

# VARIABILITY STUDIES OF DATA FROM HOUSEHOLD FOOD CONSUMPTION SURVEYS: I. RICE AND OTHER CEREALS

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Food is one of the most important, if not the most important, component of the level of living. Indicators of this component are usually derived from the results of household food consumption surveys (HFCS) and/or from data accumulated from Food Balance Sheets (FBS). In the developing economies, these components of the level of living can be used as statistical frame work in the circular process of planning and development (1, 1964).

Data from the HFCS will show the status and pattern of the indicators of the food component as actually consumed by household in term of smaller areas such as the province or the region. On the other hand, results of the FBS generally provide indications of this component by the disappearance method at the national level only. The implementation of HFCS is beset with many statistical and technical difficulties. Some of the important questions that need to be answered are as follows:

1. The weighing method which is generally used is extremely difficult to implement in the field as compared to the recall or interview method. Are there differences between these two methods?

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2. HFCS are usually conducted for a period of seven days—Monday through Sunday. Can one or two days be enough to represent the week days, Monday through Friday? If so, considerable savings in time and labor can be realized. Are there differences between week-days and week-end days?
3. How can the precision of estimates be improved? Can ratio estimators be utilized to improve the precision of estimate?

Attempts will be made to answer these questions with the use of data on rice and the other cereals from the Food and Nutrition Research Center (FNRC) survey. The results for the other food groups and nutrients will be discussed in a separate paper.

### **FNRC Survey**

Since 1957, eight out of the ten regions of the country have been surveyed. The FNRC, National Institute of Science and Technology (NIST), National Science Development Board (NSDB) conducted HFCS in the following regions: Bicol (1957) Central Luzon (1957), Metropolitan Manila (1958 and 1959), Ilocos-Mt. Province (1960), Cagayan Valley-Batanes (1961), Southern Tagalog (1962) Western Visayas (1964), and Eastern Visayas (1965).

In these surveys, the weighing method was used and the survey period was for 3 days — Tuesday, Wednesday, and Thursday, except in the re-survey of Metropolitan Manila where the 3—day was compared with the 5—day approach, Monday to Friday. Another important feature of these surveys is that the FNRC sample is a sub-sample of the Philippine Statistical Survey of Households (PSSH). The developments of the PSSH are described in some detail by the senior author (2, 1960; 3, 1965).

Examples of the FNRC and the PSSH sample are given in Table 1 for a survey of selected strata in Metropolitan Manila in 1958 and in Western Visayas in 1964. Note that in Metropolitan Manila, the FNRC sample range from 67 to 100 percent of the PSSH sample whereas for Western Visayas the range was from 50 to 80 percent. These variations in sub-samples must be considered in the estimation procedure for each of the regions. Since the range is wide, there may be a need to adjust each independent estimate separately.<sup>a</sup>

It is sufficient to stress that the precision and standard of quality of the FNRC survey rest heavily on the development and improvement of the basic PSSH design. With the new design, it is now possible to obtain estimates of the social and economics characteristics at the provincial level.

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<sup>a</sup> Preliminary results show that if these ratios are considered in the estimation procedure, then the estimate obtained will be 96 to 102 percent of the standard estimate.

**TABLE 1**  
**THE PSSH AS SAMPLING FRAME FOR THE FNRC IN**  
**SELECTED STRATA. METROPOLITAN MANILA 1958 AND**  
**AND WESTERN VISAYAS, 1964.<sup>a</sup>**

Region	Stratum number	Ordered sample	Sample area	Number of sample household				
				PSSH	FNRC	FNRC as percent of PSSH		
Manila Metropolitan 1958	1	1	First district	3	2	67		
				7	5	71		
				7	5	71		
				5	4	80		
				3	2	67		
	2	1	First district	5	4	80		
				3	2	67		
				1	1	100		
				3	2	67		
				2	2	100		
	3	1	First district	4	4	75		
				2	2	100		
				7	5	71		
				2	2	100		
				3	5	71		
Western Visayas 1964	16	1	Dauin: Poblacion	7	5	71		
			Malungcay Dacu	14	11	79		
			Maayong Tubig	17	13	76		
			Jimalalud: Poblacion	7	5	71		
			Bangcal	10	8	80		
	2		Owacan	8	6	75		
			San Agustin: Poblacion	4	3	75		
			Binonga	9	6	67		
			Cagbunaya-Cabulutan	13	10	77		
			17	2	Anilao: Poblacion	4	3	75
	4		San Juan Crisostomo	6	4	67		
			Pantalan-Sta. Rita	10	8	80		
			Passi: Poblacion	5	4	80		
			Im. Pequeno-Camiri	12	8	67		
			Agdahon	13	9	69		
	5		Buenevista: Poblacion	2	1	50		
			Getulio	29	22	76		
			Mabini-Sambaag-Taminla	16	12	75		
			18	2	Ayungon: Poblacion	5	4	80
					Gomentoc	14	10	71
	Atabay	8			6	75		
4	Bago: Poblacion	Sampinit-Sibud			3	2	67	
		Taloc			21	16	76	
		15	11	73				
5	Murcia: Poblacion	Cancilayan	6	4	67			
		7	5	71				
		Buena Vista	12	9	75			

<sup>a</sup> Source of data: Household Food Consumption Surveys conducted by the Food and Nutrition Research Center, NIST, NSDB and the PSSH, 1958 and 1964.

## Per Capital Consumption of Rice by Region

Rice is defined as polished rice and other rice preparations such as biko, suman, puto, bihon, kalamay and kutsinta whereas other cereals include ground corn, bakery products and other preparations such as miki and miswa.

The standard estimation procedure was utilized to indicate the consumption of rice per capita for eight regions in the Philippines. A summary of the results of these surveys for rice is shown in Table 2. The coefficient of variation of these estimates is about one percent or less.

The differences between regional per capita consumption of rice are marked. Eastern Visayas is a corn producing region and the people consume only about 150 grams/capita/day of rice whereas residents from Central Luzon consume about 425 grams/capita/day. In the two survey of 1958 and 1959, Metropolitan Manila showed a consistent per capita consumption of 240 grams of rice a day, while the rest of the cereal intake was in the form of bakery products made from wheat flour amounting to 52 to 58 grams per capita per day. For the last six years, the National Economic Council has been using a national estimate of 217 grams per capita per day. The calculation to arrive at this per capita estimate is given in Table 3. This national estimate appears to be very low if compared with the regional consumption estimates in Table 2.

**TABLE 2**  
**ESTIMATED RICE CONSUMPTION IN EIGHT REGIONS.**  
**PHILIPPINES.<sup>a</sup>**

R e g i o n	Date of Survey	Number of sample households	Consumption kg/cap/year : gr/cap/day	Total members in sample households	
Bicol	Mar. 1957	88	142.3	389.8	559
Central Luzon	Mar. 1957	101	154.8	424.2	594
Metropolitan Manila	Feb. -May 1958	402	87.7	240.4	2,967
Ilocos — Mt. Province	Apr. - June 1960	274	143.0	391.8	1,614
Cagayan Valley-Batanes	Apr - June 1961	293	97.6	267.5	1,814
Southern Tagalog	Jan. -Apr. 1962	368	112.6	308.5	2,502
Western Visayas	Feb. -May 1964	513	87.6	240.0	3,487
Eastern Visayas	Apr. - June 1965	306	54.7	149.9	1,952

a Source: Nutrition Survey in the different regions of the Philippines. Food and Nutrition Research Center, Manila

**TABLE 3**

**DERIVATION OF CONSUMPTION OF RICE IN GRAMS/CAPITA/YEAR. PHILIPPINES. MODEL 1960**

Category	Rice Eating Population		Whole country 1960 (million kg.)
	Number (million)	kg/capita/year	
Male	7.845	128.744	1,009.932
Female	7.779	117.800	916,930
Child below 10 years	7.998	63.728	509.697
Total	23.623	103.143	2,436.559
		(or 282.58 gr/ca/day)	
Philippines	30.756	(Total pop.) 79.222	kg/cap/day or 217.05 gr/cap/day

**Prediction of Total Rice Consumption For 1966.**

We may assume that these consumption patterns for rice are maintained for the first eight regions. For regions IX and X HFCS have been conducted; three approaches were made namely: (a) Regression of per capita production on per capita consumption, (b) Region VIII (Eastern Visayas) as base with 149.9 gr./cap/day, and (c) the use of per capita production as equivalent to per capita consumption. These three approaches will give national per capita consumption in 1966 of 293, 265, and 274 grams, respectively. A minimum consumption of 265 grams is considerably higher than the 217 grams used by the NEC. For the nation as a whole, these two estimates will differ by about 580,000 metric tons of rice in 1966. The results are given in Table 4.

TABLE 4

## TOTAL RICE CONSUMPTION FOR 1966 BY REGION.\*

R e g i o n	Rice consumption (metric tons)		
PHILIPPINES	3,527,771	3,194,871	3,285,987
(Difference with 217 gr. as base)	(913,916)	(580,389)	(682,724)
I. Mertopolitan Manila	265,365	265,365	265,365
II. Ilocos and Mt. Province	255,313	255,313	255,313
III. Cagayan Valley and Batanes	120,453	120,453	120,453
IV. Central Luzon	726,956	726,956	726,956
V. Southern Tagalog and Islands	501,506	501,506	501,506
VI. Bicol and Masbate	390,249	390,249	390,249
VII. Western Visayas	279,920	297,920	297,920
VIII. Eastern Visayas	297,984	297,984	297,984
IX. Northern Mindanao	251,024 <sup>a</sup>	129,783 <sup>b</sup>	136,189 <sup>c</sup>
X. Southern Mindanao	421,401 <sup>a</sup>	209,742 <sup>b</sup>	304,452 <sup>c</sup>
National average:			
kg./cap./year	106.9	96.8	99.9
(gr./cap./day)	(292.9)	(265.2)	(273.7)

\* Low series population projection as of July 1, 1966. Percentage allocation by region from the results of the PSSH May 1965 survey.

<sup>a</sup> Regression estimate of per capita production on per capita consumption for seven regions. Results for Regions IX and X were interpolated from the linear graph.

<sup>b</sup> Consumption in Regions IX and X is assumed to equal the lowest consumption in Regions VIII (Eastern Visayas) which is 149.9 gr./cap./day.

<sup>c</sup> Per capita production as equivalent to per capita consumption.



## Effects and Variations of Days and Methods

Using the weighing method, the FNRC conducted dietary surveys in Metropolitan Manila during the dry season of 1958 and again during the rainy season of 1959.

Statistical tests were conducted to find differences between daily per capita consumption of different food groups as obtained for 3-day intakes (Tues. to Thurs.) and for 5-day intakes (Mon. to Fri.) in 1959. Results showed that per capita consumption of rice and other cereals was the same for the 3-day as in the 5-day survey. It also was inferred that per capita rice consumption in the dry season of 1958 was the same as in the rainy season of 1959. The average difference of 1.7 grams/capita/day in the 1958 and 1959 3-day surveys given in Table 5 for Metropolitan Manila may be attributed to purely random fluctuation. Except for the seasonal fruits and vegetables, intakes of almost all the food groups showed small differences in these two surveys.

TABLE 5

### COMPARISON OF DAY PER CAPITA RICE AND CEREAL INTAKE IN GRAMS BETWEEN 3-DAY DIETARY SURVEY IN 1958, 3-DAY AND 5-DAY DIETARIES IN 1959 OF METROPOLITAN MANILA.<sup>a</sup>

FOOD GROUP	Dry Season, 1958	Rainy Season, 1959	
	3-Day Intake Tues. to Thurs.	3-Day Intake Tues. to Thurs.	5-Day Intake Mon. to Fri.
Total cereal	298.0 (39) <sup>a</sup>	294.0 (40)	289.6 (39)
Rice	240.4 (32)	242.1 (33)	238.1 (32)
Other cereals	57.6 (8)	51.9 (7)	51.5 (7)
Total food intake	762.4 (100)	739.5 (100)	739.2 (100)

<sup>a</sup> Source of data: Food and Nutrition Research Center (NIST, NSDB) Nutrition Re-survey of Metropolitan Manila. Statistical Reporter 6 (3) . pp. 1-9, July 1962.

<sup>b</sup> Figures in ( ) are percentages with total food intake equals 100 percent.

The difference between total food intake of 762 gr. during the dry season as compared to 739 gr. in the wet season was generally attributed to the additional consumption of other fruits and vegetables in the dry season.

Two conclusions may be given from these results, namely: (1) for short periods, the daily per capita consumption of rice does not change even if the periods represent differences in seasons and (2) within the week day, Monday to Friday, the 3-day survey will give the same daily capita consumption of rice as the 5-day survey period. The second conclusion will be borne out by the experimental results obtained from the Morong experience.

### **Morong Experience**

The FNRC conducted in October 1964 a demonstration survey in the municipality of Morong, Rizal. This survey was implemented through the cooperation of the Food and Agricultural Organization (FAO) of the United Nations and in conjunction with the Household Food Consumption Survey Training Center for Asia and the Far East sponsored by the Republic of the Philippines and FAO.

The survey covered all households in the poblacion as the urban area and in the barrio of San Guillermo as the rural area. A three-stage sampling scheme was adopted in the poblacion with precincts as primary sampling units (PSU), households as the secondary sampling units (SSU), and days within the week (Monday to Friday) as the tertiary sampling units (TSU). The barrio or rural sector was divided into five blocks which served as strata. Within each block, sample households were drawn as PSU's and days within the week as SSU's. In the first model, the variation between days was considered as a major category in order to find out if there exist differences in consumption between days. If no difference exists, then days can be considered as the ultimate stage units.

There was a total of 15 precincts in the poblacion. Five precincts were drawn at random with equal probability and without replacement. In each of the sampling precincts, a listing operation was instituted. In order to obtain information for possible stratification, the occupation of the principal earner, area and principal crops grown by the household were obtained during the listing operation. On the basis of these advanced characteristics, the households within each precinct were stratified as either agricultural (A) or non-agricultural (NA). There was a total of ten character strata for the five precincts. A total of 60 sample households were allocated to this urban sector such that 30 households were used for the 24-hour recall or interview method, and the other 30 households for the weighing method. Thus, there were exact pairs of households in each cell [14, 1965].

The allocation of sample households in each cell or character strata was done with proportional allocation

$$n_i = n(N_i/N)$$

In the consideration of the model for the urban sector the precincts were considered random: the A and NA strata as fixed; and, the two methods, weighing and recall, also as fixed.

In the rural sector a listing operation in each of the compact blocks also was instituted in a manner similar to that in the urban sector. This operation will give an agricultural (A) and non-agricultural (NA) strata in each of the five compact blocks. The sample households in each cell were also allocated proportional to the total number of listed households in the cell. The allocation of the sample household in the urban and rural sectors is shown in Table 6.

TABLE 6

DISTRIBUTION OF LISTED HOUSEHOLDS AND SAMPLE  
IN THE POBLACION AND BARRIO SAN GUILLERMO OF  
MORONG, RIZAL. OCTOBER 1964.

SECTOR	Precinct or Block Number	Number of Households <sup>a</sup>					
		Both Strata		Stratum A		Stratum NA	
		Listed	Sample	Listed	Sample	Listed	Sample
Poblacion (urban)	1	84	12	25	4	59	8
	2	145	20	81	12	62	8
	3	57	8	20	4	37	4
	4	63	8	10	2	53	6
	5	68	12	26	4	42	8
	TOTAL	417	60	162	26	253	34
Barrio San Guillermo (rural)	1	125	16	80	10	45	6
	2	71	12	42	8	28	4
	3	71	12	44	8	27	4
	4	51	8	41	6	10	2
	5	82	12	38	6	44	6
	TOTAL	400	60	246	38	154	22
Urban and Rural		815	120	408	64	407	56

<sup>a</sup> Each sample cell consists of random pairs of household, one household was used for the weighing method while its corresponding pair was utilized for the recall method

For each food or nutrient group, the analysis of variance (ANOVA) technique was utilized to test the differences between pair of days and methods for both rural and urban sectors. With the appropriate model, the EMS column is used as guide in testing the differences between days (D), methods (M) and interactions. The analysis was conducted with household, per capita and per consuming unit as the basic universe, respectively.

The effects of day and household variance components on the variance of the mean are presented for each unit.

### Household level

The comparisons between D, M and (D  $\times$  M) in rice and other cereal consumption of households in grams for both rural and urban sectors are given in Table 8a while the table of means is shown in Table 8b. All tests indicate no differences between means of households in terms of days observed and type of method followed. There was no interaction between days and methods in both rural and urban sectors. The other interactions also were estimated to be zero.

A combined ANOVA was attempted to test the effects of sampling dates (S), effect of methods (M) and interaction (S  $\times$  M) for each of the two sectors.

This model also was utilized for the analysis of data on the per capita and consuming unit bases.

For the rural sector, the results are summarized in Tables 10a and 10b and for the urban sector in Tables 11a and 11b.

**TABLE 8a**  
**COMPARISONS BETWEEN DAYS (D), METHODS (M)**  
**AND INTERACTION (D × M) OF HOUSEHOLD**  
**CONSUMPTION OF RICE AND OTHER CEREALS IN GRAMS.**  
**RURAL AND URBAN SECTOR. MORONG, RIZAL. 1965.**

Sampling Dates	R u r a l			U r b a n		
	Days	Method	D × M	Days	Method	D × M
Tues and Thurs.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Wed. and Fri.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Fri. and Sun.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Wed. and Sat.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tues. and Sat.	n.s.	n.s.	n.s.	—	—	—
Thurs. and Sun.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sat. and Sun.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tues. and Fri.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Wed. and Thurs.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

**TABLE 8b**  
**TABLE OF MEANS FOR THE NINE SAMPLING DATES BY**  
**TWO METHODS. RURAL AND URBAN SECTORS. MORONG,**  
**RIZAL. 1965**  
**(grams/household/day)**

Sampling Dates	R u r a l		U r b a n	
	Weighing	Recall	Weighing	Recall
Tues and Thurs.	2151	2164	2097	1798
Wed and Fri.	1792	3258	2904	2132
Fri. and Sun.	1772	2074	2160	2712
Wed. and Sat.	1174	1604	1665	2222
Tues. and Sat.	2526	2743	—	—
Thurs. and Sun.	1946	1518	2686	2580
Satt and Sun.	2045	1928	2184	2539
Tues. and Fri.	2840	929	2560	2600
Wed. and Thurs.	1781	1905	2313	2508
Overall Mean	1933	2099	2276	2393

**TABLE 10a**  
**COMBINED ANOV FOR THE NINE SAMPLING DATES OF**  
**HOUSEHOLD CONSUMPTION OF RICE AND OTHER**  
**CEREALS IN GRAMS. RURAL SECTOR. MORONG,**  
**RIZAL, 1965**

SV	DF <sup>a</sup>	MS	F	CV( $\bar{x}$ )%
Total	111			
Method (M)	1	769,080	0.39 <sup>n.s.</sup>	M = 10%
Sampling dates (S)	8	1,893,635	1.80 <sup>n.s.</sup>	S = 15%
M × S	8	2,095,761	2.00 <sup>n.s.</sup>	MxS = 21%
Pooled Hhs	38	39,866,066	4.89 <sup>**</sup>	HHS = 16%
Between days	56	214,620		

<sup>a</sup> Two households were omitted due to the difference in sampling dates for the two methods.

n.s. Not significant.

\*\*Highly significant.

**TABLE 10b**  
**TABLE OF MEANS FOR METHOD x SAMPING DATE**  
**(M x S). (grams/household/day)**

S	M	Weighing	Recall	S Mean
Tues. and Thurs.		2151	2164	2157
Wed. and Sun.		1792	3258	2525
Fri. and Sun.		1772	2074	1923
Wed. and Sat.		1174	1604	1389
Tues. and Sat.		2526	2743	2635
Thurs. and Sun.		1946	1518	1732
Sat. and Sun.		2045	1928	1986
Tues. and Fri.		2840	929	1884
Wed. and Thurs.		1781	1905	1843
M-Mean		1933	2099	2016

TABLE 11a

COMBINED ANOV FOR THE EIGHT SAMPLING DATES OF  
HOUSEHOLD CONSUMPTION OF RICE AND OTHER  
CEREALS IN GRAMS. URBAN SECTOR. MORONG, RIZAL.  
1965.

SV	DF	MS	F	CV(x) %
Total	119			
Method (M)	1	415,363	0.74 <sup>n.s.</sup>	M=4
Sampling dates (S)	7	1,065,449	0.59 <sup>n.s.</sup>	S=15
M x S	7	561,953	0.31 <sup>n.s.</sup>	MxS=25
Pooled Hhs	44	1,792,518	7.15**	HHS=15
Between days	60	250,578		

<sup>n.s.</sup> Not significant.

\*\* Highly significant.

TABLE 11b

TABLE OF MEANS FOR METHOD x SAMPLING DATE (M x S).  
(grams/household/day)

S M	Weighing	Recall	S-mean
Tues. and Thurs.	2097	1798	1948
Wed. and Fri.	2904	2132	2518
Fri. and Sun.	2160	2712	2436
Wed. and Sat.	1665	2222	1944
Thrus. and Sun.	2686	2580	2633
Sat. and Sun.	2184	2539	2361
Tues. and Fri.	2560	2600	2580
Wed. and Thurs.	2131	2508	2410
V-mean	2276	2393	2334



In both sectors, a large portion of the variability is accounted for by the variation between households within methods. In the combined ANOV, the variation between days (D) was incorporated as the within household variance. Note that in Tables 10a and 11a, the between days within household component is the smallest. The interaction (M x S) also is not significant in both sectors. The pooled households MS is a major source of variability. Again, there exist no differences between the two methods as well as between the nine sampling dates as indicated by test given in Table 10a and 11a. Note in the last column of these tables the high level of  $cv(\bar{x})$  in percent for the S, (M xS) and Hh means. The mean for M is the only estimate with a  $cv(\bar{x})$  of 10 percent or less.

### Per capita consumption

In order to remove from the variation of pooled households within cell MS the effect of varying number of household members, the household consumption was transformed to a per capita basis. The analyses for the household were performed on these transformed data. By and large, the results indicate that there exist no differences between days and methods. Also the interaction (D xM) is not significant. As in the household analyses, the major source of variation is the pooled household MS for both rural and urban sectors (Tables 12 and 13). From the ANOV, the household component ( $\sigma_h^2$ ) is estimated as follows:

$$\text{rural sector: } (19,124-5,873)/2 = 6625$$

$$\text{urban sector: } (29,448-8,505)/2 = 9571$$

In the estimation of the mean for method, sampling date or the interaction, larger number of households will be necessary in order to have an estimate with the desired precision even if the data are given in terms of consumption per capita in households.

TABLE 12a

COMBINED ANOV FOR THE NINE SAMPLING DATES OF  
PER CAPITA CONSUMPTION OF RICE AND OTHER  
CEREALS IN GRAMS. RURAL SECTOR. MORONG, RIZAL.  
1965.

SV	DF	MS	F	CV( $\bar{x}$ )%
Total	111			
Methods (M)	1	4,214	.10 <sup>n.s.</sup>	M=7
Sampling dates (S)	8	18,716	.98 <sup>n.s.</sup>	S=11
M x S	8	41,562	2.17 <sup>n.s.</sup>	MxS=15
Pooled Hh <sub>s</sub>	38	19,124	3.26 <sup>**</sup>	HHS=18
Between days	56	5,873		

<sup>n.s.</sup> Not significant.

<sup>\*\*</sup> Highly Significant.

TABLE 12b

MEANS FOR METHODS x SAMPLING DATES (M x S).  
RURAL SECTOR. (grams/capita/day)

S/M	Weighing	Recall	S Mean
Tues. and Thurs.	361	418	390
Wed. and Fri.	322	421	371
Fri. and Sun.	332	383	358
Wed. and Sat.	319	332	325
Tues. and Sat.	391	508	449
Thurs. and Sun.	477	342	409
Sat. and Sun.	266	341	304
Tues. and Fri.	381	294	337
Wed. and Thurs.	521	224	373
M-Mean	362	374	368

**TABLE 13a**  
**COMBINED ANOV FOR THE EIGHT SAMPLING DATES OF**  
**PER CAPITA CONSUMPTION OF RICE AND OTHER**  
**CEREALS IN GRAMS.**  
**URBAN SECTOR. MORONG, RIZAL. 1965.**

SV		MS	F	CV( $\bar{x}$ )%
Total	119			
Methods (M)	1	28,448	3.34**	HHS=16
Sampling dates (S)	7	17,617	1.52 <sup>n.s.</sup>	M=4
M x S	7	19,270	.68 <sup>n.s.</sup>	S=11
Pooled Hh <sub>s</sub>	44	11,549	.41 <sup>n.s.</sup>	MxS=16
Between days	60	8,505		

\*\* Highly Significant.

<sup>n.s.</sup> Not significant.

**TABLE 13b**  
**MEANS FOR METHODS x SAMPLING DATE (M x S).**  
**URBAN SECTOR. (grams/capita/day)**

S/M	Weighing	Recall	S Mean
Tues. and Thurs.	427	376	402
Wed. and Fri.	424	299	362
Fri. and Sun.	341	316	329
Wed. and Sat.	365	434	400
Tues. and Sat.	—	—	—
Thurs. and Sun.	410	422	412
Sat. and Sun.	380	386	383
Tues. and Fri.	475	424	449
Wed. and Thurs.	402	332	367
V-Mean	408	384	396

If we are going to study two methods, then we should have at least 5 households per method in order that the sampling date mean will have a  $cv(\bar{\bar{x}}_s)$  of about 10 percent. In the urban sector, the number of households should be about 12 for  $cv(\bar{\bar{x}}_s)$  to be 10 percent or 6 households per method. It is assumed that only one day is used to observe consumption levels in households. This result implies that an area is visited for only one day but the number of households will be five in the rural sector and six in the urban sector if there are two methods under test.

To obtain a desired level of  $cv(\bar{x})$  for the method mean, selected values of  $d$ ,  $h$  and  $a$  are given to study their effects on  $cv(\bar{x}_m)$ . These results are given in Table 14 where  $s_d^2=5873$ ,  $s_h^2=6625$ , and  $s_{ms}^2=3740$ . At least three sampling dates and eight households per sampling date will be necessary to obtain a  $cv(\bar{x}_m)$  equal to 10 percent or less.

### **Consuming Unit**

To remove further the differences between the per capita per day data on the consumption of rice and other cereals, the per capita data were transformed into consuming unit with the use of the League of Nations scale [5, 1964]. In this approach, the variation in terms of sex and age was removed by adjustment of each member to a standard man consumption. Total household consumption is divided by this adjusted value and the ratio is called consumption per consuming unit per day. The preliminary analyses showed

TABLE 14

COEFFICIENT OF VARIATION IN PERCENT OF A METHOD  
 MEAN AS INFLUENCED BY VARYING VALUES OF  $d$ ,  $h$   
 AND  $s$ .  
 (per capita per day)

$d = \text{one day}$

Number of households (h)	Number of sampling dates (S)			
	1	2	3	9
1	35	24	20	11
2	27	19	16	9
3	24	17	14	8
4	23	16	13	8
5	21	15	12	7
6	21	15	12	7
7	20	14	12	7
8	20	14	11	7
9	20	14	12	7
10	19	14	11	7

$d = \text{two days}$

1	24	22	18	10
2	25	18	14	8
3	23	16	13	8
4	21	15	12	7
5	20	14	12	7
6	20	14	11	7
7	19	14	11	6
8	19	14	11	6
9	19	13	11	6
10	19	13	11	6

**TABLE 14a**  
**COMBINED ANOV FOR THE NINE SAMPLING DATES OF**  
**PER CONSUMING UNIT CONSUMPTION OF RICE AND**  
**OTHER CEREALS IN GRAMS. RURAL SECTOR. MORONG,**  
**RIZAL, 1965.**  
**(League of Nation's Scale)**

SV	DF	MS	F	CV( $\bar{x}$ )%
Total	111			
Methods (M)	1	31,456	0.52 <sup>n.s.</sup>	M=6%
Sampling dates (S)	8	27,502	0.94 <sup>n.s.</sup>	S=9%
M x S	8	60,215	2.06 <sup>n.s.</sup>	MxS=13%
Pooled Hhs	38	29,190	2.94 <sup>**</sup>	HHS=13%
Between days	56	9,032		

<sup>n.s.</sup> Not significant.

<sup>\*\*</sup> Highly Significant.

**TABLE 14b**  
**MEANS FOR METHOD x SAMPLING DATES (M xS).**  
**RURAL SECTOR.**  
**(grams/unit/day)**

S/M	Weighing	Recall	S Mean
Tues. and Thurs.	481	632	561
Wed. and Fri.	499	582	545
Fri. and Sun.	471	587	530
Wed. and Sat.	455	462	458
Tues. and Sat.	602	613	688
Thurs. and Sun.	557	419	488
Sat. and Sun.	446	630	538
Tues. and Fri.	562	374	469
Wed. and Thurs.	604	350	467
M-Means	507	540	523

**TABLE 15a**  
**COMPARISON BETWEEN DAYS (D), METHODS (M) AND**  
**INTERACTION (DxM) OF CEREAL CONSUMPTION PER**  
**CONSUMING UNIT USING THE LEAGUE OF NATIONS**  
**SCALE. RURAL AND URBAN SECTORS. MORONG, RIZAL.**  
**1965.**

Sampling Dates	R U R A L			U R B A N		
	Days	Methods	DxM	Days	Methods	DxM
Tues. and Thurs.	n.s.	*	n.s.	n.s.	n.s.	n.s.
Wed. and Fri.	n.s.	*	n.s.	n.s.	n.s.	n.s.
Fri. and Sun.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Wed. and Sat.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tues. and Sat.	n.s.	n.s.	n.s.	—	—	—
Thurs. and Sun.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sat. and Sun.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tues. and Fri.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Wed. and Thurs.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

**TABLE 15b**  
**TABLE OF MEANS FOR THE TWO METHODS**

Sampling Dates	R U R A L		U R B A N	
	Weighing	Recall	Weighing	Recall
Tues. and Thurs.	491	632	536	510
Wed. and Fri.	499	592	532	412
Fri. and Sun.	471	587	430	459
Wed. and Sat.	455	562	476	555
Tues. and Sat.	602	613	—	—
Thurs. and Sun.	557	419	499	572
Sat. and Sun.	446	630	511	564
Tues. and Fri.	552	376	573	547
Wed. and Thurs.	604	350	567	489
Overall mean	507	540	530	525

n.s. Not significant.

\* Significant at five percent level

**TABLE 16a**  
**COMBINED ANOV FOR THE EIGHT SAMPLING DATES OF**  
**PER CONSUMING UNIT CONSUMPTION OF RICE AND**  
**OTHER CEREALS IN GRAMS. URBAN SECTOR. MORONG,**  
**RIZAL. 1965.**  
**(League of Nation's Scale)**

SV	DF	MS	F	CV(x)%
Total	199			
Methods (M)	1	28,664	1.73*	HHS=17%
Sampling dates <sub>s</sub> (S)	7	381	0.02 <sup>n.s.</sup>	M=3%
M x S	7	16,611	9.58 <sup>n.s.</sup>	S=8%
Pooled Hhs	44	18,144	0.63 <sup>n.s.</sup>	MxS=12%
Between days	60	16,544		

<sup>n.s.</sup> Not significant

\*Significant at five percent level.

**TABLE 16b**  
**MEANS FOR METHOD x SAMPLING DATES (M x S).**  
**URBAN SECTOR.**  
**(grams/unit/day)**

S/M	Weighing	Recall	S Mean
Tues. and Thurs.	536	591	532
Wed. and Fri.	430	459	445
Fri. and Sun.	532	412	472
Wed. and Sat.	476	555	515
Thurs. and Sun.	499	572	535
Sat. and Sun.	519	574	545
Tues. and Fri.			
Wed. and Thurs.	567	489	528
M Means	530	526	528



no differences between days, methods and interaction for the rural and urban sectors. The consumption in terms of consuming unit is relatively higher than the per capita level. The ratio is about 5:3.

The combined ANOV's and the  $e$  level of consumption for the two sectors (Table 15 and 16) confirmed the fact that there exists no differences among sampling dates, methods and interaction means. The  $cv(\bar{x})$ 's of the method means are low (Table 15a and 16a). Comparatively speaking, this approach has reduced variability to a considerable extent. One merely has to compare the  $cv(\bar{x})$  of the other units. These results are summarized in Table 17. These variabilities may be used as guide in the estimation procedures of data from household food consumption surveys.

**TABLE 17**  
**COEFFICIENT OF VARIATION OF MEANS.**  
**(percent)**

Unit	Method (M)		Sampling date (S)				Hhs	
			(M x S)		Rural	Urban		
	Rural	Urban	Rural	Urban			Rural	Urban
Consuming unit	6	3	15	15	21	22	16	15
Household	10	4	11	11	15	16	18	16
Per capita	7	4	9	8	13	12	13	17

## Ratio Estimator

In the estimation of total rice consumption the total number of members in household of the total number of consuming units in household may be an adjustor variable [6,1964]. The gain in statistical precision may be considerable, if the correlaton is high. The analysis of covariance was utilized to estimate the level of correlation between these variables at various stages of the sampling operation. These estimates are given in Table 18 for selected rural and urban strata of the FNRC surveys. Note that there is small or no correlation in the between days source of variation. This is so because the consumption and the number of consuming units remain practically constant from day to day. However, the correlation becomes apparent in the between household stage. The range is between + .65 to + .86. Also, there exists correlation in the between barrio or precinct stage (+ .25 to + .92) but the variation is high.

Considerable gain in precision at the household stage is obtained since for each stratum in Table 18,

$$r (1/2) [cv (\text{number}) / cv (\text{consumption})].$$

The range of statistical efficiency in the use of ratio estimator for the seven strata is 120 to 700 percent or an average of 425 percent.

TABLE 18

CORRELATION BETWEEN CONSUMPTION AND NUMBER  
OF MEMBERS IN HOUSEHOLD FOR SELECTED STRATA IN  
RURAL SECTORS, BY SOURCE OF VARIATION.

Source of variation	Rural strata <sup>a</sup>					Urban strata <sup>a</sup>	
	V-9	VII-16	VII-18	VII-19	VII-20	I-15 to 22	VII-15 to 16
Between days	0.34	0.25	0.03	0.78	0.01	0.04	0.01
Between households	.83	.67	.76	.85	.86	.76	.78
Between barrios (or precincts)	.25	.92	.73	.41	.72	.72	.61

a The Roman numeral refers to region and the Arabic number to the stratum within the region.

## Summary and Recommendation

1. The household food consumption survey (HFCS) of the Philippines is a sub-sample of the Philippine Statistical Survey of Households (PSSH). Eight of the ten regions have been surveyed. Estimates of per capita consumption of rice are given for the eight regions. A lower bound national daily per capita estimate of 265 grams from these regional estimates appears to be higher than the current national per capita estimate of 217 grams which is used by the National Economic Council in the assessment of supply and demand situation for rice. At the national level, this difference will account for an additional amount of about 580,000 metric tons of rice consumption in 1966.
2. Experiences in the 1959 survey in Metropolitan Manila indicate that there exists no difference in rice consumption between the 3-day and the 5-day weighing methods. Tests also showed that rice consumption in the 1958 dry season was the same as that in the 1959 rainy season for the comparable 3-day survey.
3. From the results of the Morong survey, it was demonstrated that there exists no difference between the weighing and the recall methods in either household, per capita and per consuming unit of consumption of rice and other cereals. Also, within a survey week, no differences were detected between sampling dates and between days within sampling dates. In the comparison of method, sampling date and interaction means, statistical precision is increased with the use of the consuming unit as the universe of discourse.

4. The components of variance gave estimates of the number of households to use in similar empirical studies. Ratio estimators with number of members in household as concomitant variable will result in considerable statistical gain in the estimation of total rice consumption in households. The average gain in statistical efficiency is about 425 percent.
  
5. In view of these results, it is recommended that the regional estimates on rice consumption be used in the assessment of supply and demand on the national level. The improved estimates of rice production must be incorporated into the supply side. In addition, future HFCS can be designed in such a manner that the 24-hour recall method be used and the survey be conducted for only one day. However, quality control checks in a time series must be instituted on a small sub-sample for testing the performance of the weighing and recall methods and the equality of consumption between two days of the week. In addition, ratio estimators may be instituted into the estimation procedure for total consumption.
  
6. The new design of the PSSH will allow for estimates of population and other socio-economic variables on a provincial level. Thus, the HFCS must consider not only these new findings but also the redesign of the PSSH and their impact of the design and precision of the HFCS.

## Literature Cited

- 1] Oñate, B. T. Statistical Requirements of Planning and Development. *The Philippine Economy Bulletin* 3 (1) October 1964. [The level and standard of living are compared. The former may be used in providing a statistical framework in the circular process of development plans and programs.]
- 2] —————. Development of Multi-Stage Designs for Statistical Surveys in the Philippines. *The Stat. Reporter* 4 (4). October 1960.
- 3] —————. Estimation of Population and Labor Force in the Philippines. *The Stat. Reporter* 9 (1). March 1965. [The development and historical background of the Philippine Statistical Survey of Households (PSSH) is discussed. This survey is the basic statistical framework of the Household Food Consumption Survey (HFCS). Any improvement and/or development in the PSSH also will be reflected in the HFCS.]
- 4] Samson, P. Food Consumption Demonstration Survey. *The Stat. Reporter* 8 (4). December 1964. [A brief description of the survey in Morong is given in this paper.]
- 5] McArthur, M. Some factors Involved in Estimating Calorie Requirements, with Special Reference to Persons Engaged in Agricultural Labour in Asia Countries. *Jour. Roy. Stat. Soc.* 127 (Part 3.). Series A. 1964. pp. 402.
- 6] Oñate, B. T. Uses of Census Results, Maps and Lists in Food Consumption Studies in the Philippines. *Phil. Stat.* 13 (4). December 1964.