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Directly from Food Consumption Data**

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Measuring the Prevalence of Hunger in the Philippines Directly from Food Consumption Data¹

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ABSTRACT

Two methodologies for measuring prevalence of hunger, defined as the consumption of a diet inadequate to sustain good health and normal activity, growth and development, were developed using the 2003 Food Consumption Survey. The first methodology compared per capita energy consumption using the divisor total consumption unit *TCU* with per capita hunger threshold. The second methodology compared household's total dietary energy consumption with household hunger threshold.

Prevalence of hunger was estimated using the design-based combined ratio estimator r_g . It is a ratio of two counts: total number of hungry households (persons) and total number of households (persons). Properties of the design-based estimates of hunger prevalence were determined and evaluated in terms of their bias, standard error, and coefficient of variation (CV).

Results showed that 60.95% of Filipino households and 65.05% of Filipinos were hungry using the first methodology, higher than the estimates obtained using the second methodology at 55.99% and 60.26%, respectively. Although, both methodologies gave estimates that were accurate with negligible biases relative to its standard error, precise having standard errors lower than 0.012, and reliable with CVs at most 1.92%, the second methodology was recommended for it avoids the difficulty of choosing the divisor for per capita calculations.

I. Introduction

Despite economic growth, technological advances and food surpluses in many countries, 815 million people in developing countries still do not have enough to eat to meet their basic energy requirements (Food and Agriculture Organization (FAO), 2004). This has received increased attention because of its potential, although not necessary, consequence - hunger. In fact, during the Millennium Summit in 2000, 149 countries have agreed of eradicating extreme poverty and hunger in this world of plenty, known as the first Millennium Development Goal (MDG).

For purposes of monitoring progress towards eradicating hunger, the need had arisen to identify who is hungry that will allow the estimation of its prevalence. Several definitions of the characteristic to be assessed, which is hunger, have been given. Most of them focused on subjective perceptions making it difficult to directly measure hunger

¹ This study is part of the PhD dissertation of the 1st author.

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(Margen and Neuhauser, 1987; as cited by Radimer et al., 1992), such as the uneasy or painful sensation caused by the lack of food (Life Sciences Research Office (LSRO), 1990; as cited by Carlson et al., 1999). But recent efforts were successful in giving an operational definition of it. It is the consumption of a diet inadequate to sustain good health and normal activity, growth and development (Millman and DeRose, 1998). A similar definition was for the Sixth World Food Survey (FAO, 1996). Emphasis on energy as a measure of food adequacy is justified since increased dietary energy, if derived from normal staple foods, brings with it more protein and other nutrients.

An ideal indicator of hunger, then, is one that focuses on whether people are getting enough to eat and involves the comparison between the diet actually consumed and what is required for sustaining good health and normal activity, growth and development. The Philippines, through the National Statistical Coordination Board (NSCB) and the Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST), has been doing it in their estimation of hunger statistics. However, the former does the comparison in terms of monetary values, while the latter in terms of kilocalories (kcal), a unit of measure of energy.

Practical difficulties arise in the implementation of the existing methodologies. Specifying the food threshold is one difficulty encountered in the NSCB methodology. Determining the regional menu that is cheap, locally available, typical of the local eating practices and, more importantly, that provides the minimum nutritional requirement bring about this difficulty. Determining the unit prices of the food items included in the menu adds to the complexity of the NSCB methodology. Choosing the divisor for per capita calculations poses another difficulty in both methodologies.

It is for these reasons that an indicator of hunger was developed, one that avoids the practical difficulties arising with the use of the existing official methodology. Properties of the prevalence of hunger measure based on the developed indicator were derived and evaluated in terms of the bias, standard error (*SE*), margin of error (*MOE*), and coefficient of variation (*CV*) using the data coming from the FNRI's 2003 Food Consumption Survey (FCS). Obtained estimates were compared and those with negligible bias, small *SEs*, and *CVs* at most 10% are to be considered more accurate, precise and reliable estimates of the prevalence of hunger in the Philippines, respectively.

II. Identifying Hungry Households

Dietary energy requirement of an individual is that level of energy intake from food that will balance energy expenditure when the individual has a body size and composition, and level of physical activity consistent with long-term good health, and that will allow for the maintenance of economically necessary and socially desirable physical activity (Gabbert and Weikard, 2001). This requirement is determined by FNRI and is presented together with the requirements for other nutrients in the Recommended Energy and Nutrient Intake (RENI). For the average healthy Filipino performing moderate activities, the RENI for energy is 2,013 or about 2,000 kcal per capita per day. This was obtained by taking the weighted average of the respective RENI for males and females, by age, using the proportion of the Philippine population at the various age and sex groups based on the 1990 Census of Population and Housing (CPH) (NSCB, 2003).

In the 2003 FCS, total dietary energy consumption of the sampled households was measured by one-day actual weighing of all food items they cooked in the course of the day as well as their left over portions, those fed to pets, and those given out. On the other hand, energy consumption of household members away from home was, as much as possible, estimated through recall. However, the consumption of guests who ate major meals with the household during the day was captured and not netted out. Thus, adjustments were made so that the dietary energy consumption of a household $\sum kcal$ represents exclusively the energy consumption of its members.

2.1 Method 1: Using Per Capita Hunger Threshold

$\sum kcal$ was divided by the total consumption unit TCU to arrive at the household's per capita energy consumption. Although household size N is an obvious candidate for divisor, using it will result in an underestimation of real per capita energy consumption since poor households tend to be bigger and with proportionately more children (David et al., 2004). The divisor TCU used by FNRI adjusts N to account for the household's meal pattern and the number of meals eaten at home and away from home but recalled by each household member. It is the sum of the weights w_i assigned to each member of the household, i.e. $TCU = \sum w_i \leq N$, where

$$\left[\begin{array}{ll} 0 & \text{, if household member had no major meal at home or had eaten out} \\ & \text{but not recalled} \\ 0.33 & \text{, if household member had taken (either shared in household or} \\ & \text{recalled) one meal of a 3-meal pattern} \end{array} \right.$$

- 0.5 , if household member had taken (either shared in household or recalled) one meal of a 2-meal pattern
- 0.67 , if household member had taken (either shared in household or recalled) two meals of a 3-meal pattern
- 1 , if household member had taken all the meals of the household's meal pattern

A comparison between per capita dietary energy consumption and per capita hunger threshold of 2,000 kcal was made to determine whether a household is hungry or not. A household is regarded as hungry and has inadequate dietary energy intake if its per capita energy consumption is lower than the per capita hunger threshold. And because dietary energy consumption is measured at the level of the household, the ultimate sampling unit in the FCS, the data does not allow for intra-household analysis. Thus, if a household is hungry, then all its members are considered hungry, and if a household is non-hungry, then all its members are considered non-hungry.

2.2 Method 2: Using Household Hunger Threshold

The hunger threshold of a household $\sum RENI$ is defined as the sum of the RENIs of each member of the household. But for some household members who ate away from home and whose consumptions were not recalled, their RENIs were adjusted proportionately. Hence, in this methodology, a household is regarded as hungry if the household's total dietary energy consumption is below its corresponding household hunger threshold. i.e. $\sum kcal < \sum RENI$. Consequently, all members of a hungry household are considered hungry, and all members of a non-hungry household are considered non-hungry.

III. Estimation of the Prevalence of Hunger

The data used in estimating the prevalence of hunger was obtained from the 2003 FCS. Let y_{hai} be equal to one if household i in PSU a in stratum h is said to be hungry; and zero otherwise. Similarly, let x_{hai} be equal to one if household i in PSU a belongs to stratum h ; and zero otherwise. Also, let w_{hai} be the weighting factor attached to household i in PSU a in stratum h , and is taken as the product of the base weight and the nonresponse adjustment.

Total number of hungry households and total number of households for a given stratum h were estimated according to the design of the 2003 FCS. The sum of relevant stratum estimates was computed to obtain estimates of totals in area g . Hence, the design-

based estimator of the prevalence of hunger for area g , denoted by r_g , is the ratio of the

total number of hungry households to the total number of households, i.e. $r_g = \frac{\hat{Y}_g}{\hat{X}_g}$.

The bias, SE , and CV of this combined ratio estimator r_g were computed to evaluate the accuracy, precision, and reliability of the estimates, respectively. All results were generated using the Statistical Analysis System (SAS) software.

IV. Estimates of Hunger Prevalence

Table 1 presents the prevalence of hunger at the national level among households and persons estimated using both methodologies. In the first methodology that used per capita hunger threshold, results showed that 60.95% of Filipino households were hungry, that is, about 61 in every 100 households had per capita energy consumption less than 2,000 kcal. On the other hand, prevalence of hunger using the second methodology that used household hunger threshold was significantly lower and estimated at 55.99%, that is, approximately 56 out of 100 Filipino households had total dietary energy consumption inadequate to meet the dietary energy requirements of all their members.

Table 1. Prevalence (%) of hunger by methodology

METHODOLOGY	r_g	BIAS	SE	CV(%)	95% CI
Using Per Capita Hunger Threshold					
Among Households	60.95	negligible	0.0107	1.76	58.85 - 63.05
Among Persons	65.05	negligible	0.0115	1.77	62.80 - 67.31
Using Household Hunger Threshold					
Among Households	55.99	negligible	0.0106	1.89	53.91 - 58.07
Among Persons	60.26	negligible	0.0116	1.92	57.99 - 62.53

Nevertheless, these percentages of hungry persons for both methodologies were higher than the percentages of hungry households. This is expected since hungry households usually have more members. Among persons, estimates of the prevalence of

hunger for both methodologies were found to be significantly different at 5% level of significance. The first methodology estimating it at 65.05%, while the second methodology at 60.26%.

The estimates provided by both methodologies at the national level were accurate since biases were found to be negligible relative to its *SE*, that is, the $CV\left(\hat{X}_g\right)$ is less than 0.10 (Cochran, 1977). Also, both methodologies provided precise estimates with *MOEs* of at most 3% resulting to narrow confidence intervals (CI), as well as reliable estimates since corresponding *CVs* were less than the 10% acceptable value.

These estimates when compared with the NSCB's existing methodology were considerably higher. In 2003, subsistence incidence was estimated at only 10.2% (NSCB, 2006). That is, 1 in every 10 Filipino families had insufficient income to buy basic food to meet the minimum nutritional requirements of 2,000 kcal. The differences in the estimates of the prevalence of hunger between the NSCB and the proposed methodologies are attributed to the different data sources and inputs used in the estimation procedure. NSCB methodology uses FIES survey data while the proposed methodologies use the FCS survey data. Also, NSCB uses prices and currency units while the proposed methodologies use energy units given by kcal.

At the regional level, estimates provided by both methodologies are not significantly different at 5% level of significance (Table 2). Results showed that MIMAROPA, Davao region and CAR had the lowest prevalence of hunger (Table 3). On the other hand, ARMM, Zamboanga Peninsula, Eastern Visayas, Bicol and Central Visayas were found to have the highest prevalence of hungry households. With allowance for error and a 95% confidence level, the hunger prevalence estimate for Zamboanga Peninsula was significantly higher than the national estimate obtained using either methodology.

Table 2. Prevalence (%) of hunger among households by region and by methodology

REGION	METHODOLOGY
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	Using Per Capita Hunger Threshold			Using Household Hunger Threshold		
	r_g	95% CI		r_g	95% CI	
Luzon						
I – Ilocos	58.86	51.79	- 65.94	52.33	45.18	- 59.48
II – Cagayan	59.43	50.25	- 68.61	49.41	41.42	- 57.41
CAR	50.34	40.67	- 60.01	48.90	39.27	- 58.52
III – Central Luzon	57.91	51.29	- 64.53	53.38	45.61	- 61.14
IV A – CALABARZON	60.66	53.41	- 67.91	60.31	52.59	- 68.03
IV B – MIMAROPA	55.07	47.92	- 62.23	43.56	36.32	- 50.79
V – Bicol	67.24	58.88	- 75.60	60.81	51.35	- 70.27
NCR	59.12	53.05	- 65.20	52.48	46.78	- 58.17
Visayas						
VI – Western Visayas	57.48	48.63	- 66.33	55.01	47.82	- 62.19
VII – Central Visayas	66.21	58.48	- 73.93	63.98	56.44	- 71.53
VIII – Eastern Visayas	67.75	57.03	- 78.48	61.82	53.10	- 70.55
Mindanao						
IX – Zamboanga Peninsula	70.55	63.46	- 77.64	62.92	55.85	- 69.99
X – Northern Mindanao	61.24	53.12	- 69.36	58.52	50.37	- 66.67
XI – Davao Region	53.70	44.10	- 63.31	49.17	40.43	- 57.91
XII – Soccsksargen	61.38	53.24	- 69.52	57.74	49.16	- 66.33
XIII – CARAGA	63.11	53.05	- 73.17	51.82	44.05	- 59.58
ARMM	70.68	59.84	- 81.52	63.66	54.91	- 72.42

Table 3. Regional rankings by methodology

REGION	METHODOLOGY	
	Using Per Capita Hunger Threshold	Using Household Hunger Threshold
ARMM	1	2
IX - Zamboanga Peninsula	2	3
VIII - Eastern Visayas	3	4
V - Bicol	4	5
VI - Central Visayas	5	1
XIII - CARAGA	6	13
XII - Soccsksargen	7	8
X - Northern Mindanao	8	7
IV A - CALABARZON	9	6
II - Cagayan	10	14
NCR	11	11
I - Ilocos	12	12
III - Central Luzon	13	10
VI - Western Visayas	14	9
IV B - MIMAROPA	15	17
XI - Davao Region	16	15
CAR	17	16

* 1 represents hungriest while 17 represents the least hungry.

The regional estimates provided by both methodologies possessed desirable properties. All were accurate with negligible bias relative to its *SE*. Almost all were reliable

with CVs of at most 10% except for one regional estimate with a CV of 10.04% obtained using the second methodology (Figure 1). However, the estimates were found to have SEs at least 0.0290 resulting to MOEs higher than 3% and to wider CI (Figure 2).

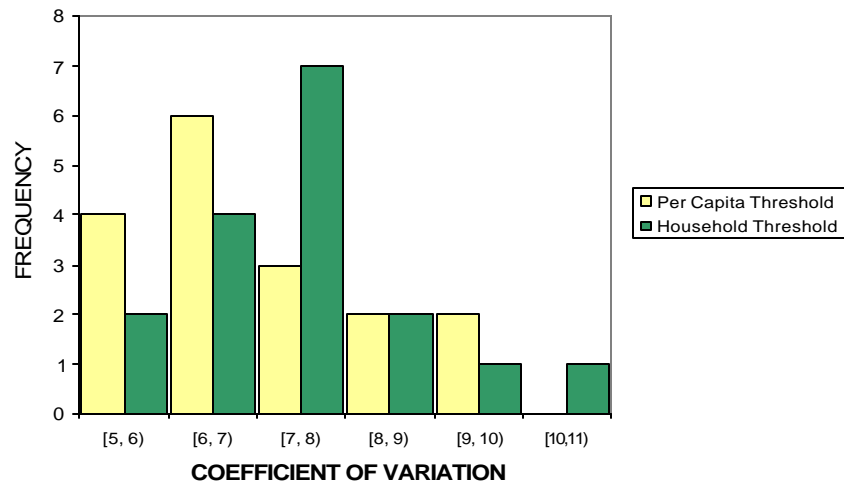


Figure 1. CV of the regional prevalence of hunger estimates by methodology

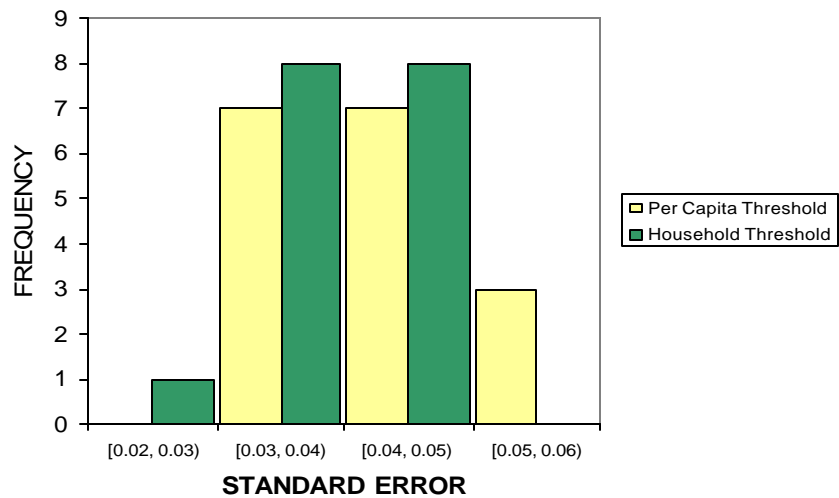


Figure 2. SE of the regional prevalence of hunger estimates by methodology

V. Conclusion

Although both methodologies gave national and regional estimates of the prevalence of hunger that were accurate and reliable, as well as precise estimates at the national level, the proposed methodology that uses household hunger threshold is recommended for it avoids per capita calculation. As such, obtained estimates are free from the effect of the choice of divisor such as the underestimation of per capita energy consumption as a result of bigger household sizes which is a characteristic of Filipino households.

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