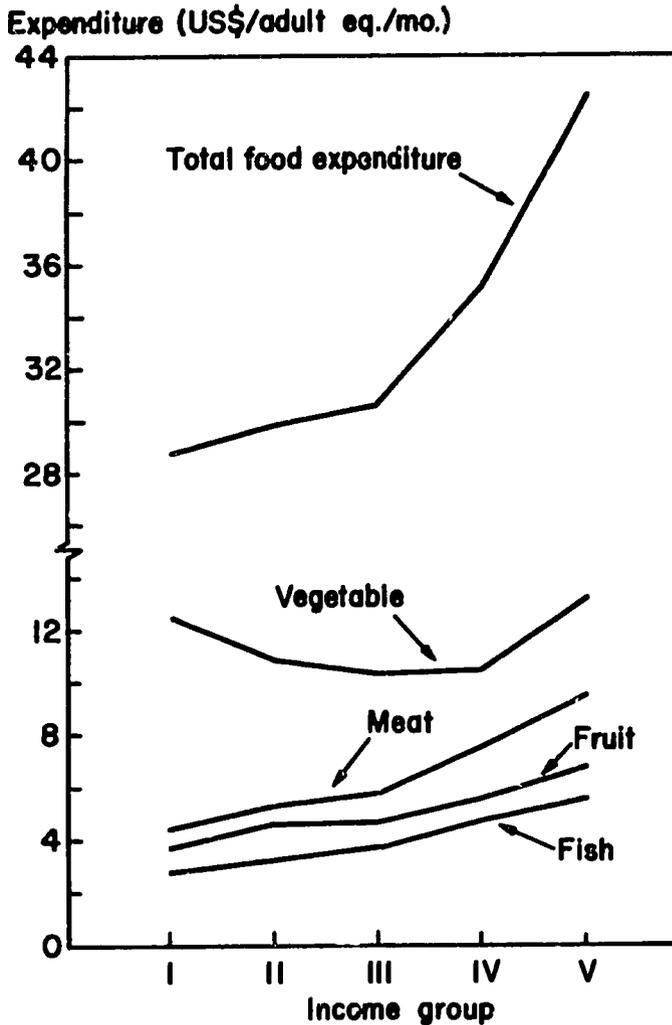


Fig. 3. Real food expenditure levels by income group, 913 households, Taiwan, 1977; AVRDC, 1978.

Within the category of vegetables, almost all types reflected the general declining pattern, and an upturn in group V (Table 4). Exceptions were leafy vegetables in Taipei, Kaohsiung, and Changhua; fruit vegetables in Changhua; and legumes in Taipei (Fig. 4). For these commodities, location influenced the consumption response to increased income.

Table 4. Actual food expenditures (US\$/adult equivalent/month), 913 urban households, Taiwan, 1977; AVRDC, 1978.

	I	II	III	IV	V
Vegetables:					
Leafy	2.24	2.09	2.01	2.10	2.74
Green	1.48	1.19	1.30	1.30	1.51
Root	1.33	1.21	1.24	1.35	1.58
Flower	1.66	1.46	1.50	1.32	1.45
Fruit	2.48	2.15	2.09	1.97	2.68
Legume	1.41	1.41	1.15	1.28	1.35
Other	1.92	1.40	1.09	1.24	1.97
Subtotal	12.52	10.92	10.39	10.55	13.27
Fruit	3.68	4.60	4.63	5.61	6.85
Fish	2.84	3.35	3.80	4.87	5.74
Meat	4.50	5.28	5.82	7.60	9.57
Milk	1.16	1.35	1.35	1.87	2.23
Egg	1.62	1.53	1.65	1.50	1.91
Rice	1.70	2.00	2.34	2.11	2.23
Wheat products	0.71	0.89	0.76	0.85	0.82
Total	28.71	29.77	30.74	35.22	42.61

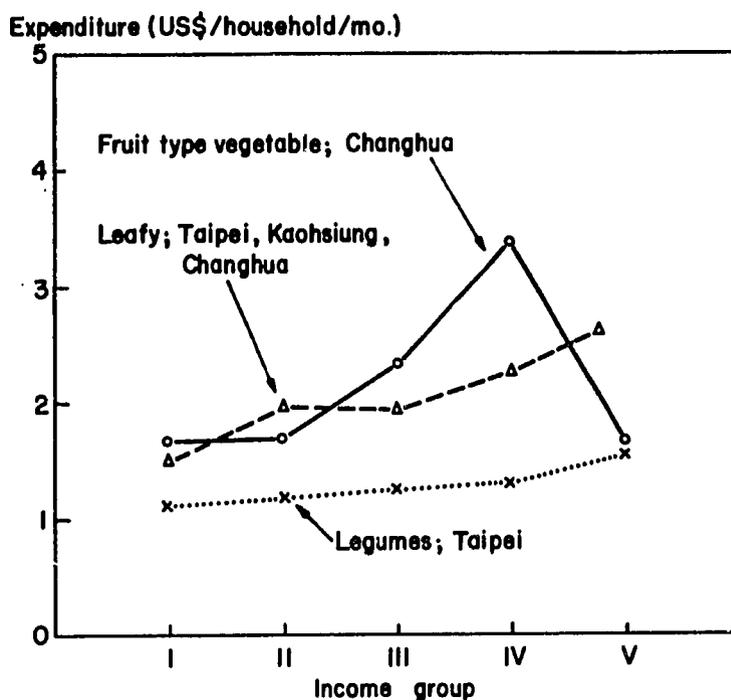


Fig. 4. Real expenditures on fruit and selected vegetable subcategories by income group and city, Taiwan, 1977; AVRDC, 1978.

Cross-sectional Variations in Expenditure Patterns

Table 5 shows for 24 city/income subpopulations the coefficients of variation of expenditures on various food groups:

1. Of the foods with lowest variation within a given subpopulation, fruit (9 subpopulations), meat (7), and fish (5) were most important. In other words, expenditures to these foods were the most equal for all members of many subpopulations throughout urban Taiwan. Fruit was particularly evenly consumed in group IV and in Taitung and Changhua; meat in group III and Taipei, Taichung, and Changhua; and fish in group IV and in Kaohsiung.

2. Of the foods with highest variation, "other vegetables" was listed in 19 of 24 subpopulations. Even more variable, however, was milk for the low income populations of Taipei and Taitung; wheat products in group II of Taitung; root crop vegetables for group IV of Taitung; and leguminous vegetables for the highest income group in Taichung.

3. Taitung had the most even consumption patterns of any city (eggs, wheat products, leafy and fruit vegetables, others), followed by Changhua (meat, fruit, root, green vegetables), Kaohsiung (fish, milk), Taichung (legumes, rice), and Taipei (flower vegetables). This order almost reverses that of income distribution. Thus, the more evenly distributed the income, the more even the consumption patterns from household to household. We rejected hypothesis 5, that food consumption patterns are similar from city to city.

Table 5. Coefficients of variation of food expenditures in 5 cities, 1977; AVRDC, 1978.

Subpopulation ^a	Vegetable							Fruit	Fish	Meat	Milk	Eggs	Rice	Wheat prod.	Total	
	Leafy	Green	Root	Flower	Fruit	Leg.	Others									
I	Taipei	0.84	1.05	1.15	0.63	0.91	0.79	1.05	1.09	0.73	0.72	2.13	0.71	0.96	1.16	0.42
	Kaohsiung	0.83	0.71	1.16	0.82	0.72	0.68	2.25	0.87	0.58	0.78	0.97	0.70	0.99	0.92	0.44
	Taichung	0.85	0.86	0.75	0.74	0.76	0.64	1.66	0.53	0.64	0.73	0.88	0.77	1.02	0.76	0.41
	Taitung	0.76	0.91	0.78	0.68	0.71	0.78	1.00	0.96	0.69	0.75	1.27	1.08	1.92	1.11	0.44
	Changhua	0.69	0.61	0.70	0.65	0.87	0.91	1.77	1.34	0.89	0.55	1.14	0.99	0.98	1.26	0.49
II	Taipei	0.90	0.76	0.84	0.97	0.72	0.93	1.66	0.76	0.82	0.77	1.33	0.64	0.81	1.12	0.38
	Kaohsiung	0.75	0.80	0.86	0.80	0.88	0.88	1.56	0.49	0.58	0.64	1.40	0.85	0.63	1.12	0.34
	Taichung	1.05	0.94	0.86	1.01	1.05	0.80	2.14	0.95	0.87	0.80	1.15	0.86	0.67	1.17	0.52
	Taitung	0.63	0.93	1.23	0.99	1.17	0.89	1.35	1.24	0.80	0.58	1.32	1.00	1.36	2.16	0.50
	Changhua	0.72	0.98	1.01	1.12	1.29	1.19	1.96	0.70	0.76	0.78	1.21	0.69	0.97	1.25	0.43
III	Taipei	0.77	0.72	0.84	1.18	0.80	0.85	1.38	0.61	0.73	0.54	0.97	0.65	0.78	1.08	0.34
	Kaohsiung	0.73	0.99	1.62	0.90	1.15	0.83	2.36	0.61	0.53	0.61	1.27	0.81	0.90	1.48	0.40
	Taichung	0.74	0.93	0.97	0.78	0.82	0.62	1.88	0.74	0.76	0.60	1.17	0.99	0.81	0.95	0.40
	Taitung	0.58	0.94	0.99	1.28	1.12	1.05	2.43	0.48	0.54	0.65	0.89	0.77	0.73	1.26	0.39
	Changhua	0.83	1.12	0.88	0.82	1.24	0.81	1.78	0.62	0.62	0.57	1.09	0.73	1.02	1.23	0.46
IV	Taipei	0.67	1.12	1.17	1.02	1.10	0.84	2.08	0.81	1.02	0.61	0.94	0.81	0.84	1.29	0.48
	Kaohsiung	0.89	1.24	1.13	1.35	1.17	1.09	2.10	0.61	0.61	0.55	1.84	0.68	0.73	2.59	0.41
	Taichung	0.92	0.94	0.81	1.12	0.91	0.93	2.54	0.74	0.67	0.69	0.78	0.75	0.84	0.80	0.29
	Taitung	1.19	1.53	1.61	0.93	0.82	0.90	1.43	0.38	0.75	0.47	0.80	0.52	0.80	0.51	0.27
	Changhua	0.69	0.85	1.06	1.02	1.08	0.76	2.04	0.43	0.70	1.11	1.08	0.72	1.06	0.86	0.58
V ^b	Taipei	1.03	1.12	1.03	1.15	1.25	0.84	1.69	0.80	0.72	0.76	1.07	0.75	1.04	1.62	0.46
	Kaohsiung	0.85	1.10	1.23	1.36	1.48	0.98	3.01	0.80	0.87	0.83	0.69	0.72	0.70	1.08	0.56
	Taichung	0.90	0.65	1.04	0.93	0.99	1.28	2.24	0.76	0.78	0.56	1.26	0.67	0.62	1.27	0.51
	Changhua	0.62	1.53	0.60	1.13	0.95	0.73	2.30	0.35	0.73	0.45	0.95	0.56	0.67	1.00	0.21

^aI-V represent income groups; ^bincome group V had only one observation in Taitung and, therefore, the coefficients of variation had no meaning.

4. The highest income class had the most even consumption patterns for the most foods (milk, meat, fruit, rice, and root vegetables), followed by group I (green vegetables, fruit vegetables, others, flower vegetables). After a high income is achieved, the consumption of high-priced animal protein products, fruit, and potatoes becomes widespread. Until medium income is achieved, people tend to subsist universally on vegetables.

Responses to Changes in Income

Because we lacked information on changes over time in purchasing patterns as income increased, we could not compute income elasticities of demand.^a Instead, we asked consumers to explain what their response would be if their income were to increase (Table 6). An overwhelming percentage of extra income would be spent on fruit consumption. From 30-40% of people surveyed said that they would buy more fruit while consuming equal levels of vegetables, and the percentage who would do so increased with income class. Between 3-5% would eat fewer vegetables and eat more fruit; understandably the percentage in this category declined as income category increased.

The second most important response to higher income was to increase meat consumption. Between 19-27% would maintain vegetable consumption and consume more meat and fish. The percentage who would do so increased by income class except for group V. Between 4-5% would reduce their vegetable consumption and consume more meat, but there was no significant difference across income classes.

The third response was to diversify vegetable consumption; in other words, to pay more for exotic or expensive vegetables without increasing the volume consumed. Between 14-19% would do so, but there was no trend with rising income class.

Between 8-14% of people surveyed in various income classes would buy larger quantities of vegetables in response to higher income. As with absolute and percentage expenditure patterns, the numbers who would do so declined as income category increased, except for an upswing in the highest income bracket. This trend suggests that high income families are aware of the nutritional benefits of consuming vegetables.

Finally, there is a discrepancy between what the consumers say they will do and what they actually do. Table 6 shows that no more than 10% in any income class would decrease their vegetable purchases as income increased. However, Fig. 3 shows decreased purchases to be the predominant actual pattern, except for group V.

Preferred and Actual Shopping Location

Table 7 shows that the most preferred location for food purchases in all income categories was retail markets, followed by supermarkets, shops and stores, and stalls. As income category increased, there was

^aIncome elasticity of demand is defined as the percentage change in the expenditure on a commodity given a 1% change in income.

Table 6. How consumers regard the effects of increased income on their food purchases, 913 households, Taiwan, 1977; AVRDC, 1978.

Income group	Increase vegetable quantity	Increase vegetable diversity	Maintain vegetables; increase meat, fish	Maintain vegetables; increase fruit	Decrease vegetables; increase meat, fish	Decrease vegetables; increase fruit	Increase picked, canned food	Increase frozen food
	-----%							
I	14.2	18.0	19.1	30.1	4.9	4.9	6.0	2.7
II	12.4	19.1	19.8	31.9	4.2	5.3	3.7	3.6
III	11.5	16.2	21.1	37.3	4.3	4.5	2.8	2.4
IV	7.5	16.3	26.8	39.7	3.8	4.2	1.3	0.4
V	12.2	14.4	23.2	40.3	4.4	2.8	1.1	1.6

a movement away from supermarkets, except for income class V. This pattern reflects absolute and percentage purchasing patterns for vegetables and suggests that vegetables may be an exceptionally important purchase at supermarkets. Stalls were most preferred by middle class buyers because of convenience.

Where did consumers actually make their purchases? Retail markets were again most common in each category. However, they were followed by stalls, in all but category I, shops and stores in the lowest three income categories, and supermarkets in the upper two. People did not use supermarkets as much as they might like, however consumers in the top two income categories frequented them most often. Although everyone said that they preferred shops and stores to stalls, they tended to visit stalls more frequently.

Table 7. Preferred and actual marketing location by income group, 913 urban households, Taiwan, 1977; AVRDC, 1978.

Income group	Desired purchase source				%	Actual purchase source			
	Retail market	Super-market	Store	Stall		Retail market	Super-market	Store	Stall
I	57.1	32.9	5.7	4.3		65.4	9.5	12.8	12.2
II	50.8	32.0	7.4	9.8		62.6	9.8	11.4	15.3
III	59.8	23.6	5.1	11.4		59.1	9.6	11.3	20.0
IV	69.1	20.6	4.0	6.3		56.8	12.9	11.5	18.8
V	58.5	31.9	6.4	3.2		58.2	15.3	10.1	16.4

Refrigerator Ownership and Location of Meals

Between 98.5-100% of families surveyed owned refrigerators, except for those with the lowest income, who had an 80% ownership rate (Table 8). We would expect that the poorest families would eat more outside the home than those in the middle class and in simpler establishments; while people in the highest income classes would eat out for pleasure at better restaurants. The data support this pattern.

The percentage of meals eaten at home declined with income group, except for low income households. Because of lower ownership rates of refrigerators, the latter group also took lunch boxes to work less often.

Consumption Patterns for Selected Commodities

AVRDC is working to understand how improvements in production and marketing can lead to greater availability of Chinese cabbage, tomato, mungbean, soybean, and sweet potato. To understand current buying patterns and attitudes toward these crops, we asked questions regarding the most commonly consumed form of each crop. We also asked about common cabbage.

Table 8. Refrigerator ownership and meal location patterns by income group, 913 urban households, Taiwan, 1977; AVRDC, 1978.

Income group	Refrigerators	Meals consumed		
		Outside	Home	Brought from home
		%		
I	79.8	9.5	80.8	9.7
II	98.9	5.9	83.0	11.1
III	98.9	7.0	81.3	11.7
IV	98.5	8.3	79.9	11.8
V	100.0	9.7	78.6	11.7

Chinese cabbage. Table 9 shows the responses for the five income groups in the consumer sample to questions regarding consumption patterns, attitudes, and the effects of changes in price or income.

Table 9. Consumption patterns and attitudes for Chinese cabbage, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	%				
<u>Consumption pattern</u>					
Never	10.8	4.4	3.5	3.9	0.9
Occasionally	49.5	48.9	45.5	53.9	41.5
Frequently	39.8	46.7	51.0	42.2	57.6
<u>Consume more if</u>					
Lower price	35.8	38.7	40.3	37.4	33.6
Higher income	32.6	32.8	27.0	20.6	19.6
<u>Reason for current consumption</u>					
Low price	48.9	46.2	49.8	44.3	44.9
Good appearance	87.5	86.1	88.0	89.2	87.5
Good taste	89.8	87.9	92.3	91.3	89.1
High nutrition	93.3	88.2	89.5	87.9	86.7
<u>Rank of importance</u>					
Price	19.8	22.7	22.1	21.1	21.6
Appearance	19.8	18.8	19.1	19.7	19.4
Taste	27.2	26.6	27.8	26.3	28.2
Nutrition	33.2	31.9	31.0	32.9	30.8

As income increased, the percentage of households who never consumed Chinese cabbage declined, and those who frequently consumed it increased. Still, as income class rose, a smaller and smaller percentage of consumers would respond to increases in income by buying more Chinese cabbage.

Most people in all classes consumed Chinese cabbage because of taste, appearance, and they believed, high nutrition. In fact, the commodity contains only intermediate amounts of vitamin C, and low amounts of vitamin A and minerals (Table 10). Consumers in the higher income classes were more aware of this and reported nutrition as a motivation less frequently.

Table 10. Comparative nutrient contents per 100-gm portions of selected foods; AVRDC, 1978.

Nutrient	Chinese cabbage ^a	Common cabbage ^a	Tomato ^a	Mungbean sprouts ^b	Soybean milk ^c	Sweet potato ^a
Calories	11	15	14	15	42	77
Protein (gm)	0.7	1.3	1.1	1.8	3.6	0.7
Calcium (mg)	16.0	34.0	4.0	11.0	15.0	11.0
Iron (mg)	1.3	4.3	1.6	0.5	1.2	1.8
Vit. A (I.U.)	105.0	134.0	617.0	Tr.	n.a.	21,130.0
Thiamine (mg)	0.04	0.01	0.04	0.08	0.03	0.03
Riboflavin (mg)	0.03	Tr.	0.03	0.10	0.02	0.07
Niacin (mg)	0.22	0.35	0.53	0.10	0.50	1.24
Vit. C (mg)	18.0	22.0	15.0	19.0	n.a.	31.0

^aRef. 2; ^b5; and ^c4.

Common cabbage. This commodity was popular with all income groups, but group III consumed it most frequently (Table 11). As with Chinese cabbage, there was no difference in response to lower price by income group, and extra income led to higher consumption less frequently as income rose. The main reasons given for present consumption were good appearance, taste, and nutrition.

Mungbean sprouts. The lowest income households consumed beansprouts considerably less often than other consumers (Table 12). They would also respond most to a drop in the price of this commodity or a rise in their incomes. They found the price low with least frequency and the appearance unappealing. The most important criterion for all groups was nutrition, followed by taste and appearance.

Table 11. Consumption patterns and attitudes for common cabbage, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
<u>Consumption pattern</u>					
Never	3.2	1.9	0.4	0.9	5.7
Occasionally	55.3	36.9	28.9	34.4	37.7
Frequently	41.5	61.3	70.7	64.8	56.6
<u>Consume more if</u>					
Lower price	40.1	45.2	44.1	44.3	44.9
Higher income	33.7	34.7	26.2	21.4	19.6
<u>Reason for current consumption</u>					
Low price	58.4	48.4	55.3	51.6	47.0
Good appearance	95.5	92.8	93.4	93.4	87.9
Good taste	97.8	94.4	92.7	94.5	96.0
High nutrition	97.8	96.7	93.9	94.5	96.1
<u>Rank of importance</u>					
Price	20.4	21.9	22.9	20.5	19.3
Appearance	15.3	17.8	17.1	17.0	18.9
Taste	26.8	26.0	26.7	27.2	27.8
Nutrition	37.5	34.3	33.3	35.2	34.0

Table 12. Consumption patterns and attitudes for mungbean sprouts, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
<u>Consumption pattern</u>					
Never	19.1	9.4	8.7	7.0	9.7
Occasionally	46.1	46.4	46.4	52.7	44.7
Frequently	34.8	44.2	44.8	40.3	45.9
<u>Consume more if</u>					
Lower price	37.9	36.2	32.3	29.0	33.6
Higher income	31.6	30.0	23.2	21.4	23.4
<u>Reason for current consumption</u>					
Low price	65.1	71.8	76.7	72.5	81.0
Good appearance	72.3	83.1	80.2	80.2	83.9
Good taste	85.4	86.0	83.6	84.2	87.4
High nutrition	83.7	87.0	81.2	85.6	85.1
<u>Rank of importance</u>					
Price	18.5	20.6	20.8	19.6	21.4
Appearance	23.2	22.3	22.4	20.9	20.7
Taste	26.5	26.4	26.0	27.6	27.9
Nutrition	31.8	30.6	30.8	31.9	30.0

Soybean milk. The lowest income group consumed soybean milk less frequently than other groups (Table 13). Income, rather than price, was the major reason. Except for income class V, as income class increased greater numbers would consume more soy milk in response to extra income. Interestingly, those with lower income valued soy milk for its nutritional content more than others, but did not have the income to purchase it regularly. The major factors determining consumption frequency were nutrition, taste, and appearance.

Is animal milk replacing soy milk? The latter is a traditional part of the diet in Taiwan; the former used to be fed only to infants. Table 14 shows that both soy and animal milk are popular. The consumption of animal milk, especially in powdered over condensed form, increased with income class as the number of people who replaced it in their diets declined. Except for the lowest income class, there was a trend to replace soy milk in the diet but not animal milk. We accepted hypothesis 6, that soy milk consumption is decreasing while cow's milk is increasing. But there is little evidence of direct substitution of soy by animal milk.

Greater than average quantities of animal milk were consumed in all income classes in Kaohsiung and Changhua, while less than average was consumed in the more remote Taitung. The greatest number of Taichung consumers in all classes replaced soy milk with other foods.

Table 13. Consumption patterns and attitudes for soybean milk, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
<u>Consumption pattern</u>					
Never	14.1	7.6	5.9	7.0	4.8
Occasionally	48.9	46.0	48.8	46.5	58.1
Frequently	37.0	46.4	45.3	46.5	37.1
<u>Consume more if</u>					
Lower price	34.7	36.2	30.0	34.4	33.6
Higher income	31.6	29.7	25.1	24.4	32.7
<u>Reason for current consumption</u>					
Low price	75.3	76.1	81.8	81.5	77.0
Good appearance	88.0	87.0	88.8	84.2	93.6
Good taste	87.2	94.0	90.6	89.2	93.0
High nutrition	95.4	94.2	93.9	91.1	92.3
<u>Rank of importance</u>					
Price	16.9	19.5	17.2	16.6	17.4
Appearance	22.2	21.3	18.0	19.1	20.8
Taste	32.7	27.2	35.8	29.3	28.8
Nutrition	28.2	32.0	29.0	35.0	33.0

Table 14. Soybean milk food use and substitutes, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
<u>Consume</u>					
Soy milk	87.1	87.8	87.0	92.4	91.4
Animal milk	89.3	90.4	93.9	96.2	94.2
<u>Have replaced</u>					
Soy milk	40.7	45.3	42.6	44.1	50.0
Animal milk	56.7	63.9	68.4	74.0	75.5
<u>Preferred form</u>					
Condensed	13.3	14.0	12.3	10.3	6.0
Powdered	25.5	20.7	24.2	29.4	20.0
Bottled	37.8	38.9	39.2	43.7	54.0
None	23.5	26.4	24.2	16.7	20.0

Table 15. Consumption patterns and attitudes for fresh tomato, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
<u>Consumption pattern</u>					
Never	18.9	9.7	9.7	5.5	1.9
Occasionally	46.7	42.0	40.9	43.3	38.8
Frequently	34.4	48.3	49.4	51.2	59.2
<u>Consume more if</u>					
Lower price	40.0	47.4	46.4	52.7	48.6
Higher income	34.7	44.9	35.7	35.9	31.8
<u>Reason for current consumption</u>					
Low price	51.8	53.2	56.4	44.8	53.5
Good appearance	86.9	90.3	89.5	86.3	93.9
Good taste	89.2	89.7	92.7	91.7	94.0
High nutrition	90.6	94.7	94.5	94.4	96.9
<u>Rank of importance</u>					
Price	17.2	19.0	20.4	19.5	18.8
Appearance	21.8	22.6	20.9	18.8	21.0
Taste	28.0	26.1	26.7	27.3	27.6
Nutrition	33.1	32.3	32.0	34.4	32.6

Fresh-market tomato^a. The frequency of tomato consumption positively related to income class (Table 15). However, the response to improvements in price and income showed no trend by income group: 40-53% of all consumers would buy more tomatoes if price fell, and 32-45% would buy more if their incomes rose. The major factors were nutritional content, taste, and appearance. As income class rose, more people consumed tomato for taste and nutrition.

Questions regarding food use and ideal tomato type showed significant differences not by income class, but by city (Table 16). Taipei residents used tomato as a vegetable most often, while those in Changhua used it most often as a fruit. Taipei consumers also preferred red color while more people in Kaohsiung favored green fruit. Most residents of Taichung favored fist-sized fruit, reflecting the overall preference of the sample, but people in Kaohsiung preferred fruit the size of eggs.

^aProcessed tomato is consumed in many forms in Taiwan. This study limited its scope to a survey of consumer preferences for fresh tomato only.

Table 16. Tomato food use and ideal types, by city, 913 households, 1977; AVRDC, 1978.

	Taipei	Kaohsiung	Taichung	Taitung	Changhua
	----- % -----				
<u>Food use</u>					
Vegetable	52.4	31.8	33.6	40.6	28.5
Fruit	47.7	68.2	66.4	59.4	71.5
<u>Color</u>					
Green	28.3	35.5	25.9	28.1	36.5
Red	71.7	64.5	74.1	71.9	63.5
<u>Season consumed</u>					
Spring	7.5	14.2	7.0	48.5	10.7
Summer	37.2	22.8	29.5	25.0	28.2
Fall	5.7	8.6	7.8	8.8	6.1
Winter	16.0	36.5	49.6	12.8	29.0
All year	33.7	18.0	6.2	4.9	26.0
<u>Ideal size</u>					
Egg	40.0	51.0	26.9	33.6	48.2
Fist	60.0	49.0	73.1	66.4	51.9

Tomato in Taiwan is least available and most expensive in the summer. Taipei residents consumed unusually high quantities in this season, reflecting their higher income. Taipei residents consuming only in the fall and winter were less than average for the sample. Kaohsiung consumers bought particularly low quantities in the summer.

Sweet potato. In contrast to Chinese cabbage and tomato, sweet potato consumption was negatively correlated with income class (Table 17). We accepted hypothesis 7, that sweet potato is consumed most by low income people and fresh market tomato, especially in the summer, by high income people.

Only in the very highest class did people begin to consume sweet potato more frequently, not as an inexpensive staple but as a novel snack. In lower income classes, more consumers would respond to lower price and extra income. In higher classes, more people ranked taste in sweet potato important and fewer concerned themselves with appearance. As with other commodities, price was the least important decision factor in consumption patterns, but people in the lowest income classes were most sensitive to it. Thus, marketing improvements to lower sweet potato price would benefit poorer consumers most.

The consumption of sweet potato in Taiwan is dropping rapidly (1). To assess why, we asked consumers how they currently used sweet potato in their diets and their views on sweet potato prices (Table 18). Consumption ranged from 2.40 kg/month for the lowest two income groups to

Table 17. Consumption patterns and attitudes for sweet potato, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
	----- % -----				
<u>Consumption pattern</u>					
Never	9.9	10.5	11.9	17.7	16.1
Occasionally	61.5	63.2	67.2	63.8	65.1
Frequently	28.6	26.3	20.9	18.5	18.9
<u>Consume more if</u>					
Lower price	43.2	35.0	30.4	26.7	23.8
Higher income	30.5	29.7	23.9	15.3	14.3
<u>Reason for current consumption</u>					
Low price	32.5	29.0	30.7	25.9	24.7
Good appearance	65.9	64.4	63.1	64.5	78.2
Good taste	90.4	88.2	90.3	90.4	89.3
High nutrition	89.5	86.0	87.0	82.5	87.6
<u>Rank of importance</u>					
Price	19.7	19.0	20.4	18.6	17.4
Appearance	23.2	21.8	20.6	19.9	21.0
Taste	26.0	27.7	27.6	28.9	30.2
Nutrition	31.1	31.5	31.4	32.7	31.4

Table 18. Sweet potato food use and price response, 913 households, 1977; AVRDC, 1978.

	I	II	III	IV	V
<u>Consumption</u>					
kg/month	2.39	2.40	2.09	1.85	1.48
Staple (%)	27.6	19.5	17.7	9.0	14.6
Side dish (%)	33.7	26.4	28.9	27.9	26.2
Snack (%)	38.8	54.1	53.5	63.1	59.2
<u>Price</u>					
Too high (%)	24.2	23.5	23.4	27.6	13.6
Cheap (%)	13.2	20.4	22.1	28.6	44.4
Just right (%)	41.8	29.4	33.8	21.9	14.8
Don't know (%)	20.9	26.7	20.8	21.9	14.8
<u>Amount consumed at ideal price (kg/month)</u>	3.41	3.67	3.76	3.23	3.26

1.48 kg/month in the highest income group. The percentage of consumers who used sweet potato as a staple declined steadily as income rose, except for the highest income group. Consumers who believed the crop to be inexpensive also increased with income group. The highest number of consumers who felt price just right were in group I.

There was no clear pattern by income group on the ideal price that sweet potato should have or the amount that people would consume at that price. The highest ideal price was cited by the people in the lowest income group, only slightly below the actual price of US\$0.13/kg. Consumers in group III reported that they would consume the greatest amount of sweet potato at ideal prices; however, consumers in all groups would consume significantly more. These answers probably overstate the response to price changes.

People in Taipei in all income classes used sweet potato less than average as a staple food and those in Taichung more than average as a snack. Taitung had more than average numbers who thought sweet potato too expensive: they suggested the lowest ideal price. Consumers in Kaohsiung had greater than average percentages in each category who could not evaluate the current price of sweet potatoes. They also would consume lower than average amounts in all income categories at ideal prices.

Comparative Consumption Patterns and Attitudes

Table 19 shows the weighted responses over 5 income groups and cities to questions regarding the 6 selected commodities. Commodities are listed in rough order of descending consumer preference. Common cabbage was the most prevalent of the six commodities in current consumption patterns and sweet potato the least. Not surprisingly, the lowest number of people would consume more sweet potato if the price fell or incomes rose. We would not expect large consumer benefits from investing government resources in improving the efficiency of sweet potato marketing so as to lower price. However, such benefits would go in large part to low income consumers. The reverse is true for tomato and common cabbage, for which the largest number would increase their purchases if price dropped. Fresh market tomato also showed the highest consumer response to increased income.

What were the reasons for these consumption patterns? Price was most important in soy milk (where low levels encourage people to purchase it) and in Chinese cabbage (where high prices make over 50% consume less). Good appearance was most important in common cabbage, and bad appearance in sweet potato. Taste and nutrition were important in encouraging consumers to buy common cabbage. However, they felt that mungbean sprouts had the least attractive taste and the lowest nutritional value of the six commodities. In fact, mungbean is high in protein, vitamin C, thiamine, and riboflavin (Table 10).

For all commodities nutrition was the most important determinant of consumption practices, followed by taste, appearance, and price, in that order. In Chinese cabbage, common cabbage, and mungbean sprouts, the order of the last two factors was reversed. Thus, programs to encourage the greater consumption of vegetables in Taiwan should not rely simply

on the stimulus of lower prices. An appeal must also be made to nutritional quality, flavor, and the quality and appearance of the produce. In certain cases, such as mungbean sprouts, consumer education of nutritional benefits could also help.

Table 19. Comparative consumption patterns and attitudes for selected commodities, 913 households, Taiwan, 1977; AVRDC, 1978.

	Chinese cabbage	Common cabbage	Fresh tomato	Mungbean sprouts	Soymilk	Sweet potato
	----- % -----					
<u>Consumption pattern</u>						
Never	4.3	1.9	9.2	9.9	7.4	12.5
Occasionally	47.8	36.3	42.0	47.1	48.6	64.5
Frequently	47.9	62.0	48.9	43.1	44.1	23.0
<u>Consume more if</u>						
Lower price	38.1	44.4	47.3	34.0	33.8	32.1
Higher income	27.8	28.6	38.5	26.3	28.2	24.3
<u>Reason for current consumption</u>						
Low price	47.1	51.6	52.7	73.6	78.5	71.1
Good appearance	87.5	92.9	89.7	80.9	88.1	65.9
Good taste	90.1	94.6	91.4	85.2	91.6	89.6
High nutrition	89.0	95.7	94.5	20.4	93.7	86.4
<u>Rank of importance</u>						
Price	21.9	21.6	19.3	22.4	17.9	19.2
Appearance	19.2	17.4	21.3	22.1	20.1	21.3
Taste	27.2	26.7	26.8	26.7	30.7	28.0
Nutrition	31.8	34.5	32.7	30.9	31.3	31.6

Summary and Conclusions

In October 1977, AVRDC conducted a survey of 1000 consumer households in Taipei, Kaohsiung, Taichung, Taitung, and Changhua cities. The respondents were students in primary and lower-middle schools selected at random in each city.

The data showed that most households fell into the lower-middle and middle income categories. Income was higher but more unevenly distributed in larger cities. As income increased, the percentage of food expenditures to vegetables declined as those to meat, fish, fruit, and milk increased. Differences, however, were noted by subcategory of vegetables.

Real expenditures to vegetables also declined as income class rose, except for the highest class. There were great differences by city in consumption patterns. As high income is achieved the consumption of animal protein, fruit, and potatoes becomes widespread; until medium income is reached, people universally consume large quantities of vegetables.

In the event of increases in income, people would increase their consumption of fruit and meat, and diversify vegetable types consumed.

Most consumers preferred to and did shop in retail markets. However, many without access to them would like to shop in supermarkets. The ownership of refrigerators was universal except for the lowest income group.

Soy milk was decreasing in importance in the Chinese diet while cow's milk was increasing. Sweet potato was consumed most by low income people while fresh market tomato was bought most often by those with high income, especially in summer.

Relatively small consumer benefits would result from government improvements in the efficiency of sweet potato marketing, but such benefits would go to low income consumers. The opposite is true for tomato and common cabbage. Nutrition, taste, and appearance were more important in determining consumption levels than price. Therefore, a program to increase vegetable consumption should include all four components, particularly nutrition education.

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