IFPRI

FCND DP No. 136

FCND DISCUSSION PAPER NO. 136

DIETARY DIVERSITY AS A FOOD SECURITY INDICATOR

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June 2002

ABSTRACT

Household food security is an important measure of well-being. Although it may not encapsulate all dimensions of poverty, the inability of households to obtain access to enough food for an active, healthy life is surely an important component of their poverty. Accordingly, devising an appropriate measure of food security outcomes is useful in order to identify the food insecure, assess the severity of their food shortfall, characterize the nature of their insecurity (for example, seasonal versus chronic), predict who is most at risk of future hunger, monitor changes in circumstances, and assess the impact of interventions. However, obtaining detailed data on food security status—such as 24-hour recall data on caloric intakes—can be time consuming and expensive and require a high level of technical skill both in data collection and analysis.

This paper examines whether an alternative indicator, dietary diversity, defined as the number of unique foods consumed over a given period of time, provides information on household food security. It draws on data from 10 countries (India, the Philippines, Mozambique, Mexico, Bangladesh, Egypt, Mali, Malawi, Ghana, and Kenya) that encompass both poor and middle-income countries, rural and urban sectors, data collected in different seasons, and data on calories acquisition obtained using two different methods. The paper uses linear regression techniques to investigate the magnitude of the association between dietary diversity and food security. An appendix compiles the results of using methods such as correlation coefficients, contingency tables, and receiver operator curves.

We find that a 1 percent increase in dietary diversity is associated with a 1 percent increase in per capita consumption, a 0.7 percent increase in total per capita caloric availability, a 0.5 percent increase in household per capita daily caloric availability from *staples*, and a 1.4 percent increase in household per capita daily caloric availability from *nonstaples*. These associations, which are found in both rural and urban areas and across seasons, do not depend on the method used to assess these associations, nor when using the number of unique food groups consumed is the measure of dietary diversity. There is an association between dietary diversity and food access at the individual level, although the magnitude of this association is considerably weaker than that between dietary diversity and food access. Looking across all samples, the magnitude of the association between dietary diversity and caloric availability at the household level increases with the mean level of caloric availability. Accordingly, dietary diversity would appear to show promise as a means of measuring food security and monitoring changes and impact, particularly when resources available for such measurement are scarce.

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ACKNOWLEDGMENTS

We thank Bruce Cogill, Anne Swindale, and seminar participants from FANTA and the International Food Policy Research Institute (IFPRI) for helpful comments. This publication was made possible through the support provided to the Food and Nutrition Technical Assistance (FANTA) Project by the Office of Health and Nutrition of the Bureau for Global Programs Field Support and Research at the U.S. Agency for International Development (USAID), under terms of Cooperative Agreement No. HRN-A-00-98-00046-00 awarded to the Academy for Educational Development (AED). The opinions expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Agency for International Development.

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1. INTRODUCTION

Household food security is an important dimension of well-being. Although it may not encapsulate all dimensions of poverty, the inability of households to obtain access to enough food for an active, healthy life is surely an important component of their poverty. In this context, devising an appropriate measure of food security outcomes is useful for several reasons: to identify the food-insecure, characterize the nature of their insecurity (for example, seasonal versus chronic), monitor changes in their circumstances, and assess the impact of interventions. However, obtaining detailed data on food security status—such as 24-hour recall data on caloric intakes—can be time consuming and expensive and requires a high level of technical skill both in data collection and analysis.

The juxtaposition of the value of indicators of food security, together with the difficulties in obtaining detailed information, is the motivation for this paper, which explores whether dietary diversity—the number of different foods or food groups consumed over a given reference period—can act as an alternative indicator of food security under a variety of circumstances, including poor and middle-income countries, rural and urban areas, and across seasons. Field experience indicates that respondents find such questions relatively straightforward, non-intrusive, and undemanding on time or recall to answer. Asking these questions typically takes under 10 minutes per respondent. But while data on dietary diversity are clearly simpler to collect than are data on caloric acquisition or intake, in order for the data to be used to create an alternative measure, it is necessary to show a strong correlation with more traditional measures of food security.

Below we present evidence on this issue from 10 countries: India, the Philippines, Mozambique, Mexico, Bangladesh, Egypt, Mali, Malawi, Ghana, and Kenya. These data sets encompass both poor and middle-income countries, rural and urban sectors, data collected in different seasons, and data on calories acquisition obtained using both seven-day recall on food consumption and 24-hour individual intake data. To be confident that the results are not driven by the use of a particular method or variable, we examine associations between dietary diversity (defined as the number of unique foods consumed in the previous seven days) and household per capita consumption; household per capita daily caloric availability; household per capita daily caloric availability from *staples*; and household per capita daily caloric availability from *nonstaples*. Additionally, we explore the associations between the number of unique food groups consumed and these variables. We do so using linear regression techniques; in Appendix 1, we also check for the robustness of results by calculating three other measures of association: correlation coefficients (Pearson and Spearman), contingency tables, and receiver operator curves.

We find that a 1.0 percent increase in dietary diversity is associated with a 1.0 percent increase in per capita consumption, a 0.7 percent increase in total per capita caloric availability, a 0.5 percent increase in household per capita daily caloric availability from staples, and a 1.4 percent increase in household per capita daily caloric availability from nonstaples. These associations, which are found in both rural and urban areas and across seasons, do not depend on the method used to assess these associations, nor when using the number of unique food groups consumed as the measure of dietary diversity. There is an association between dietary diversity and food access at the individual level, although the magnitude of this association is considerably weaker than that between dietary diversity and food access. Looking across all samples, the magnitude of the association between dietary diversity and caloric availability at the household level increases with the mean level of caloric availability. Accordingly, dietary diversity would appear to show promise as a means of measuring food security and monitoring changes and impact, particularly when resources available for such measurement are scarce.

2. BACKGROUND: RATIONALE, METHODS, AND DATA

Determining whether dietary diversity meets the criteria of a good indicator of food security requires that we define what we mean by "food security" and a "good indicator." We follow the U.S. Agency for International Development (USAID) concept of food security, namely that food security exists "when all people at all times have both the physical and economic access sufficient to meet their dietary needs in order to lead a healthy and productive life (USAID 1992). There are three dimensions to this definition of food security: availability (a measure of food that is, and will be, physically available in the relevant vicinity of a population during a given period); access (a measure of the population's ability to acquire available food during a given period); and utilization (a measure of whether a population will be able to derive sufficient nutrition during a given period).

The available data contain information on the value of household consumption of food and nonfood goods (what we will call *consumption*), the amount of food consumed by all household members over the last seven days (what we will call *caloric availability*), and, for several samples, the amount of food consumed by individual household members as measured using intake techniques over a 24-hour period (what we will call *caloric intake*). Given these data, we assess the usefulness of dietary diversity as an indicator of the "access" dimension to food security by considering the following questions:

- How strong is the correlation between dietary diversity and consumption and caloric availability and intake (the latter also being separated into staples and nonstaples)?
- Is this correlation observed across a variety of countries?
- Does the strength of this correlation vary seasonally?
- Is this correlation observed in both rural and urban localities?

RATIONALE FOR FOCUSING ON DIETARY DIVERSITY AS A FOOD SECURITY INDICATOR

Dietary diversity—the number of different foods or food groups consumed over a given reference period—is an attractive indicator for four reasons.[1] First, a more varied

[1] Earlier studies on this include Hatloy, Torheim, and Oshaug (1998), Lorenzana and Sanjur (1999), and Morris (1999).

diet is a valid outcome in its own right. Second, a more varied diet, either directly or indirectly through improved acquisition of micronutrients, is associated with a number of improved outcomes in areas such as birthweight (Rao et al. 2001), child anthropometric status (Allen et al. 1991; Hatloy et al. 2000; Onyango, Koski, and Tucker 1998; Taren and Chen 1993; Tarini, Bakari, and Delisle 1999), improved hemoglobin concentrations (Bhargava, Bouis, and Scrimshaw 2001), reduced incidence of hypertension (Miller, Crabtree, and Evans 1992), reduced risk of mortality from cardiovascular disease and cancer (Kant, Schatzkin, and Ziegler 1995). Third, such questions can be asked at the household or individual level, making it possible to examine food security and the household and intrahousehold levels. Fourth, obtaining these data is relatively straightforward. Training field staff to obtain information on dietary diversity is straightforward. Our own field experience indicates that respondents find such questions relatively straightforward, nonintrusive, and not especially burdensome to answer. Asking these questions typically takes under 10 minutes per respondent.

METHODS

Broadly speaking, the literature exploring associations between measures of food security uses one of two approaches.

The first focuses on dichotomizing households into two groups: the food-secure and the food-insecure. These are used in the construction of contingency tables, which cross classify indicators. For example, households could be classified by whether per person caloric availability is above or below a certain figure and cross-classified against dietary diversity. There are three numbers of interest: *specificity*, the fraction of food-insecure households also classified by the alternative as food-insecure; *sensitivity*, the fraction of food-secure households also classified by the alternative indicator as food-secure; and a chi-squared test of whether there is a statistically significant association between these attributes. An alternative indicator strongly associated with caloric availability will have high specificity, high sensitivity, and a significant chi-squared statistic. Studies that have used this approach include Chung et al. (1996) and Habicht, Meyers, and Brownie (1982).

Using contingency tables requires the specification of cutoffs for both the underlying measure of food security and the indicator. Suppose that the underlying measure is per capita calories available at the household level. One approach is to take some norm for some given activity level and body weight and use this to determine the level at which caloric acquisition meets requirements. Estimates of "basic requirements to meet food needs" range from 1,885 to 2,500 kilocalories (kcal) (James and Schofield 1990; Smil 1994). An alternative approach is to construct country-specific norms based on average heights, weights, and activity levels (see FANTA 1999). It is then necessary to specify the cutoff for the alternative indicator, such as dietary diversity. One approach is to rank households by the alternative indicator and then disaggregate the households into groups based on the proportions believed to be food-secure and food-insecure as indicated by the underlying indicator. For example, if 25 percent of households are classified as being food-insecure based on caloric availability, the sample is similarly divided into those households whose dietary diversity is above and below the 25^{th}

percentile. If dietary diversity were a perfect indicator of food security, this classification would produce specificity and sensitivity measures equal to 1.

A limitation of contingency tables is that they are informationally inefficient—that is, they do not make full use of all information available. For example, to calculate per capita caloric availability, we need to know the number of people in the household. By default, we also know household location. It is also likely that we have information on other household characteristics such as the age, education, and sex of the household head. Exploiting this information implies moving away from simple bivariate comparisons to a multivariate setting, using a probit or logit. In fact, this can be taken further.

Recall that from any multivariate analysis, it is possible to obtain predicted values of the dependent variable. In comparing these predicted and actual outcomes, a standard cutoff is 0.5; that is to say that if the predicted value for a household is greater than 0.5, we assume that the household is food-secure. If, however, we increase this cutoff to say 0.66, then we will increase the number of households predicted as food-insecure and reduce the number predicted as secure. In other words, we would improve the sensitivity of the model, but at a cost of worsened specificity. A *receiver-operator curve* (ROC) allows us to examine whether the ability of a proxy indicator such as dietary diversity to mimic other measures of household food security is affected by these trade-offs between sensitivity and specificity.

A drawback to contingency tables, as well as logits and ROC analysis, is that the dependent variable is chosen on the basis of a cutoff that contains some arbitrariness. In the case of contingency tables, further arbitrariness is introduced via the choice of the cutoff for the alternative indicator. These analyses do not take into account the fact that there are variations in the severity of food insecurity. For example, no distinction is made between misclassifying a household just below the caloric threshold and one far below this cutoff. Put another way, by restricting our analysis to a zero-one variable, we throw away information on the variation in caloric availability, and this is informationally inefficient.[2]

An alternative approach is to construct measures of association, treating both the underlying measure of food security and the alternative as continuous variables.

Pearsonian and Spearman *correlation coefficients* are index numbers that show the extent to which two variables are linearly related. The Pearson correlation coefficient is based on the actual values of these data; the Spearman coefficients are based on rankings of these households by these variables. Both can take on values that range from –1 to 1. A priori, it is expected that the dietary diversity index and per capita calorie consumption are positively related, that is, both increase in value together. However, these have several limitations. First, an observed correlation could be driven by just one part of the distribution of joint variables. Suppose that for most households there is little correlation between dietary diversity and calorie consumption. But for very rich households, the correlation is quite high. As a consequence, the calculated coefficient might just prove to be statistically significant. A second problem is that of false correlation where some other variable is correlated with both measures, producing a false

[2] Brownie, Habicht, and Cogill (1986) suggest a method for remedying this limitation. Unfortunately, our data do not satisfy the preconditions they specify for their approach.

correlation between the two variables that are observed. Computing these correlation coefficients provides some interesting hypotheses regarding these associations, but additional investigation is warranted.

Alternatively, one can use linear regression techniques. The dependent variable would be the measure of household consumption or caloric availability. The coefficient on dietary diversity indicates how many additional calories are associated with an increase of one unit of dietary diversity, controlling for confounding factors such as household size, age and education of head, and location. In the work reported below, we use a log-log specification (both dietary diversity and the dependent variable are expressed in logarithmic terms) so that the estimated coefficient is also the elasticity, that is, the percentage change in the dependent variable, given the percentage change in dietary diversity.

As part of discussions of methodology, it is also useful to consider the construction of the measure of dietary diversity itself. One approach, suggested by Kant et al. (1991), Hatloy, Torheim, and Oshaug (1998), and Swindale and Ohri-Vachaspati (1999), is to count the number of food groups consumed. Kant et al. and Hatloy, Torheim, and Oshaug suggest eight groups. Swindale and Ohri-Vachaspati suggest the 12 groups used to construct the Food and Agriculture Organization of the United Nations (FAO) food balance sheets. An alternative approach, suggested by Krebs-Smith et al. (1987), Drewnowski et al. (1997) and Hatloy, Torheim, and Oshaug (1998), is to count each food item separately. There are advantages and disadvantages to both approaches. Knowing, for example, that a household consumes four food groups, as opposed to four different types of cereals, is more indicative of a diverse diet. Conversely, changes in food consumption resulting from higher incomes may be evidenced by improved quality of foods rather than consumption of different food groups. Consequently, the analysis described below uses both food groups and number of unique foods consumed.

DATA SETS

In this section, we describe the 10 data sets used in our analysis from India, the Philippines, Mozambique, Mexico, Bangladesh, Egypt, Mali, Malawi, Ghana, and Kenya. All data sets were collected with input from the International Food Policy Research Institute (IFPRI). We pay particular attention to the sample-specific measurements of dietary diversity, consumption, caloric availability, and intake.

The Indian data are a resurvey of four villages that were part of the International Crops Research Institute for the Semi-Arid Tropics' (ICRISAT) longitudinal village-level studies: Kanzara, Shirapur, Aurepalle, and Dokur. There were three survey rounds, covering 320 households. The first survey round was conducted in August–September, 1992, a time of poor food availability in Dokur and Shirapur, moderate availability in Kanzara, and surplus in Aurepalle. The second round was fielded in January–February 1993, during the post-rainy season *(rabi)* with food surpluses available in all villages. The final round occurred in the late summer/early monsoon period, June–July 1993, a time of poor food availability in all localities.[3] Data on individual, 24-hour recall of the

[3] See Chung et al. (1996) for a more detailed description of these surveys.

physical consumption of food were converted into kcal using the conversion factors found in NIH (1993).

The Philippines data were collected in the southern part of Bukidnon Province, located on the southern island of Mindanao as part of research on the impact of cash crop production on nutrition (see Bouis and Haddad 1990 for a detailed description). Four survey rounds were undertaken at four-month intervals beginning in August 1984 and ending in August 1985. Rounds 1 and 4 correspond to the harvest period for maize, the main staple crop; Round 3 corresponds to the height of the hungry season for this area. Households eligible for inclusion in the survey had to have less than 15 hectares of land and at least one child less than 60 months of age. There are 448 households comprising 9,967 individuals in the sample. A unique feature of these data is that food consumption is available from two sources, caloric availability—taken from seven-day recall information on food expenditures and consumption—and caloric intake—taken from 24-hour recall of food consumed by each individual in the household. The data on the physical consumption of food were used to tabulate the number of unique foods consumed by all household members; this datum is the measure of dietary diversity used here.

Data on Mozambique are drawn from the *Inquerito Nacional aos Agregados Familiares Sobre As Condicoes de Vida* (MIAF) or National Household Survey on Living Conditions.[4] The survey was conducted from February 1996 through April 1997.

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[4] This description draws heavily on Datt et al. (2000).

It covered all 10 of Mozambique's provinces as well as the city of Maputo. The sample consists of 8,274 households and is nationally representative. Each participating household was visited three times within a seven-day period. During the first interview, recall data from the previous day's consumption on food items, as well as minor nonfood items, were obtained. At the second interview, three days after the first, the same data were obtained using a three-day recall period, and this was repeated three days later as part of the final interview. Additional information was obtained on major nonfood expenditures over the previous three months. Data on the physical consumption of food were converted into kcal using conversion factors supplied by Mozambique's Ministry of Health. These were supplemented, where necessary, from other sources (see Datt et al. 2000, p. 18 for a detailed description). As in the Egyptian and Philippine surveys, data on the physical consumption of food were used to tabulate the number of unique foods consumed by all household members; this datum is the measure of dietary diversity used here.

The source of information on Mexico is two rounds of the ENCEL surveys conducted in June and November 1999. These surveys were fielded in 505 rural localities in seven south-central Mexican states: Guerrero, Hidalgo, Michoacan, Puebla, Querataro, San Luis Potosi, and Veracruz. The sample contains approximately 23,000 households, of which about 60 percent received cash benefits as part of the Programa Nacional de Educación, Salud y Alimentación (PROGRESA) program. Food consumption data, obtained for a relatively small number of items (a maximum of 35) over the previous seven days, were then converted to kcal. Dietary diversity was calculated by summing the number of unique foods consumed by the household in this period.[5]

The Bangladesh 1996–1997 household survey data were collected to assess the impact of new agricultural technologies disseminated by several nongovernmental organizations (NGOs) (FCND 2000). Three survey sites were chosen: Saturia (Saturia *thana* in Manikganj district) with commercial vegetable production technology, Jessore (Jessore Sadar *thana* in Jessore district) with group-managed fishponds and Mymensingh (Gaffargaon *thana* in Mymensingh district and Pakundia and Kishoreganj Sadar *thanas* in Kishoreganj district) with individually owned fishponds. At each site, three different types of households were selected: (1) households that were NGO members and adopted new technology in villages where the technology had been disseminated; (2) households that were NGO members, lived in villages where technology was not yet made available, but were likely to adopt the technology when introduced, and (3) a sampling of all other households (non-NGO members and NGO members who had not adopted) in both types of villages. The survey was conducted in four rounds (June-September 1996, October-December 1996, February-May 1997, and June-September 1997) with four-month intervals at each site and covered 955 households and 5,541 individuals in 47 villages. Throughout each round, detailed data were collected both at individual and household levels covering a wide range of issues, such as agricultural production, income, expenditures, education, employment, health and morbidity, anthropometry, recall

[5] See Hoddinott, Skoufias, and Washburn (2000) for a further description.

information on food consumption, and 24-hour food intakes by individuals.[6] Rounds 1 and 4 correspond to the planting of the *Aman* rice crop and are regarded as the lean season. Round 2 took place during the *Aman* harvest and Round 3 in the postharvest period.

The source of information on Egypt is the Egypt Integrated Household Survey (EIHS), a nationwide, multiple-topic household survey conducted between March and May, 1997.[7] The survey was administered to 2,476 households from 20 governorates (covering both urban and rural localities) using a two-stage stratified selection process that ensured that the data were nationally representative. Total household consumption was measured as the sum of total food consumption, total nonfood, nondurable good expenses, the estimated value of durable goods, and the actual or imputed rental value of housing. Food consumption data were obtained for 123 food items over the past seven days and were then converted to kcal. Dietary diversity was calculated by summing the number of unique foods consumed by the household in this seven-day period.

The Mali study was conducted between June 1997 and August 1998 in the Zone Lacustre region.[8] The purpose of this work was to assess food security in this very poor locality and to test different methodologies for assessing food security. As part of this work, 275 households in 10 villages participated in a four-round household survey

[6] The recall periods for food consumption were as follows: for (1) cereals and fish—last three days; (2) pulses, edible oil, and vegetables—last seven days; (3) spices—two weeks (14 days); and (d) animal products, fruits and other foods—last one month. These were converted into the equivalent of seven-day recall data.

[7] See Datt, Jolliffe, and Sharma (1998) for a detailed description.

[8] See Christiaensen (1999) for further details.

covering crop production, nonagricultural activities, assets, food consumption and expenditure, purchases of nonfood items, and coping strategies. Food consumption data were obtained for approximately 70 food items over the past seven days, and this was then converted to kcal equivalents. Dietary diversity was calculated by summing the number of unique foods consumed by the household in this seven-day period.

The Malawi study was conducted in January–February 1998 to assess the income and food-security impact of participation in two rural development projects (Carletto 1999). The study area was located at Central region of Malawi at Kandeu Extension Planning Area. The sampling unit was a farm household with no more than 10 hectares of land. The objectives of the study dictated the selection of households from the list of participants in each of the two projects as well as from the list of households not participating in either project. Nonbeneficiary households for the control group were randomly selected for each beneficiary household in the sample using a “random walk” procedure that is a variant of EPI-cluster sampling method. A total of 708 households were interviewed several weeks before the beginning of harvest. Food consumption data were obtained and converted to kcal. Dietary diversity was calculated by summing the number of unique foods consumed by the household in this seven-day period.

The Accra Urban Food and Nutrition Security Study survey consists of one survey round conducted from January to April 1997(Maxwellet al. 2000). The basic sampling unit for analysis was limited to households with children under age 3 years. Approximately 576 households were surveyed in 16 enumeration areas. Because this was an urban survey, particular care was taken to ensure that food consumption data were obtained on consumption of food prepared outside the household as well as that within it. Data were obtained on 160 food items grouped into 14 food categories consumed over the previous seven days.

The Kenyan data come from the second phase of a series of surveys situated in South Nyanza District, Nyanza Province, where a new sugar factory was constructed in the early 1980s. Households selected for inclusion in the first phase had at least one preschooler, less than 20 hectares of land, and a resident farmer. The second phase supplemented this with families displaced by the creation of the sugar factory and manual workers at the factory. We use data from three rounds of the second phase, running from December 1985 to March 1987. Round 1 corresponds to a preharvest period for crops planted in September for the short rainy season, four months after the long rains crop harvest period. Round 3 was conducted in the postharvest period for crops grown during the long rains. Round 4, fielded in February-March 1987, ended at the start of crop planting period for the long rains. Data were obtained on food items consumed over the previous seven days (Kennedy and Cogill 1987).

From each data set, we extracted the following information: a unique household identifier; a set of variables denoting location; a dummy variable for rural/urban; household size; household per capita consumption; caloric availability from seven-day consumption recall data; and, in the case of the Philippine and Bangladesh surveys, individual 24-hour recall data. In nine surveys, caloric availability was further disaggregated into kcal from staples and from nonstaples.[9] Prior to analysis, the data were checked for outliers, defined as household daily per capita caloric consumption below 1,400 kcal or above 4,500 kcal. There were only a trivial number of such outliers in all surveys except for Mozambique. In that survey, as is standard, respondents were asked to report quantities using physical units that they regarded as being most appropriate. In practice, it proved difficult to convert many of these into metric units. Using the same cutoffs as used in the other surveys would have resulted in a massive loss of sample size. Consequently, for this sample alone we followed the suggestion of Datt et al. (2000) and dropped 665 observations (8 percent of the sample) with household daily per capita caloric availability less than 500 kcal and 1,037 observations (12 percent of the sample) with caloric availability above 5,000 kcal.

These 10 data sets permit a variety of comparisons. The Egyptian and Mozambique surveys allow us to see whether dietary diversity is associated with dimensions of food security in both rural and urban areas. The Philippine and Bangladesh data sets allow us to examine whether the manner in which data on food security are obtained—using seven-day household level data or 24-hour individual recall—affects our findings. The Indian, Bangladesh, and Philippine surveys all provide information on expenditures, caloric acquisition, and dietary diversity at different points throughout the crop year.

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[9] It was not possible to do this with the Indian data.

Table 1 provides some descriptive statistics on these samples. In this table, and throughout this paper, the samples are ordered from those with the lowest to highest levels of mean daily per capita caloric availability. By this measure, the households in the Indian sample are least well-off, followed by the Accra and Bukidnon samples. Note that expressed in terms of the number of unique foods consumed, these poor households appear to enjoy a varied diet, even when compared to better-off households elsewhere. In part, this may be due to differences in questionnaire design, as the number of possible unique foods that could be consumed is also relatively high for these individuals. But also note that nonstaple foods contribute very little in the way of calories in the Philippines, and also in the two Maharashtra villages in the Indian sample (see Chung et al. 1996, p. 77).

3. RESULTS

INTRODUCTION

We now turn to the results of applying the methodologies to the data described in Section 2. We consider, in turn, associations between dietary diversity (number of unique foods) and four indicators of food security: per capita expenditures, caloric availability, caloric availability from staples, and caloric availability from nonstaples. We also consider associations between consumption of unique food groups and these four characteristics. For the latter work, we divided foods into the following categories: country-specific basic staples (e.g., maize in Mozambique, rice in Bangladesh); country

Table 1: Basic descriptive statistics

Country/locality	Survey period	Number of observations	Mean household per capita expenditures in local currency	Mean household per capita expenditures in PPP dollars	Mean daily per capita caloric availability from 7-day consumption recall data	Mean daily per capita caloric availability from *staples* using 7-day consumption recall data	Mean daily per capita caloric availability from *nonstaples* using 7-day consumption recall data	Dietary diversity (number of unique foods consumed)	Dietary diversity (maximum number of unique foods consumed)
India, Round 1	1992-93	321	62	11	1,610			37	77
Round 2	1992-93	308	47	8	1,578			47	78
Round 3	1992-93	308	56	9	1,539			48	74
Pooled	1992-93	937	55	10	1,576			44	78
Ghana (Accra)	1997	558	19,773	45	1,717	1,002	715	39	89
Bukidnon, Philippines, Round 1	1984-85	448	49	10	1,926	1,610	325	34	64
Round 2	1984-85	448	43	9	1,794	1,504	290	33	61
Round 3	1984-85	448	47	9	1,910	1,616	294	33	67
Round 4	1984-85	448	45	9	1,765	1,482	283	33	68
Pooled	1984-85	1,792	46	9	1,849	1,550	298	34	68
Mozambique, Urban	1997	2,023	59,557	20	2,075	1,145	929	15	35
Rural	1997	4,525	37,372	12	2,065	1,084	981	9	30
All	1997	6,548	44,226	14	2,068	1,103	965	11	35
Kenya, Round 1	1985/86	583	60	9	2,306	1,670	636	21	50
Round 3	1986	593	63	9	2,143	1,534	609	19	43
Round 4	1987	587	71	10	2,282	1,663	619	20	41
Pooled	1985-87	1,763	65	9	2,243	1,622	621	20	50
Malawi	1997	706	336	48	2,850	1,599	1,251	10	22
Mali, Round 1	1997	272			2,860	2,663	198	7	17
Round 4	1997	255			2,480	2,203	277	8	18
Mexico, PROGRESA, June	1999	22,229	54	9	2,447	1,849	602	17	35
November	1999	23,248	49	8	2,200	1,559	642	18	35
Pooled		45,477	52	9	2,321	1,699	622	18	35
Bangladesh, Round 1	1996-97	955	160	16	2,310	1,815	495	30	67
Round 2	1996-97	949	144	14	2,225	1,788	441	29	57
Round 3	1996-97	948	171	15	2,503	1,954	563	32	65
Round 4	1996-97	946	170	15	2,453	1,862	599	33	59
Pooled	1996-97	3,798	161	15	2,373	1,854	524	31	67
Egypt, Urban	1997	1,115	56	56	3,474	1,697	1,776	28	58
Rural	1997	1,311	31	31	3,746	2,222	1,525	25	56
Full sample	1997	2,426	43	43	3,611	1,961	1,650	27	58

Source: PPP conversion factors were obtained from WDI 2001 CD-ROM.

Note: Expenditures are on weekly basis.

specific “luxury staples” (e.g., macaroni and *fino* bread in Egypt; breakfast cereal in Mexico); vitamin A- rich roots, tubers, vegetables, and fruits; beans, soya, and other pulses; dairy; fats; sugars; meat, fish, and eggs; other roots and tubers; other fruits; other vegetables; and beverages, spices, and other products. This section focuses on summarizing these results and providing some explanatory notes.

A challenge in presenting these results is summarizing the many measures of association that have been estimated. Applying the four methods described above to assess the association between dietary diversity as measured by the number of unique foods consumed and the number of unique food groups consumed to per capita expenditures, caloric availability, caloric availability from staples, and caloric availability from nonstaples using both a common and nationally specific cutoff for caloric adequacy for the 34 available data sets (recall that for many surveys, we have more than one round, and in some cases we have caloric availability based on both seven-day and 24-hour data) produces more than 1,300 measures of association. The complete set of results, which are found in Appendix 1, are quite lengthy.

In light of this, our discussion focuses on the regression coefficients we obtain when exploring the relationship between dietary diversity and these measures of food security. These coefficients are based on the following regressions:

$$\text{Log } \textit{per capita consumption} = \alpha + \beta\,(\text{Log } \textit{of number of unique foods consumed}) + \textit{“control variables”} + \textit{disturbance term}; \quad (1)$$

$$\text{Log } \textit{per capita caloric availability} = \alpha + \beta\,(\text{Log } \textit{of number of unique foods consumed}) + \textit{“control variables”} + \textit{disturbance term}; \quad (2)$$

$$\text{Log } \textit{per capita caloric availability from staples} = \alpha + \beta \text{ (Log } \textit{of number of unique foods consumed}) + \textit{“control variables”} + \textit{disturbance term}; \qquad (3)$$

$$\text{Log } \textit{per capita caloric availability from nonstaples} = \alpha + \beta \text{ (Log } \textit{of number of unique foods consumed}) + \textit{“control variables”} + \textit{disturbance term}; \qquad (4)$$

and

$$\text{Log } \textit{per capita consumption} = \alpha + \beta \text{ (Log } \textit{of number of unique food groups consumed}) + \textit{“control variables”} + \textit{disturbance term}; \qquad (5)$$

$$\text{Log } \textit{per capita caloric availability} = \alpha + \beta \text{ (Log } \textit{of number of unique food groups consumed}) + \textit{“control variables”} + \textit{disturbance term}; \qquad (6)$$

$$\text{Log } \textit{per capita caloric availability from staples} = \alpha + \beta \text{ (Log } \textit{of number of unique food groups consumed}) + \textit{“control variables”} + \textit{disturbance term}; \qquad (7)$$

$$\text{Log } \textit{per capita caloric availability from nonstaples} = \alpha + \beta \text{ (Log } \textit{of number of unique food groups consumed}) + \textit{“control variables”} + \textit{disturbance term}. \qquad (8)$$

Our decision to focus on the regression results is based on three considerations. First, using any of the methods we described above yields the same pattern of association between dietary diversity and food security. Thus, we do not lose information or mislead in any way if we examine the regression results in detail. Second, an attraction of these results is that the coefficients are readily interpretable in terms of the strength of association. Because we use a “log-log” specification, the coefficients are also elasticities; a coefficient of 0.696 on dietary diversity for urban Mozambique in equation (2) indicates that a 1 percent increase in dietary diversity is associated with a 0.696 percent increase in per capita caloric availability. An urban Mozambican household with dietary diversity 20 percent below the mean has per capita caloric availability 14 percent below the mean.[10] Third, these regressions control for confounding factors such as household size, age and education of head, and location. These controls serve two roles. First, it may be the case that the availability of foods varies by location. Consider two localities, a very poor urban area with access to a wide variety of foods, and a moderately well-off rural area where staples and a handful of nonstaple foods are available. A comparison of mean values might show that the poorer urban locality is characterized by greater dietary diversity and lower caloric availability, with the converse holding in the rural locality. In this simple comparison, it would appear that dietary diversity is inversely related to food security, but such an observation is driven by the availability of different foods. The second role for these controls is to take into account, albeit rather crudely, differences in tastes and preferences. A household with a large number of adults may be more likely to contain individuals with a wider range of tastes; tastes may also vary with age and education. Given these possibilities, an attraction of focusing on the multivariate regressions is that they permit us to explore these associations, controlling for confounding factors such as tastes and physical availability of different foods.[11]

These regression results are summarized in Tables 2 through 9. Appendix 2 provides a visual representation of these findings.

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[10] To see this, multiply 20 percent by 0.696.

[11] Haddad, Kennedy, and Sullivan (1994) correctly point out that regression analysis will be unsatisfactory when outliers in the data exert excessive leverage on the parameter estimates. As a check on these results, we re-estimated these regressions using least absolute deviation (LAD) estimators. Because LAD estimators pass through the median, not the mean, they are not susceptible to the influence of outliers. Doing so produces only trivial differences in the results reported here.

BASIC FINDINGS

Table 2 reports associations between dietary diversity and per capita expenditures, the latter being a measure of access to food—a measure of the population's ability to acquire available food during a given period. The striking feature of Table 2 is that, irrespective of the sample used (and as Appendix 1, Table 14 shows, irrespective of the measure of association employed), there are strong associations recorded between dietary diversity and per capita expenditures.

Table 2: Parameter estimates for association of dietary diversity with per capita expenditures

Survey	Parameter estimate for dietary diversity	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
India, postharvest season (Round 2)	0.390 (3.41)**	1,578	47	78
Mozambique, rural	0.614 (28.68)**	2,065	9	30
India, hungry season (Round 3)	0.619 (2.72)**	1,539	48	74
Mali, hungry season 1998 (Round 4)	0.543 (5.44)**	2,480	8	18
Malawi	0.634 (10.45)**	2,850	10	22
Accra, Ghana	0.654 (10.24)**	1,717	39	89
India, early hungry season (Round 1)	0.661 (7.35)**	1,610	37	77
Mali, hungry season 1997 (Round 1)	0.819 (8.44)**	2,982	9	20
Egypt, urban	0.829 (9.60)**	3,474	28	58
Egypt, rural	0.865 (20.68)**	3,746	25	56
Kenya, hungry season (Round 4)	0.882 (7.55)**	2,282	20	41
Philippines, early hungry season (Round 2)	0.953 (14.63)**	1,794	33	61
Bangladesh, lean season (Round 3)	0.987 (7.52)**	2,503	32	65
Philippines, postharvest season (Round 1)	0.990 (13.11)**	1,926	34	64
Mozambique, urban	1.002 (21.69)**	2,075	15	35
Philippines, hungry season (Round 3)	1.059 (13.34)**	1,910	33	67
Philippines, postharvest season (Round 4)	1.083 (12.80)**	1,765	33	68
Kenya, early hungry season (Round 1)	1.111 (16.55)**	2,306	21	50
Bangladesh, postharvest season (Round 2)	1.161 (19.68)**	2,225	29	57
Bangladesh, lean season (Round 1)	1.203 (19.08)**	2,310	30	67
Kenya, postharvest season (Round 3)	1.250 (7.55)**	2,143	19	43
Mexico, November 1999	1.309 (86.57)**	2,200	18	35
Bangladesh, lean season (Round 4)	1.326 (10.87)**	2,453	33	59
Mexico, June 1999	1.373 (81.80)**	2,447	17	35

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 3 reports associations between dietary diversity and per capita caloric availability, the latter being another measure of access. Across the three survey rounds conducted in this poor, semi-arid region of India, there is no systematic association between dietary diversity and per capita caloric availability. Indeed, sometimes, as in the postharvest period, the association is negative, though poorly measured. However, in the remaining 19 samples, the relationship is positive and statistically significant, though there are variations in the magnitude of this association.

Table 3: Parameter estimates for association of dietary diversity with per capita caloric availability, using seven-day recall data

Survey	Parameter estimate for dietary diversity	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
India, postharvest season (Round 2)	-0.067 (1.31)	1,578	47	78
India, early hungry season (Round 1)	0.036 (0.28)	1,610	37	77
India, hungry season (Round 3)	0.167 (2.20)*	1,539	48	74
Mali, hungry season 1998 (Round 4)	0.342 (3.71)**	2,480	8	18
Philippines, postharvest season (Round 1)	0.367 (6.38)**	1,926	34	64
Mozambique, rural	0.369 (16.66)**	2,065	9	30
Malawi	0.371 (7.48)**	2,850	10	22
Philippines, early hungry season (Round 2)	0.465 (8.58)**	1,794	33	61
Philippines, postharvest season (Round 4)	0.481 (7.67)**	1,765	33	68
Philippines, hungry season (Round 3)	0.545 (9.71)**	1,910	33	67
Accra, Ghana	0.599 (10.74)**	1,717	39	89
Mexico, November 1999	0.605 (39.87)**	2,200	18	35
Mali, hungry season 1997 (Round 1)	0.665 (6.24)**	2,982	9	20
Bangladesh, lean season (Round 1)	0.690 (12.87)**	2,310	30	67
Mozambique, urban	0.695 (20.72)**	2,075	15	35
Egypt, rural	0.707 (18.34)**	3,476	25	56
Egypt, urban	0.709 (15.73)**	3,746	28	58
Bangladesh, postharvest season (Round 2)	0.728 (8.66)**	2,225	29	57
Mexico, June 1999	0.781 (36.63)**	2,447	17	35
Kenya, hungry season (Round 4)	0.879 (8.62)**	2,282	20	41
Kenya, early hungry season (Round 1)	1.036 (14.72)**	2,306	21	50
Kenya, postharvest season (Round 3)	1.152 (16.13)**	2,143	19	43
Bangladesh, lean season (Round 4)	1.222 (8.09)**	2,453	33	59
Bangladesh, lean season (Round 3)	1.321 (6.17)**	2,503	32	65

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 4 reports associations between dietary diversity and per capita caloric availability from staples for all samples except India. Generally, the association is positive and statistically significant. Again, there is considerable variation in the magnitude of these associations, ranging from 0.073 in the case of Mozambique to 1.126 in the case of the postharvest period for the Kenyan sample.

Table 4: Parameter estimates for association of dietary diversity with per capita caloric availability from staples, using seven-day recall data

Survey	Parameter estimate for dietary diversity	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
Mozambique, rural	0.073 (1.82)	2,065	9	30
Philippines, postharvest season (Round 1)	0.184 (2.88)**	1,926	34	64
Mali, hungry season 1998 (Round 4)	0.206 (2.11)**	2,480	8	18
Malawi	0.249 (4.27)**	2,850	10	22
Philippines, early hungry season (Round 2)	0.311 (5.05)**	1,794	33	61
Philippines, postharvest season (Round 4)	0.320 (4.58)**	1,765	33	68
Egypt, urban	0.369 (7.30)**	3,474	28	58
Philippines, hungry season (Round 3)	0.413 (6.94)**	1,910	33	67
Mexico, November 1999	0.423 (24.80)**	2,200	18	35
Bangladesh, lean season (Round 1)	0.469 (7.71)**	2,310	30	67
Egypt, rural	0.487 (9.87)**	3,476	25	56
Mozambique, urban	0.512 (8.75)**	2,075	15	35
Mali, hungry season 1997 (Round 1)	0.580 (5.01)**	2,982	9	20
Bangladesh, postharvest season (Round 2)	0.594 (3.11)**	2,225	29	57
Mexico, June 1999	0.634 (28.97)**	2,447	17	35
Accra, Ghana	0.654 (10.23)**	1,717	39	89
Bangladesh, lean season (Round 3)	0.759 (5.89)**	2,503	32	65
Bangladesh, lean season (Round 4)	0.763 (6.55)**	2,453	33	59
Kenya, hungry season (Round 4)	0.782 (7.11)**	2,282	20	41
Kenya, early hungry season (Round 1)	1.027 (11.73)**	2,306	21	50
Kenya, postharvest season (Round 3)	1.126 (12.27)**	2,143	19	43

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 5 reports associations between dietary diversity and per capita caloric availability from nonstaples for all samples except India. These results are remarkably consistent across all samples (and measures of association—see Appendix 2); increases in dietary diversity are associated with increases in the number of calories consumed from nonstaples. Apart from the Malawi and Accra samples, the magnitude of association is remarkably similar across these diverse samples.

Table 5: Parameter estimates for association of dietary diversity with per capita caloric availability from nonstaples, using seven-day recall data

Survey	Parameter estimate for dietary diversity	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
Malawi	0.663 (7.74)**	2,850	10	22
Accra, Ghana	0.822 (10.86)**	1,717	39	89
Mozambique, rural	1.011 (23.40)**	2,065	9	30
Mexico, November 1999	1.101 (23.40)**	2,200	18	35
Mozambique, urban	1.167 (22.35)**	2,075	15	35
Mali, hungry season 1998 (Round 4)	1.191 (9.60)**	2,480	8	18
Kenya, early hungry season (Round 1)	1.291 (11.26)**	2,306	21	50
Mali, hungry season 1997 (Round 1)	1.308 (8.48)**	2,982	9	20
Mexico, June 1999	1.347 (53.86)**	2,447	17	35
Egypt, urban	1.373 (9.39)**	3,474	28	58
Philippines, postharvest season (Round 4)	1.381 (18.49)**	1,765	33	68
Kenya, post harvest season (Round 3)	1.416 (16.33)**	2,143	19	43
Egypt, rural	1.418 (11.74)**	3,476	25	56
Bangladesh, postharvest season (Round 2)	1.469 (27.71)**	2,225	29	57
Philippines, postharvest season (Round 1)	1.490 (16.38)**	1,926	34	64
Philippines, early hungry season (Round 2)	1.552 (15.20)**	1,794	33	61
Bangladesh, lean season (Round 3)	1.567 (10.84)**	2,503	32	65
Philippines, hungry season (Round 3)	1.583 (14.26)**	1,910	33	67
Kenya, hungry season (Round 4)	1.589 (11.48)**	2,282	20	41
Bangladesh, lean season (Round 1)	1.601 (23.08)**	2,310	30	67
Bangladesh, lean season (Round 4)	1.613 (28.17)**	2,453	33	59

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Tables 6 through 9 provide information on these associations where we use the number of unique food groups, rather than the number of unique foods, as the measure with which we compare to measures of food access. These results are comparable to those reported in Tables 2 through 5 in that they indicate a well-measured association between food groups consumed and per capita consumption and per capita caloric acquisition of nonstaples. As in the results for number of unique foods, there are a number of samples where there is no statistically significant association between food groups consumed and calories from staples. Caloric availability from all foods is associated with consumption if a wider variety of food groups, though there are marked variations across the samples. The magnitudes of these associations are, not surprisingly, larger than those reported for the number of unique foods consumed.

COMPARING ASSOCIATIONS IN URBAN AND RURAL LOCALITIES

Two of our samples, Egypt and Mozambique, have data collected in both urban and rural areas. Table 10 compares the parameter estimates on associations by location.

Table 6: Parameter estimates for association of food groups with per capita consumption

Survey	Parameter estimate for food groups	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
Mali, hungry season 1998 (Round 4)	0.485 (2.58)**	2,480	8	18
Mozambique, rural	0.618 (22.97)**	2,065	9	30
Malawi	0.633 (8.82)**	2,850	10	22
Mali, hungry season 1997 (Round 1)	0.829 (4.97)**	2,982	9	20
Kenya, hungry season (Round 4)	0.860 (5.77)**	2,282	20	41
Egypt, urban	0.874 (6.30)**	3,474	28	58
Mozambique, urban	1.049 (14.55)**	2,075	15	35
Accra, Ghana	1.064 (9.80)**	1,717	39	89
Egypt, rural	1.077 (13.05)**	3,476	25	56
Bangladesh, lean season (Round 3)	1.092 (5.41)**	2,503	32	65
Bangladesh, postharvest season (Round 2)	1.139 (9.10)**	2,225	29	57
Mexico, June 1999	1.225 (61.44)**	2,447	17	35
Mexico, November 1999	1.255 (67.67)**	2,200	18	35
Kenya, postharvest season (Round 3)	1.338 (13.35)**	2,143	19	43
Bangladesh, lean season (Round 1)	1.376 (11.73)**	2,310	30	67
Kenya, early hungry season (Round 1)	1.379 (12.09)**	2,306	21	50
Bangladesh, lean season (Round 4)	1.510 (7.29)**	2,453	33	59
Philippines, hungry season (Round 3)	1.602 (8.92)**	1,910	33	67
Philippines, early hungry season (Round 2)	1.703 (12.15)**	1,794	33	61
Philippines, postharvest season (Round 1)	1.822 (9.90)**	1,926	34	64
Philippines, postharvest season (Round 4)	2.037 (10.66)**	1,765	33	68

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 7: Parameter estimates for association of food groups with per capita caloric availability

Survey	Parameter estimate for food groups	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
Mozambique, rural	0.351 (12.77)**	2,065	9	30
Malawi	0.377 (6.36)**	2,850	10	22
Mali, hungry season 1998 (Round 4)	0.485 (2.58)**	2,480	8	18
Mexico, November 1999	0.551 (29.45)**	2,200	18	35
Philippines, postharvest season (Round 1)	0.587 (4.48)**	1,926	34	64
Philippines, early hungry season (Round 2)	0.715 (5.98)**	1,794	33	61
Mexico, June 1999	0.724 (28.99)**	2,447	17	35
Mozambique, urban	0.728 (13.92)**	2,075	15	35
Philippines, hungry season (Round 3)	0.817 (6.52)**	1,910	33	67
Mali, hungry season 1997 (Round 1)	0.829 (4.98)**	2,982	9	20
Bangladesh, lean season (Round 1)	0.884 (9.18)**	2,310	30	67
Egypt, urban	0.906 (8.84)**	3,474	28	58
Kenya, hungry season (Round 4)	0.931 (6.48)**	2,282	20	41
Accra, Ghana	0.933 (6.08)**	1,717	39	89
Bangladesh, postharvest season (Round 2)	0.933 (5.25)**	2,225	29	57
Egypt, rural	0.958 (13.11)**	3,476	25	56
Philippines, postharvest season (Round 4)	1.023 (6.12)**	1,765	33	68
Kenya, early hungry season (Round 1)	1.209 (9.54)**	2,306	21	50
Kenya, postharvest season (Round 3)	1.315 (11.68)**	2,143	19	43
Bangladesh, lean season (Round 4)	1.763 (5.58)**	2,453	33	59
Bangladesh, lean season (Round 3)	2.214 (5.54)**	2,503	32	65

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 8: Parameter estimates for association of food groups with per capita caloric availability from staples

Survey	Parameter estimate for food groups	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
Mozambique, rural	-0.054 (1.05)	2,065	9	30
Mali, hungry season 1998 (Round 4)	0.129 (1.08)	2,480	8	18
Philippines, postharvest season (Round 1)	0.258 (1.73)	1,926	34	64
Mexico, November 1999	0.334 (17.01)**	2,200	18	35
Egypt, urban	0.340 (3.61)**	3,474	28	58
Philippines, early hungry season (Round 2)	0.424 (3.28)**	1,794	33	61
Mozambique, urban	0.466 (5.22)**	2,075	15	35
Mexico, June 1999	0.557 (22.86)**	2,447	17	35
Egypt, rural	0.569 (6.63)**	3,746	25	56
Philippines, hungry season (Round 3)	0.592 (4.68)**	1,910	33	67
Bangladesh, lean season (Round 1)	0.613 (5.70)**	2,310	30	67
Malawi	0.633 (8.82)**	2,850	10	22
Accra, Ghana	0.652 (4.20)**	1,717	39	89
Mali, hungry season 1997 (Round 1)	0.656 (3.70)**	2,982	9	20
Kenya, hungry season (Round 4)	0.792 (5.19)**	2,282	20	41
Bangladesh, postharvest season (Round 2)	0.820 (1.83)	2,225	29	57
Philippines, postharvest season (Round 4)	0.864 (3.73)**	1,765	33	68
Bangladesh, lean season (Round 4)	0.979 (4.28)**	2,453	33	59
Kenya, early hungry season (Round 1)	1.118 (6.71)**	2,306	21	50
Kenya, postharvest season (Round 3)	1.255 (9.05)**	2,143	19	43
Bangladesh, lean season (Round 3)	1.303 (4.58)**	2,503	32	65

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 9: Parameter estimates for association of food groups with per capita caloric availability from nonstaples, using seven-day recall data

Survey	Parameter estimate for food groups	Mean per capita caloric availability	Mean dietary diversity	Maximum dietary diversity
Malawi	0.632 (6.29)**	2,850	10	22
Mozambique, rural	1.046 (19.43)**	2,065	9	30
Mexico, November 1999	1.174 (49.23)**	2,200	18	35
Mozambique, urban	1.317 (16.10)**	2,075	15	35
Mali, hungry season 1998 (Round 4)	1.396 (6.12)**	2,480	8	18
Mexico, June 1999	1.424 (52.05)**	2,447	17	35
Accra, Ghana	1.531 (8.12)**	1,717	39	89
Mali, hungry season 1997 (Round 1)	1.675 (8.83)**	2,982	9	20
Bangladesh, postharvest season (Round 2)	1.711 (12.05)**	2,225	29	57
Kenya, postharvest season (Round 3)	1.726 (12.13)**	2,143	19	43
Bangladesh, lean season (Round 1)	1.919 (14.41)**	2,310	30	67
Kenya, early hungry season (Round 1)	1.947 (9.47)**	2,306	21	50
Bangladesh, lean season (Round 4)	2.010 (13.48)**	2,453	33	59
Kenya, hungry season (Round 4)	2.120 (9.09)**	2,282	20	41
Bangladesh, lean season (Round 3)	2.182 (5.81)**	2,503	32	65
Egypt, urban	2.220 (7.03)**	3,474	28	58
Egypt, rural	2.280 (9.21)**	3,746	25	56
Philippines, postharvest season (Round 4)	2.623 (12.81)**	1,765	33	68
Philippines, postharvest season (Round 1)	2.645 (11.05)**	1,926	34	64
Philippines, hungry season (Round 3)	2.778 (9.25)**	1,910	33	67
Philippines, early hungry season (Round 2)	2.881 (11.34)**	1,794	33	61

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

Table 10: Comparing measures of association between rural and urban areas

		Parameter estimate on number of unique foods consumed			
Survey	Location	Per capita expenditures	Per capita caloric availability	Per capita calories from staples	Per capita calories from nonstaples
Mozambique					
	Rural	0.614	0.369	0.073	1.011
		(28.68)**	(16.66)**	(1.82)	(23.40)**
	Urban	1.002	0.695	0.512	1.167
		(21.69)**	(20.72)**	(8.75)**	(22.35)**
Egypt					
	Rural	0.865	0.707	0.487	1.418
		(20.68)**	(18.34)**	(9.87)**	(11.74)**
	Urban	0.829	0.709	0.369	1.373
		(9.60)**	(15.73)**	(7.30)**	(9.39)**

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the (log) number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

In Egypt, the richer sample, there is no meaningful difference between the results for rural and urban areas. In Mozambique, the strength of association appears larger in urban localities; in rural areas, it is weaker—and in the case of the association with per capita calories from staples, nonexistent. We return to this feature later.

COMPARING ASSOCIATIONS ACROSS SEASONS

Table 11 compares the parameter estimates on associations by season for four samples: India, Bangladesh, the Philippines, and Kenya. There is some suggestion in these data of seasonal variations. In India, Bangladesh, and the Philippines, the magnitudes of association are higher for per capita caloric availability in the hungry seasons than in the postharvest seasons (compare Rounds 2 and 3 for India, Rounds 2 and 4 for Bangladesh, and Rounds 1 and 3 for the Philippines). This pattern would appear to be driven by differences in associations for staples (compare Rounds 2 and 4 for Bangladesh and Rounds 1 and 3 for the Philippines). One explanation for this could lie in seasonal variations in prices. In the postharvest period, when staples fall in price, it may make sense for households to "stock up" on staples—that is to say, acquiring calories (and body mass) when it is relatively cheap to do so. This argument is consistent with recent work by Dercon and Krishnan (2000), who look at the determinants of adult nutritional status across seasons in rural Ethiopia. They find that body mass rises sharply in the postharvest period when calories are cheap to acquire. However, this pattern does not hold for all comparisons of postharvest and hungry seasons. The opposite pattern is found for the Kenyan sample and there are other periods where the magnitudes of these associations are comparable across seasons in both Bangladesh and the Philippines. This ambiguity in findings may reflect the fact that the "hungry" and "postharvest" seasons are defined relative to the staple crop. Households in these samples grow both staples and other crops and it may be variations in the harvesting of the latter that lead to the absence of a consistent pattern in these estimates.[12]

Table 11: Comparing measures of association across seasons

		Parameter estimate on number of unique foods consumed			
Survey	**Location**	**Per capita expenditures**	**Per capita caloric availability**	**Per capita calories from staples**	**Per capita calories from nonstaples**
India	Postharvest (Round 2)	0.390	-0.067		
		(3.41)**	(1.31)		
	Early hungry (Round 1)	0.661	0.036		
		(7.35)**	(0.28)		
	Hungry (Round 3)	0.619	0.167		
		(2.72)**	(2.20)*		
Bangladesh	Postharvest (Round 2)	1.161	0.728	0.594	1.469
		(19.68)**	(8.66)**	(3.11)**	(27.17)**
	Early hungry (Round 3)	0.987	1.321	0.759	1.567
		(7.52)**	(6.17)**	(5.89)**	(10.84)**
	Hungry (Round 4)	1.326	1.222	0.763	1.613
		(10.87)**	(8.09)**	(6.55)**	(28.17)**
	Hungry (Round 1)	1.203	0.690	0.469	1.601
		(19.08)**	(12.87)**	(7.71)**	(23.08)**
Philippines	Postharvest (Round 4)	1.083	0.197	0.320	1.177
		(12.80)**	(7.39)**	(4.58)**	(25.35)**
	Postharvest (Round 1)	0.990	0.190	0.184	1.124
		(13.11)**	(5.48)**	(2.88)**	(19.95)**
	Early hungry (Round 2)	0.953	0.197	0.311	1.183
		(14.63)**	(6.70)**	(5.05)**	(20.45)**
	Hungry (Round 3)	1.059	0.228	0.413	1.583
		(13.34)**	(7.86)**	(6.94)**	(14.26)**
Kenya	Postharvest (Round 3)	1.250	1.152	1.126	1.416
		(7.55)**	(16.13)**	(12.27)**	(16.33)**
	Early hungry (Round 1)	1.111	1.036	1.027	1.291
		(16.55)**	(14.72)**	(11.73)**	(11.26)**
	Hungry (Round 4)	0.882	0.879	0.782	1.589
		(7.55)**	(8.62)**	(7.11)**	(11.48)**

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the (log) number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

[12] For example, in many parts of Africa, legumes and vegetables are harvested prior to the maize crop.

COMPARING ASSOCIATIONS BY DATA COLLECTION METHOD FOR CALORIC ACQUISITION

Lastly, for two samples—the Philippines and Bangladesh, data on caloric acquisition was obtained in two ways. We have a measure of caloric acquisition at the household level based on seven-day recall information on food consumption. Additionally, we have information on caloric intake by individuals based on 24-hour recall module. This allows us to explore whether our results are sensitive to the manner in which data on caloric acquisition were obtained. These results are reported in Table 12.

There is an unambiguous pattern to these results. There is a statistically significant association between dietary diversity and access to calories from all foods and from nonstaples. An association also exists between individual consumption of calories from staples in the Bangladesh sample but not in the Philippines sample. The magnitudes of these associations are considerably smaller than those for caloric availability at the household level.

4. CONCLUSION

Tables 2–12, together with the appendixes, contain an enormous number of estimates of association between dietary diversity and measures of food security. It is helpful to begin by briefly summarizing these results.

Table 12: Comparing measures of association by data collection method for caloric acquisition

Survey	Location	Parameter estimate on number of unique foods consumed		
		Per capita caloric availability	Per capita calories from staples	Per capita calories from nonstaples
Philippines				
Round 1	7-day recall	0.367	0.184	1.490
		(6.38)**	(2.28)**	(16.38)**
	24-hour recall	0.190	0.084	1.124
		(5.48)**	(1.24)	(19.95)**
Round 2	7-day recall	0.465	0.311	1.552
		(8.58)**	(5.05)**	(15.20)**
	24-hour recall	0.197	0.051	1.183
		(6.70)**	(1.60)	(20.45)**
Round 3	7-day recall	0.545	0.413	1.583
		(9.71)**	(6.94)**	(14.26)**
	24-hour recall	0.228	0.064	1.191
		(7.86)**	(2.05)*	(26.59)**
Round 4	7-day recall	0.481	0.320	1.381
		(7.67)**	(4.58)**	(18.49)**
	24-hour recall	0.197	0.024	1.177
		(7.39)**	(0.82)	(25.35)**
Bangladesh				
Round 1	7-day recall	0.690	0.469	1.601
		(12.87)**	(7.71)**	(23.08)**
	24-hour recall	0.093	0.086	0.150
		(10.20)**	(8.62)**	(11.46)**
Round 2	7-day recall	0.728	0.594	1.469
		(8.66)**	(3.11)**	(27.17)**
	24-hour recall	0.067	0.063	0.117
		(7.54)**	(6.74)**	(8.90)**
Round 3	7-day recall	1.321	0.759	1.567
		(6.17)**	(5.89)**	(10.84)**
	24-hour recall	0.083	0.064	0.123
		(7.53)**	(6.07)**	(9.82)**
Round 4	7-day recall	1.222	0.763	1.613
		(8.09)**	(6.55)**	(28.17)**
	24-hour recall	0.113	0.108	0.155
		(11.49)**	(10.88)**	(12.00)**

Notes: * significant at the 5% level; ** significant at the 1% level. Dietary diversity is the (log) number of unique foods consumed. Control variables are log household size, log age of head, education of head, and location.

- In every sample, there is a well-measured, positive, statistically significant association between dietary diversity and household per capita consumption—a dimension of food security described as access. This result is obtained irrespective of the measures of association used.
- In every sample, there is a well-measured, positive, statistically significant association between dietary diversity and household per capita daily caloric availability from *nonstaples*. The quantity of calories from nonstaples—arguably an indictor of dietary quality—appears to rise with the number of nonstaples consumed.
- In the majority of samples, there is a well-measured, positive, statistically significant association between dietary diversity and household per capita daily caloric availability from *staples*. However, there are exceptions, such as the Philippines in the postharvest period and rural Mozambique, Malawi, and Mali in the 1998 hungry season.
- In the majority of samples, there is a well-measured, positive, statistically significant association between dietary diversity and total household per capita daily caloric availability. But again, there are some exceptions where this relationship is either not statistically significant (as in the three Indian samples) or relatively small in magnitude, as in the Philippines in the postharvest period and rural Mozambique, Malawi, and Mali in the 1998 hungry season.
- These associations appear to be found in both rural and urban areas.

- These associations are generally found across all seasons. Although there are variations in these magnitudes, there does not appear to be a systematic pattern to these variations.
- The measurement of these associations does not depend on the method used to assess these associations (see Appendix 1).
- These associations are also found when using the number of unique food groups consumed as the measure of dietary diversity.
- There is an association between dietary diversity and food access as measured by individual intakes.

Are these results plausible? The associations between dietary diversity and per capita consumption—a proxy for food security access—and calories from nonstaples are consistent with econometric studies showing that the income elasticity for the demand for nonstaple foods is typically considerably higher than that for staples (see Bouis and Novenario-Reese 1997, Alderman and Lindert 1998, and Hoddinott and Skoufias 2000 for recent examples). The mixed evidence on the associations between dietary diversity and caloric acquisition requires a little more detailed explanation.

A good starting point is papers by Subramanian and Deaton (1996), Strauss and Thomas (1995), and Hoddinott, Skoufias, and Washburn (2000). These provide nonparametric estimates of the relationship between caloric acquisition and per capita consumption for rural India, Brazil, and rural Mexico, respectively. One attraction of this approach is that it allows the functional form of this relationship to be data driven, rather than imposed externally by the analyst. In particular, it is possible to see how the consumption-calorie elasticity—how caloric acquisition responds to changes in incomes—evolves as one moves from examining the behavior of poorer to richer households. The households in Strauss and Thomas's Brazil sample are the richest, followed by Hoddinott, Skoufias, and Washburn's Mexican households, with Subramanian and Deaton's Indian households being the poorest. Strauss and Thomas find strong non-linearities in the income-calorie relationship, with elasticities of 0.24–0.33 for households with per capita consumption below the median. Richer households exhibit much lower estimates that fall toward zero. Hoddinott, Skoufias, and Washburn find higher elasticities, around 0.4, with these falling towards 0.2 for the richest deciles. Subramanian and Deaton's work indicate elasticities between 0.3 and 0.5, but with less flattening out at higher values of per capita consumption.

Hoddinott, Skoufias, and Washburn rationalize these findings by appealing to earlier work by Behrman (1988) and Behrman and Deolalikar (1987). The essence of the argument is that at the margin, people select foods for reasons beyond their caloric value. Behrman and Deolalikar (1987) suggest that food variety itself may be valued so that as incomes increase, individuals purchase a wider variety of foods even though this may not affect their caloric intakes very much. This desire for variety is derived from the many characteristics, apart from calories, that different foods possess. These include attributes such as texture, status value, appearance, taste, aroma, and ease of preparation. As a result, below a subsistence constraint, households focus primarily on acquiring additional calories. Once this constraint is met, further increases in income cause the household to move off the subsistence constraint with both calories and dietary diversity increasing.

Meta-regression analysis allows us to explore this possibility more formally.[13] In meta-regression analysis, the dependent variable is a summary statistic drawn from *each* sample. The regression coefficients listed in Table 3 are an example of such a statistic. The independent variables are characteristics of the sample. In our case, we want to determine if variations in mean caloric availability across samples are associated with variations in the magnitude of association between dietary diversity and per capita caloric availability.

The results of our meta-regression analysis are reported in Table 13. Despite the fact that we have just 24 samples for these regressions, they appear to produce a fairly clear finding. Specification (1) shows that the magnitude of the association between dietary diversity and caloric availability at the household level rises with the mean level of caloric availability. Evaluated at the means of the coefficient estimates (0.631) and mean caloric availability (2198), a 1 percent rise in mean caloric availability increases the magnitude of the association by 1.2 percent. We also explored whether this change was linear or whether it leveled off at high levels of caloric availability. Specification (2) adds an interaction term between mean caloric availability and a dummy variable equaling 1 if this mean is in the top quartile of the samples available to us. The negative coefficient on the interaction term shows this flattening effect. Judging by the *t* statistic, this is a well-

[13] See Stanley (2001) for a more detailed introduction to meta-regression analysis.

measured effect, and the *R*2 indicates that the regression accounts for about half of the variation in these coefficients across all samples. The inclusion of a quadratic term shows a similar effect (results not reported). Lastly, as a check on functional form, we re-estimate the model using the log of mean caloric availability. This produces similar results: a rise in 1 percent in mean caloric availability increases the magnitude of the association by 1.3 percent. Note that these results are robust to the inclusion of variables denoting size of sample, mean dietary diversity in sample, maximum dietary diversity in sample, and indicator variables denoting that sample is urban and observed in postharvest period.

To conclude, we find that as a general rule, changes in dietary diversity—as defined as the number of unique foods consumed—are a good indicator of changes in per

Table 13: Meta-regression analysis of the parameter estimates of association between dietary diversity with per capita caloric availability under three specifications

	(1)	(2)	(3)
Mean caloric availability	0.000302	0.000897	-
	(2.22)*	(5.01)**	
Mean caloric availability X	-	-0.000355	-
Dummy variable =1 if mean caloric availability >2,500		(4.49)**	
Log of sample mean caloric availability	-	-	0.825
			(2.61)*
F statistic	4.92*	14.61**	6.83*
Adjusted R2	0.19	0.58	0.19
Number of samples	24	24	24

Notes: * significant at the 5% level; ** significant at the 1% level. Dependent variable is the parameter estimate on dietary diversity as reported in Table 3. Results are robust to the inclusion of quadratic on mean caloric availability, size of sample, mean dietary diversity in sample, maximum dietary diversity in sample and indicator variables denoting that sample is urban and observed in post-harvest period.

capita consumption and per capita caloric acquisition, both "access" measures of household food security. Changes in dietary diversity are associated with changes in the consumption of staples and nonstaples, with the magnitude of this association being higher for nonstaples. This association is observed in both rural and urban locations and in different seasons. It is also observed when dietary diversity is measured as the number of unique food groups consumed. These results are not dependent on the methods used to assess association. We find that dietary diversity is also associated with individual caloric intakes recalled over the previous 24 hours, but that the magnitude of this association is considerably smaller.

These findings indicate that households with low levels of dietary diversity are likely to have low levels of consumption per person and low caloric availability. Further, increases in dietary diversity increases are associated with increases in consumption, caloric availability, and calories from staples and nonstaples. As such, dietary diversity can play a role in identifying the food-insecure, monitoring changes in circumstances, and assessing the impact of interventions. Based on the reasonably large number of data sets available, we can also suggest the magnitudes of these changes. Eliminating the "extreme estimates"—those found in the bottom and top quartiles of the parameter estimates, a 1 percent increase in dietary diversity is associated with households experiencing between a 0.65–1.11 percent increase in per capita consumption, a 0.37–0.73 percent increase in per capita caloric availability, a 0.31–0.76 percent increase in caloric availability from staples, and a 1.17–1.57 percent increase in caloric availability from nonstaples. The meta-regression results indicate that for caloric availability, differences in these estimates are related to the mean level of caloric availability. Lower estimates are more appropriate in populations with relatively low levels of caloric availability; higher estimates are more appropriate in populations with higher levels of caloric availability.

APPENDIX 1

Full results of associations between dietary diversity and food security and between unique food groups and dietary diversity

Table 14: Associations between dietary diversity and per capita consumption

a) India

		Round 1	Round 2	Round 3	Pooled
Pearson correlation coefficient		0.159**	0.318**	0.194**	0.137**
Spearman correlation coefficient		0.336**	0.456**	0.485**	0.257**
Parameter estimate, dietary diversity		0.661	0.390	0.619	0.551
		(7.35)**	(3.41)**	(2.72)**	(7.07)**
Contingency table:	Specificity	0.53	0.50	0.61	0.46
	Sensitivity	0.74	0.75	0.80	0.71
	Chi squared statistic	23.11**	19.77**	52.30**	26.78**

b) Philippines (7-day recall)

		Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient		0.470**	0.519**	0.551**	0.575**	0.530**
Spearman correlation coefficient		0.537**	0.552**	0.587**	0.599**	0.573**
Parameter estimate, dietary diversity		0.990	0.953	1.059	1.083	0.995
		(13.11)**	(14.63)**	(13.34)**	(12.80)**	(26.52)**
Contingency table:	Specificity	0.65	0.70	0.71	0.73	0.70
	Sensitivity	0.75	0.75	0.70	0.69	0.73
	Chi squared statistic	74.72**	89.46**	73.94**	78.99**	327.62**

c) Mozambique

		Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient		0.238**	0.225**	0.280**
Spearman correlation coefficient		0.454**	0.304**	0.378**
Parameter estimate, dietary diversity		1.002	0.614	0.661
		(21.69)**	(28.68)**	(34.35)**
Contingency table:	Specificity	0.71	0.74	0.75
	Sensitivity	0.57	0.48	0.52
	Chi squared statistic	142.91**	195.29**	433.16**

d) Mexico

		June 1999	November 1999	Pooled
Pearson correlation coefficient		0.101**	0.241**	0.117**
Spearman correlation coefficient		0.470**	0.423**	0.445**
Parameter estimate, dietary diversity		1.373	1.309	1.334
		(81.80)**	(86.57)**	(118.21)**
Contingency table:	Specificity	0.61	0.51	0.56
	Sensitivity	0.73	0.77	0.75
	Chi squared statistic	2,630.15**	1,981.08**	4,563.83**

(continued)

Table 14 (continued)

e) Bangladesh (7-day recall)

		Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient		0.358**	0.340**	0.347**	0.340**	0.350**
Spearman correlation coefficient		0.526**	0.511**	0.453**	0.434**	0.488**
Parameter estimate, dietary diversity		1.203	1.161	0.987	1.326	1.095
		(19.08)**	(19.68)**	(7.52)**	(10.87)**	(20.54)**
Contingency table:	Specificity	0.59	0.55	0.56	0.54	0.56
	Sensitivity	0.78	0.76	0.73	0.71	0.78
	Chi squared statistic	134.65**	94.94**	81.39**	60.14**	465.79**

f) Egypt

		Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient		0.339**	0.406**	0.372**
Spearman correlation coefficient		0.497**	0.480**	0.520**
Parameter estimate, dietary diversity		0.829	0.865	0.859
		(9.60)**	(20.68)**	(19.21)**
Contingency table:	Specificity	0.46	0.45	0.45
	Sensitivity	0.87	0.88	0.89
	Chi squared statistic	126.57**	151.28**	296.12**

g) Mali

		Round 1	Round 4	Pooled
Pearson correlation coefficient		0.289**	0.327**	0.254**
Spearman correlation coefficient		0.362**	0.258**	0.284**
Parameter estimate, dietary diversity		0.819	0.543	0.696
		(8.44)**	(5.54)**	(10.72)**
Contingency table:	Specificity	0.51	0.43	0.46
	Sensitivity	0.76	0.66	0.71
	Chi squared statistic	21.59**	2.63**	16.73**

h) Malawi

Pearson correlation coefficient		0.308**
Spearman correlation coefficient		0.384**
Parameter estimate, dietary diversity		0.634
		(10.45)**
Contingency table:	Specificity	0.75
	Sensitivity	0.52
	Chi squared statistic	55.17**

(continued)

Table 14 (continued)

i) Accra

Pearson correlation coefficient		0.142**
Spearman correlation coefficient		0.275**
Parameter estimate, dietary diversity		0.654
		(10.23)**
Contingency table:	Specificity	0.85
	Sensitivity	0.27
	Chi squared statistic	6.71**

j) Kenya (7-day recall)

		Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient		0.305**	0.300**	0.368**	0.312**
Spearman correlation coefficient		0.498**	0.449**	0.416**	0.451**
Parameter estimate, dietary diversity		1.111	1.250	0.882	0.975
		(16.55)**	(19.73)**	(7.55)**	(13.48)**
Contingency table:	Specificity	0.72	0.71	0.75	0.75
	Sensitivity	0.55	0.56	0.58	0.55
	Chi squared statistic	39.84**	40.46**	62.59**	131.98**

Notes: *significant at the 5% level; ** significant at the 1% level. Cutoffs for contingency curves are based on proportion of national population known to be poor. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design. Absolute values of t statistics are in parentheses. To save space, the full contingency tables are not reported. For this reason, it is helpful to provide some additional detail regarding their construction. Contingency tables require cutoffs to be established that place individual households into different cells. Here the cutoffs are based on the proportion of the population who are deemed poor, which is defined as having levels of per capita expenditures below some locally defined minimum subsistence level for the consumption of food and nonfood goods. These cutoffs are applied to the per capita expenditure and dietary diversity data. For example, the four cells for the Egyptian contingency table are households that have per capita expenditures below the poverty line and households that have a level of dietary diversity that puts them in the bottom 20 percent of all households (*specificity*); households that have per capita expenditures below the poverty line but a level of dietary diversity that puts them above the bottom 20 percent of all households; households that have per capita expenditures above the poverty line but a level of dietary diversity that puts them in the bottom 20 percent of all households; and households that have per capita expenditures above the poverty line and households that have a level of dietary diversity that puts them above the bottom 20 percent of all households (*sensitivity*). Thus, cutoffs for contingency tables are based on the percentile below which the household is deemed poor using locally defined poverty line. These percentiles are 36 (India), 50 (Philippines), 69 (Mozambique), 42 (Mexico), 40 (Bangladesh), 20 (Egypt), 48 (Mali), 41 (Malawi), 84 (Accra), and 67 (Kenya).

Table 15: Associations between unique food groups and per capita consumption

a) India

(Food groups are not available)

b) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.442**	0.425**	0.383**	0.395**	0.403**
Spearman correlation coefficient	0.523**	0.518**	0.508**	0.544**	0.523**
Parameter estimate, food groups	1.822	1.703	1.602	2.037	1.766
	(9.90)**	(12.15)**	(8.92)**	(10.66)**	(2.94)**

c) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.167**	0.181**	0.227**
Spearman correlation coefficient	0.359**	0.259**	0.332**
Parameter estimate, food groups	1.049	0.618	0.654
	(14.55)**	(22.97)**	(26.10)**

d) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.115**	0.348**	0.138**
Spearman correlation coefficient	0.522**	0.514**	0.513**
Parameter estimate, food groups	1.225	1.255	1.229
	(61.44)**	(67.67)**	(89.32)**

e) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.252**	0.196**	0.260**	0.226**	0.240**
Spearman correlation coefficient	0.362**	0.345**	0.351**	0.295**	0.351**
Parameter estimate, food groups	1.376	1.139	1.092	1.510	1.219
	(11.73)**	(9.10)**	(5.41)**	(7.29)**	(12.78)**

f) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.152**	0.241**	0.158**
Spearman correlation coefficient	0.281**	0.297**	0.267**
Parameter estimate, food groups	0.874	1.077	0.992
	(6.30)**	(13.05)**	(12.83)**

(continued)

Table 15 (continued)

g) Mali

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.167**			0.177**	0.179**
Spearman correlation coefficient	0.224**			0.118**	0.198**
Parameter estimate, food groups	0.829			0.485	0.628
	(4.97)**			(2.58)**	(5.73)**

h) Malawi

Pearson correlation coefficient	0.302**
Spearman correlation coefficient	0.343**
Parameter estimate, food groups	0.633
	(8.82)**

i) Accra

Pearson correlation coefficient	0.224**
Spearman correlation coefficient	0.346**
Parameter estimate, food groups	1.064
	(9.80)**

j) Kenya (7-day recall)

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.234**	0.201**	0.261**	0.226**
Spearman correlation coefficient	0.387**	0.353**	0.309**	0.351**
Parameter estimate, food groups	1.379	1.338	0.860	1.150
	(12.09)**	(13.35)**	(5.77)**	(10.60)**

Notes: *significant at the 5% level; ** significant at the 1% level. Cutoffs for contingency curves are based on proportion of national population known to be poor. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design. Absolute values of t statistics are in parentheses.

Table 16: Associations between dietary diversity and per capita caloric availability

a) India

	Round 1	Round 2	Round 3	Pooled
Pearson correlation coefficient	-0.095	-0.119*	-0.037	-0.093**
Spearman correlation coefficient	-0.048	-0.039	-0.001	-0.030
Parameter estimate, dietary diversity	0.036	-0.067	0.167	0.035
	(0.28)	(1.31)	(2.20)*	(0.65)
Contingency tables (common caloric requirement)				
Specificity	0.90	0.92	0.91	0.91
Sensitivity	0.09	0.12	0.08	0.08
Chi Squared	0.09	0.35	0.02	0.08
Odds ratio from logistic regression	0.300	-0.940	0.752	-0.124
(common caloric requirement)	(0.47)	(2.60)**	(1.22)	(0.40)
Area under the Receiver –Operator-Curve (common caloric requirement)	0.67	0.79	0.75	0.72
Contingency tables: (national caloric requirement)				
Specificity	0.90	0.89	0.87	0.91
Sensitivity	0.09	0.13	0.12	0.07
Chi Squared	0.056	0.102	0.011	0.264
Odds ratio from logistic regression	0.255	-1.101	0.796	-0.208
(national caloric requirement)	(0.42)	(2.90)**	(1.22)	(0.68)
Area under the Receiver –Operator-Curve (national caloric requirement)	0.658	0.812	0.762	0.730

b) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.253**	0.330**	0.468**	0.408**	0.370**
Spearman correlation coefficient	0.250**	0.333**	0.426**	0.370**	0.348**
Parameter estimate, dietary diversity	0.367	0.465	0.545	0.481	0.471
	(6.38)**	(8.58)**	(9.71)**	(7.67)**	(16.09)**
Contingency tables: (common caloric requirement)					
Specificity	0.83	0.82	0.86	0.83	0.84
Sensitivity	0.28	0.37	0.39	0.42	0.36
Chi squared	6.46**	13.38**	27.91**	20.19**	68.26**
Odds ratio from logistic regression (common caloric requirement)	1.963	3.245	3.380	4.055	1.963
	(4.02)**	(3.81)**	(5.07)**	(5.49)**	(4.02)**
Area under the Receiver-operator-curve (common caloric requirement)	0.73	0.78	0.82	0.82	0.78
Contingency tables: (national caloric requirement)					
Specificity	0.83	0.84	0.86	0.85	0.84
Sensitivity	0.30	0.33	0.41	0.41	0.37
Chi squared	9.698**	11.242**	32.317**	22.088**	72.962**
Odds ratio from logistic regression (national caloric requirement)	2.068	3.38	3.49	4.004	2.911
	(3.94)**	(3.83)**	(5.08)**	(5.36)**	(9.12)**
Area under the Receiver-operator-curve (national caloric requirement)	0.744	0.795	0.821	0.818	0.784

(continued)

Table 16 (continued)

c) Philippines (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.085**	0.182**	0.190**	0.143**	0.161**
Spearman correlation coefficient	0.092**	0.164**	0.192**	0.126**	0.158**
Parameter estimate, dietary diversity	0.190 (5.48)**	0.197 (6.70)**	0.228 (7.86)**	0.197 (7.39)**	0.203 (13.62)**
Contingency tables: (common caloric requirement)					
Specificity	0.69	0.77	0.73	0.70	0.75
Sensitivity	0.38	0.36	0.46	0.39	0.38
Chi squared	10.35**	36.52**	65.53**	17.77**	142.4**
Odds ratio from logistic regression (common caloric requirement)	0.649 (5.07)**	0.897 (5.68)**	1.380 (8.43)**	0.898 (6.29)**	0.923 (12.79)**
Area under the Receiver-operator-curve (common caloric requirement)	0.60	0.62	0.66	0.65	0.63
Contingency tables: (national caloric requirement)					
Specificity	0.69	0.77	0.72	0.70	0.75
Sensitivity	0.38	0.36	0.47	0.40	0.38
Chi squared	12.23**	35.50**	68.36**	18.57**	145.43**
Odds ratio from logistic regression (z statistic in parentheses) (national caloric requirement)	0.672 (5.16)**	0.952 (5.91)**	1.436 (8.53)**	0.915 (6.26)**	0.956 (12.92)**
Area under the Receiver-operator-curve (national caloric requirement)	0.601	0.629	0.661	0.663	0.637

d) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.238**	0.225**	0.280**
Spearman correlation coefficient	0.454**	0.304**	0.378**
Parameter estimate, dietary diversity	0.695 (20.72)**	0.369 (16.66)**	0.422 (22.86)**
Contingency tables: (common caloric requirement)			
Specificity	0.69	0.57	0.61
Sensitivity	0.51	0.45	0.42
Chi squared	70.68**	2.11	8.96**
Odds ratio from logistic regression (common caloric requirement)	2.984 (13.02)**	1.249 (10.67)**	1.463 (15.05)**
Area under the Receiver-operator-curve (common caloric requirement)	0.80	0.79	0.77
Contingency tables: (national caloric requirement)			
Specificity	0.68	0.68	0.67
Sensitivity	0.51	0.35	0.36
Chi squared	66.945**	2.339	6.989**
Odds ratio from logistic regression (national caloric requirement)	3.026 (12.88)**	1.223 (10.32)**	1.468 (14.84)**
Area under the Receiver-operator-curve (national caloric requirement)	0.767	0.805	0.787

(continued)

Table 16 (continued)

e) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.215**	0.169**	0.185**
Spearman correlation coefficient	0.233**	0.195**	0.205**
Parameter estimate, dietary diversity	0.781 (36.63)**	0.605 (39.87)**	0.685 (50.60)**
Contingency tables: (common caloric requirement)			
Specificity	0.59	0.61	0.65
Sensitivity	0.56	0.52	0.48
Chi Squared	445.00**	348.76**	663.85**
Odds ratio from logistic regression (common caloric requirement)	2.360 (31.52)**	2.916 (33.21)**	2.432 (44.38)**
Area under the Receiver – Operator-Curve (common caloric requirement)	0.73	0.78	0.74
Contingency tables: (national caloric requirement)			
Specificity	0.68	0.60	0.64
Sensitivity	0.45	0.52	0.48
Chi Squared	371.82**	297.31**	581.43**
Odds ratio from logistic regression (national caloric requirement)	2.279 (30.03)**	2.914 (31.60)**	2.364 (42.00)**
Area under the Receiver – Operator-Curve (national caloric requirement)	0.733	0.782	0.743

f) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.334**	0.311**	0.249**	0.358**	0.307**
Spearman correlation coefficient	0.348**	0.311**	0.355**	0.310**	0.340**
Parameter estimate, dietary diversity	0.690 (12.87)**	0.728 (8.66)**	1.321 (6.17)**	1.222 (8.09)**	0.998 (10.41)**
Contingency tables: (common caloric requirement)					
Specificity	0.61	0.59	0.62	0.64	0.61
Sensitivity	0.65	0.60	0.60	0.55	0.61
Chi Squared	62.65**	33.18**	46.50**	34.43**	179.01**
Odds ratio from logistic regression (common caloric requirement)	3.665 (9.27)**	3.477 (9.39)**	3.879 (8.99)**	4.442 (10.14)**	3.573 (19.15)**
Area under the Receiver –Operator-Curve (common caloric requirement)	0.76	0.78	0.77	0.79	0.76
Contingency tables: (national caloric requirement)					
Specificity	0.67	0.64	0.63	0.64	0.66
Sensitivity	0.59	0.55	0.60	0.56	0.56
Chi Squared	64.61**	35.13**	50.89**	38.78**	173.71**
Odds ratio from logistic regression (national caloric requirement)	3.66 (9.19)**	3.453 (9.26)**	3.928 (8.99)**	4.50 (10.17)**	3.590 (19.09)**
Area under the Receiver –Operator-Curve (national caloric requirement)	0.768	0.773	0.773	0.787	0.760

(continued)

Table 16 (continued)

g) Bangladesh, 24-hour recall

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.121**	0.106**	0.061**	0.171**	0.105**
Spearman correlation coefficient	0.181**	0.131**	0.097**	0.190**	0.136**
Parameter estimate, dietary diversity	0.093	0.067	0.083	0.113	0.084
	(10.20)**	(7.54)**	(7.53)**	(11.49)**	(17.75)**
Contingency tables: (common caloric requirement)					
Specificity	0.59	0.59	0.58	0.60	0.58
Sensitivity	0.49	0.49	0.48	0.49	0.48
Chi Squared	28.04**	25.30**	13.02**	32.61**	72.44**
Odds ratio from logistic regression (common caloric requirement)	0.305	0.213	0.274	0.312	0.252
	(8.50)**	(5.94)**	(6.73)**	(8.24)**	(14.03)**
Area under the Receiver –Operator-Curve (common caloric requirement)	0.62	0.63	0.64	0.65	0.60
Contingency tables: (national caloric requirement)					
Specificity	0.61	0.61	0.58	0.69	0.60
Sensitivity	0.47	0.47	0.48	0.40	0.46
Chi Squared	28.025**	24.209**	12.70**	27.646**	70.206**
Odds ratio from logistic regression (national caloric requirement)	0.318	0.224	0.274	0.309	0.257
	(8.85)**	(6.24)**	(6.69)	(8.19)**	(14.28)**
Area under the Receiver –Operator-Curve (national caloric requirement)	0.620	0.634	0.638	0.653	0.602

h) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.373**	0.383**	0.353**
Spearman correlation coefficient	0.391**	0.405**	0.380**
Parameter estimate, dietary diversity	0.709	0.707	0.676
	(15.73)**	(18.34)**	(23.57)**
Contingency tables: (common caloric requirement)			
Specificity	0.41	0.39	0.42
Sensitivity	0.85	0.86	0.83
Chi squared	72.05**	80.30**	134.39**
Odds ratio from logistic regression (common caloric requirement)	4.468	3.567	3.804
	(9.90)**	(10.06)**	(14.11)**
Area under the Receiver-operator-curve (common caloric requirement)	0.85	0.83	0.83
Contingency tables: (national caloric requirement)			
Specificity	0.41	0.39	0.44
Sensitivity	0.83	0.83	0.81
Chi squared	70.48**	71.68**	151.49**
Odds ratio from logistic regression (national caloric requirement)	4.593	3.608	3.805
	(10.15)**	(10.71)**	(14.97)**
Area under the Receiver-operator-curve (national caloric requirement)	0.846	0.818	0.822

(continued)

Table 16 (continued)

i) Mali

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.362**			0.187**	0.198**
Spearman correlation coefficient	0.212**			0.146**	0.237**
Parameter estimate, dietary diversity	0.665 (6.24)**			0.342 (3.71)**	0.513 (7.51)**
Contingency tables: (common caloric requirement)					
Specificity	0.50			0.41	0.45
Sensitivity	0.75			0.64	0.70
Chi squared	18.18**			0.69	13.22**
Odds ratio from logistic regression (common caloric requirement)	3.89 (5.97)**			1.213 (2.40)**	2.160 (6.00)**
Area under the Receiver-operator-curve (common caloric requirement)	0.830			0.712	0.754

Note: National caloric requirement is equal to common caloric requirement.

j) Malawi

Pearson correlation coefficient	0.242**
Spearman correlation coefficient	0.223**
Parameter estimate, dietary diversity	0.371 (7.48)**
Contingency tables: (common caloric requirement)	
Specificity	0.43
Sensitivity	0.68
Chi squared	9.045**
Odds ratio from logistic regression (common caloric requirement)	1.458 (5.56)**
Area under the Receiver-operator-curve (common caloric requirement)	0.780
Contingency tables: (national caloric requirement)	
Specificity	0.42
Sensitivity	0.69
Chi squared	8.978**
Odds ratio from logistic regression (national caloric requirement)	1.378 (5.29)**
Area under the Receiver-operator-curve (national caloric requirement)	0.776

(continued)

Table 16 (continued)

k) Accra

	Accra
Pearson correlation coefficient	0.308**
Spearman correlation coefficient	0.320**
Parameter estimate, dietary diversity	0.599 (10.74)**
Contingency tables: (common caloric requirement)	
Specificity	0.85
Sensitivity	0.29
Chi squared	10.273**
Odds ratio from logistic regression (common caloric requirement)	2.201 (5.33)**
Area under the Receiver-operator-curve (common caloric requirement)	0.754
Contingency tables: (national caloric requirement)	
Specificity	0.88
Sensitivity	0.19
Chi squared	2.163
Odds ratio from logistic regression (national caloric requirement)	2.232 (4.77)**
Area under the Receiver-operator-curve (national caloric requirement)	0.752

l) Kenya (7-day recall)

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.309**	0.307**	0.316**	0.312**
Spearman correlation coefficient	0.456**	0.401**	0.410**	0.435**
Parameter estimate, dietary diversity	1.036 (14.72)**	1.152 (16.13)**	0.879 (8.62)**	1.000 (18.52)**
Contingency tables: (common caloric requirement)				
Specificity	0.73	0.70	0.73	0.75
Sensitivity	0.54	0.59	0.53	0.54
Chi squared	42.706**	42.856**	40.616**	142.010**
Odds ratio from logistic regression (common caloric requirement)	4.444 (8.15)**	4.627 (8.10)**	4.940 (8.44)**	4.524 (14.39)**
Area under the Receiver-operator-curve (common caloric requirement)	0.841	0.832	0.841	0.841
Contingency tables: (national caloric requirement)				
Specificity	0.71	0.76	0.78	0.74
Sensitivity	0.53	0.54	0.48	0.54
Chi squared	36.602**	45.249**	41.092**	131.98**
Odds ratio from logistic regression (national caloric requirement)	4.380 (7.92)**	4.769 (7.97)**	5.001 (8.31)**	4.478 (14.12)**
Area under the Receiver-operator-curve (national caloric requirement)	0.842	0.836	0.835	0.828

(continued)

Table 16 (continued)

Notes: * = significant at the 5% level; ** = significant at the 1% level. Absolute value of t statistics is in parentheses for parameter estimates. Z statistics are in parentheses for odds ratios. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design. Contingency tables using a “common caloric requirement” are constructed by assuming that, for each country, a minimum level of utilization is 2,345 kcal per person per day. As is well known, a level of sufficient caloric utilization depends on a person’s age, sex, and levels of physical activity. The figure of 2,345 kcal per person per day corresponds to the caloric needs of a 60 kilogram male, aged 30–59 undertaking “light” activities, such as sitting quietly, with no moving around and no strenuous activity or a 55 kilogram female, aged 30–59, undertaking seated work and limited home production. This minimum was also used to classify households for the logistic regressions that were used in the ROC exercise. Households were further divided into groups based on their level of dietary diversity. Specifically, they were divided based on whether they are above or below the percentile of households considered to be food-insecure as defined by the 2,345 kcal cutoff described above. Centiles for cutoffs for contingency tables based on this requirement are 92 (India), 88 (Philippines, 7-day recall), 76 (Philippines, 24-hour recall), 65 (Mozambique), 60 (Mexico), 56 (Bangladesh, 7-day and 24-hour recall), 23 (Egypt), 48 (Mali), 23 (Malawi), 23 (Accra), and 68 (Kenya). Note that for most countries in the sample, these are virtually identical to the proportions of households deemed to be poor. Contingency tables using a “national caloric requirement” are constructed on the basis of data found in FANTA (1999). These “national caloric requirements” (expressed in kcal per person per day) and centiles for cutoffs for contingency tables based on this requirement are 2,377 kcal and 92, respectively, for India; 2,388 and 82 for the Philippines, 7-day recall, 2,388 and 77 for the Philippines, 24-hour recall, 2,467 kcal and 65 for Mozambique, 2,544 kcal and 60 for Mexico, 2,358 kcal and 57 for Bangladesh, 7-day and 24-hour recall, 2,622 kcal and 23 (Egypt), 2,347 kcal and 48 for Mali, 2,386 and 43 for Malawi, 2,485 and 88 for Accra, and 2,427 and 69 for Kenya.

Table 17: Associations between unique food groups and per capita caloric availability

a) India

(Food groups are not available.)

b) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.188**	0.236**	0.343**	0.315**	0.273**
Spearman correlation coefficient	0.172**	0.257**	0.336**	0.332**	0.274**
Parameter estimate, food groups	0.587 (4.48)**	0.715 (5.98)**	0.817 (6.52)**	1.023 (6.12)**	0.788 (11.29)**
Odds ratio from logistic regression (common caloric requirement)	2.23 (2.12)**	5.395 (3.14)**	4.446 (2.97)**	6.02 (3.63)**	3.870 (5.82)**
Area under the Receiver-operator-curve (common caloric requirement)	0.721	0.764	0.773	0.771	0.743
Odds ratio from logistic regression (national caloric requirements)	2.205 (2.00)*	5.209 (3.21)**	4.848 (3.03)**	6.436 (3.70)**	4.010 (5.81)**
Area under the Receiver-operator-curve (national caloric requirements)	0.727	0.770	0.780	0.772	0.747

c) Philippines (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.088**	0.161**	0.180**	0.122**	0.149**
Spearman correlation coefficient	0.087**	0.143**	0.178**	0.113**	0.143**
Parameter estimate, food groups	0.221 (5.44)**	0.183 (5.62)**	0.237 (7.79)**	0.183 (6.30)**	0.206 (12.66)**
Odds ratio from logistic regression (common caloric requirement)	0.779 (5.12)**	0.944 (5.32)**	1.482 (8.40)**	0.786 (5.00)**	0.972 (11.96)**
Area under the Receiver-operator-curve (common caloric requirement)	0.594	0.619	0.653	0.645	0.627
Odds ratio from logistic regr ession (national caloric requirements)	0.772 (4.96)**	0.998 (5.47)**	1.530 (8.39)**	0.804 (5.01)**	1.00 (11.94)**
Area under the Receiver-operator-curve (national caloric requirements)	0.596	0.624	0.653	0.654	0.632

(continued)

Table 17 (continued)

d) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.186**	0.056**	0.085**
Spearman correlation coefficient	0.223**	0.071**	0.103**
Parameter estimate, food groups	0.728 (13.92)**	0.351 (12.77)**	0.402 (16.66)**
Odds ratio from logistic regression (common caloric requirement)	2.743 (8.680**	1.058 (7.72)**	1.197 (10.340)**
Area under the Receiver-operator-curve (common caloric requirement)	0.766	0.778	0.750
Odds ratio from logistic regression (national caloric requirements)	2.859 (8.65)**	1.034 (7.40)**	1.214 (10.23)**
Area under the Receiver-operator-curve (national caloric requirements)	0.768	0.779	0.751

e) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.167**	0.120**	0.130**
Spearman correlation coefficient	0.176**	0.148**	0.146**
Parameter estimate, food groups	0.724 (28.99)**	0.551 (29.45)**	0.630 (37.92)**
Odds ratio from logistic regression (common caloric requirement)	1.907 (24.79)**	2.451 (25.35)**	1.956 (33.81)**
Area under the Receiver –Operator-Curve (common caloric requirement)	0.721	0.761	0.728
Odds ratio from logistic regression (national caloric requirements)	1.813 (23.05)**	2.443 (23.95)**	1.877 (31.42)**
Area under the Receiver –Operator-Curve (national caloric requirements)	0.720	0.768	0.730

f) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.277**	0.217**	0.218**	0.250**	0.244**
Spearman correlation coefficient	0.271**	0.204**	0.288**	0.195*	0.254**
Parameter estimate, food groups	0.884 (9.18)**	0.933 (5.25)**	2.214 (5.54)**	1.763 (5.58)**	1.519 (7.73)**
Odds ratio from logistic regression (common caloric requirement)	4.368 (6.73)**	3.378 (5.73)**	5.556 (6.61)**	3.808 (5.59)**	3.953 (12.33)**
Area under the Receiver –Operator-Curve (common caloric requirement)	0.724	0.736	0.744	0.735	0.716
Odds ratio from logistic regression (national caloric requirements)	4.405 (6.72)**	3.249 (5.54)**	5.688 (6.62)**	3.901 (5.67)**	3.954 (12.27)**
Area under the Receiver –Operator-Curve (national caloric requirements)	0.732	0.733	0.749	0.736	0.718

(continued)

Table 17 (continued)

g) Bangladesh, 24-hour recall

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.221**	0.136**	0.138**	0.203**	0.169**
Spearman correlation coefficient	0.194**	0.117**	0.105**	0.186**	0.147**
Parameter estimate, food groups	0.475 (12.86)**	0.307 (8.33)**	0.523 (9.95)**	0.425 (10.36)**	0.411 (20.05)**
Odds ratio from logistic regression (common caloric requirement)	1.632 (11.42)**	1.004 (7.02)**	1.847 (9.87)**	1.242 (8.84)**	1.279 (17.89)**
Area under the Receiver –Operator-Curve (common caloric requirement)	0.633	0.638	0.652	0.656	0.611
Odds ratio from logistic regression (national caloric requirements)	1.682 (11.67)**	1.066 (7.40)**	1.837 (9.78)**	1.207 (8.62)**	1.292 (18.01)**
Area under the Receiver –Operator-Curve (national caloric requirements)	0.633	0.639	0.653	0.653	0.611

h) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.239**	0.282**	0.265**
Spearman correlation coefficient	0.255**	0.304**	0.283**
Parameter estimate, food groups	0.906 (8.84)**	0.958 (13.11)**	0.925 (15.49)**
Odds ratio from logistic regression (common caloric requirement)	4.974 (5.89)**	4.375 (8.78)**	4.519 (10.26)**
Area under the Receiver-operator-curve (common caloric requirement)	0.786	0.781	0.774
Odds ratio from logistic regression (national caloric requirements)	4.43 (5.38)**	4.64 (8.74)**	4.443 (10.04)**
Area under the Receiver-operator-curve (national caloric requirements)	0.778	0.778	0.768

i) Mali

	Round 1	Round 4	Pooled
Pearson correlation coefficient	0.167*	0.171**	0.179**
Spearman correlation coefficient	0.220**	0.118**	0.198**
Parameter estimate, food groups	0.829 (4.98)**	0.485 (2.58)**	0.628 (5.73)**
Odds ratio from logistic regression (z statistic in parentheses) (common caloric requirement)	4.448 (5.38)**	1.132 (1.62)	2.375 (4.77)**
Area under the Receiver-operator-curve (common caloric requirement)	0.814	0.706	0.746

Note: National caloric requirement is equal to common caloric requirement.

(continued)

Table 17 (continued)

j) Malawi

Pearson correlation coefficient	0.224**
Spearman correlation coefficient	0.214**
Parameter estimate, food groups	0.377 (6.36)**
Odds ratio from logistic regression (common caloric requirement)	1.586 (5.13)**
Area under the Receiver-operator-curve (common caloric requirement)	0.781
Odds ratio from logistic regression (national caloric requirements)	1.505 (4.91)**
Area under the Receiver-operator-curve (national caloric requirements)	0.778

k) Accra

	Accra
Pearson correlation coefficient	0.329**
Spearman correlation coefficient	0.254**
Parameter estimate, food groups	0.933 (6.08)**
Odds ratio from logistic regression (common caloric requirement)	4.756 (4.11)**
Area under the Receiver-operator-curve (common caloric requirement)	0.739
Odds ratio from logistic regression (national caloric requirements)	5.535 (4.07)**
Area under the Receiver-operator-curve (national caloric requirements)	0.736

l) Kenya

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.237**	0.229**	0.270**	0.247**
Spearman correlation coefficient	0.370**	0.346**	0.349**	0.363**
Parameter estimate, food groups	1.209 (9.54)**	1.315 (11.68)**	0.931 (6.48)**	1.108 (11.80)**
Odds ratio from logistic regression (common caloric requirement)	5.569 (7.61)**	4.774 (6.35)**	5.335 (6.73)**	5.01 (11.76)**
Area under the Receiver-operator-curve (common caloric requirement)	0.799	0.790	0.804	0.828
Odds ratio from logistic regression (national caloric requirements)	5.389 (7.22)**	4.951 (6.09)**	5.711 (6.79)**	5.109 (11.36)**
Area under the Receiver-operator-curve (national caloric requirements)	0.799	0.794	0.800	0.789

(continued)

Table 17 (continued)

Notes: * = significant at the 5% level; ** = significant at the 1% level. Absolute value of t statistics is in parentheses for parameter estimates. Z statistics are in parentheses for odds ratios. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design. "Common caloric requirement" is 2,345 kcal per person per day. Centiles for cutoffs for contingency tables based on this requirement are 92 (India), 88 (the Philippines, 7-day recall), 76 (the Philippines, 24-hour recall), 65 (Mozambique), 60 (Mexico), 56 (Bangladesh, 7-day and 24-hour recall), 23 (Egypt), 48 (Mali), 23 (Malawi), 23 (Accra), and 68 (Kenya). "National caloric requirement" (expressed in kcal per person per day) and centiles for cutoffs for contingency tables based on this requirement are 2,377 kcal and 92 respectively for India, 2,388 and 82 for the Philippines, 7-day recall, 2,388 and 77 for the Philippines, 24-hour recall, 2,467 kcal and 65 for Mozambique, 2,544 kcal and 60 for Mexico, 2,358 kcal and 57 for Bangladesh, 7-day and 24-hour recall, 2,622 kcal and 23 for Egypt, 2,347 kcal and 48 for Mali, 2,386 and 43 for Malawi, 2,485 and 88 for Accra, and 2,427 and 69 for Kenya.

Table 18: Associations between dietary diversity and per capita caloric availability from staples

a) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.097*	0.203**	0.385**	0.260**	0.244**
Spearman correlation coefficient	0.093*	0.202**	0.309**	0.242**	0.212**
Parameter estimate, dietary diversity	0.184	0.311	0.413	0.320	0.315
	(2.88)**	(5.05)**	(6.94)**	(4.58)**	(9.67)**

b) Philippines (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	-0.028	0.042*	0.037	-0.009	0.023*
Spearman correlation coefficient	-0.021	0.036	0.055**	-0.009	0.028**
Parameter estimate, dietary diversity	0.084	0.051	0.064	0.024	0.045
	(1.24)	(1.60)	(2.05)*	(0.82)	(2.81)**

c) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.074**	-0.039**	0.017
Spearman correlation coefficient	0.163**	0.016	0.093**
Parameter estimate, dietary diversity	0.512	0.073	0.158
	(8.75)**	(1.82)	(4.90)**

d) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.146**	0.093**	0.111**
Spearman correlation coefficient	0.158**	0.110**	0.123**
Parameter estimate, dietary diversity	0.634	0.423	0.515
	(28.97)**	(24.80)**	(36.30)**

e) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.188**	0.166**	0.153**	0.204**	0.173**
Spearman correlation coefficient	0.190**	0.162**	0.228**	0.151**	0.184**
Parameter estimate, dietary diversity	0.469	0.594	0.759	0.763	0.646
	(7.71)**	(3.11)**	(5.89)**	(6.55)**	(9.53)**

f) Bangladesh (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.096**	0.089**	0.023	0.148**	0.078**
Spearman correlation coefficient	0.139**	0.096**	0.050**	0.157**	0.095**
Parameter estimate, dietary diversity	0.086	0.063	0.064	0.108	0.076
	(8.62)**	(6.74)**	(6.07)**	(10.88)**	(15.54)**

(continued)

Table 18 (continued)

g) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.153**	0.239**	0.148**
Spearman correlation coefficient	0.135**	0.254**	0.156**
Parameter estimate, dietary diversity	0.369	0.487	0.391
	(7.30)**	(9.87)**	(11.12)**

h) Mali

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.173**			0.109	0.149**
Spearman correlation coefficient	0.226**			0.077	0.169**
Parameter estimate, dietary diversity	0.580			0.206	0.410
	(5.01)**			(2.11)**	(5.40)**

i) Malawi

Pearson correlation coefficient	0.151**
Spearman correlation coefficient	0.155**
Parameter estimate, dietary diversity	0.249
	(4.27)**

j) Accra

Pearson correlation coefficient	0.202**
Spearman correlation coefficient	0.237**
Parameter estimate, dietary diversity	0.654
	(10.23)**

k) Kenya

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.237**	0.229**	0.244*	0.238**
Spearman correlation coefficient	0.389**	0.337**	0.341**	0.372**
Parameter estimate, dietary diversity	1.027	1.126	0.782	0.952
	(11.73)**	(12.27)**	(7.11)**	(14.97)**

Notes: * = significant at the 5% level; ** = significant at the 1% level. Absolute value of t statistics is in parentheses for parameter estimates. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design.

Table 19: Associations between unique food groups and per capita caloric availability from staples

a) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.049	0.126**	0.274**	0.206**	0.169**
Spearman correlation coefficient	0.021	0.136**	0.233**	0.219**	0.151**
Parameter estimate, unique foods	0.258	0.424	0.592	0.864	0.543
	(1.73)	(3.28)**	(4.68)**	(3.73)**	(6.49)**

b) Philippines (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	-0.027	0.035	0.036	-0.007	0.020*
Spearman correlation coefficient	-0.03	0.024	0.049*	-0.009	0.019
Parameter estimate, unique foods	0.064	0.037	0.075	0.029	0.051
	(1.47)	(1.09)	(2.27)*	(0.90)	(2.93)**

c) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.021	-0.038*	0.0002
Spearman correlation coefficient	0.107**	0.01	0.08**
Parameter estimate, unique foods	0.466	-0.054	0.049
	(5.22)**	(1.05)	(1.13)

d) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.095**	0.042**	0.051**
Spearman correlation coefficient	0.096**	0.057**	0.058**
Parameter estimate, unique foods	0.557	0.334	0.432
	(22.86)**	(17.01)**	(26.49)**

e) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.174**	0.10**	0.133**	0.143**	0.140**
Spearman correlation coefficient	0.153**	0.084**	0.201**	0.10**	0.141**
Parameter estimate, unique foods	0.613	0.820	1.303	0.979	0.923
	(5.70)**	(1.83)	(4.58)**	(4.28)**	(5.72)**

f) Bangladesh (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.150**	0.085**	0.044**	0.143**	0.097**
Spearman correlation coefficient	0.131**	0.065**	0.011**	0.130**	0.077**
Parameter estimate, unique foods	0.394	0.220	0.338	0.347	0.311
	(8.90)**	(5.78)**	(7.25)**	(8.73)**	(14.86)**

(continued)

Table 19 (continued)

g) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.110**	0.189**	0.157**
Spearman correlation coefficient	0.104**	0.219**	0.170**
Parameter estimate, unique foods	0.340	0.569	0.463
	(3.61)**	(6.63)**	(7.16)**

h) Mali

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.125*			0.107	0.131**
Spearman correlation coefficient	0.155*			0.047	0.129**
Parameter estimate, unique foods	0.656			0.129	0.401
	(3.70)**			(1.08)	(3.91)**

i) Malawi

Pearson correlation coefficient	0.158**
Spearman correlation coefficient	0.162**
Parameter estimate, unique foods	0.633
	(8.82)**

j) Accra

Pearson correlation coefficient	0.177**
Spearman correlation coefficient	0.123**
Parameter estimate, unique foods	0.652
	(4.20)**

k) Kenya

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.174**	0.181**	0.219**	0.192**
Spearman correlation coefficient	0.319**	0.296**	0.291**	0.313
Parameter estimate, unique foods	1.118	1.255	0.792	0.999
	(6.71)**	(9.05)**	(5.19)**	(9.45)**

Notes: * = significant at the 5% level; ** = significant at the 1% level. Absolute value of t statistics is in parentheses for parameter estimates. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design.

Table 20: Associations between dietary diversity and per capita caloric availability from nonstaples

a) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.496**	0.524**	0.539**	0.630**	0.543**
Spearman correlation coefficient	0.594**	0.601**	0.629**	0.624**	0.614**
Parameter estimate, dietary diversity	1.490	1.552	1.583	1.381	1.490
	(16.38)**	(15.20)**	(14.26)**	(18.49)**	(31.06)**

b) Philippines (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.321**	0.411**	0.457**	0.434**	0.407**
Spearman correlation coefficient	0.411**	0.468**	0.517**	0.500**	0.486**
Parameter estimate, dietary diversity	1.124	1.183	1.191	1.177	1.168
	(19.95)**	(20.45)**	(26.59)**	(25.35)**	(45.66)**

c) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.348**	0.152**	0.167**
Spearman correlation coefficient	0.430**	0.274**	0.257**
Parameter estimate, dietary diversity	1.167	1.011	0.992
	(22.35)**	(23.40)**	(29.58)**

d) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.322**	0.280**	0.303**
Spearman correlation coefficient	0.361**	0.325**	0.345**
Parameter estimate, dietary diversity	1.347	1.101	1.227
	(53.86)**	(57.99)**	(76.34)**

e) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.525**	0.511**	0.404**	0.413**	0.460**
Spearman correlation coefficient	0.570**	0.591**	0.533**	0.540**	0.574**
Parameter estimate, dietary diversity	1.601	1.469	1.567	1.613	1.496
	(23.08)**	(27.17)**	(10.84)**	(28.17)**	(28.56)**

f) Bangladesh (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.122**	0.113**	0.130**	0.147**	0.125**
Spearman correlation coefficient	0.238**	0.219**	0.184**	0.221**	0.205**
Parameter estimate, dietary diversity	0.150	0.117	0.123	0.155	0.134
	(11.46)**	(8.90)**	(9.82)**	(12.00)**	(20.86)**

(continued)

Table 20 (continued)

g) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.417**	0.441**	0.442**
Spearman correlation coefficient	0.488**	0.512**	0.518**
Parameter estimate, dietary diversity	1.373	1.418	1.378
	(9.39)**	(11.74)**	(14.91)**

h) Mali

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.290**			0.367**	0.318**
Spearman correlation coefficient	0.519**			0.381**	0.463**
Parameter estimate, dietary diversity	1.308			1.191	1.312
	(8.48)**			(9.60)**	(14.47)**

i) Malawi

Pearson correlation coefficient	0.213**
Spearman correlation coefficient	0.241**
Parameter estimate, dietary diversity	0.663
	(7.74)**

j) Accra

Pearson correlation coefficient	0.299**
Spearman correlation coefficient	0.359**
Parameter estimate, dietary diversity	0.822
	(10.86)**

k) Kenya

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.337**	0.338**	0.292**	0.319**
Spearman correlation coefficient	0.487**	0.442**	0.474**	0.468
Parameter estimate, dietary diversity	1.291	1.416	1.589	1.407
	(11.26)**	(16.33)**	(11.48)**	(21.21)**

Notes: * = significant at the 5% level; ** = significant at the 1% level. Absolute value of t statistics is in parentheses for parameter estimates. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design.

Table 21: Associations between unique food groups and per capita caloric availability from nonstaples

a) Philippines (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.430**	0.431**	0.422**	0.470**	0.435**
Spearman correlation coefficient	0.531**	0.519**	0.525**	0.534**	0.528**
Parameter estimate, unique foods	2.645	2.881	2.778	2.623	2.731
	(11.05)**	(11.34)**	(9.25)**	(12.81)**	(20.98)**

b) Philippines (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled sample
Pearson correlation coefficient	0.324**	0.370**	0.427**	0.368**	0.378**
Spearman correlation coefficient	0.405**	0.424**	0.487**	0.462**	0.454**
Parameter estimate, unique foods	1.247	1.103	1.183	1.105	1.156
	(18.07)**	(17.00)**	(23.49)**	(22.23)**	(39.86)**

c) Mozambique

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.258**	0.121**	0.120**
Spearman correlation coefficient	0.343**	0.228**	0.213**
Parameter estimate, unique foods	1.317	1.046	1.034
	(16.10)**	(19.43)**	(23.17)**

d) Mexico

	June 1999	November 1999	Pooled
Pearson correlation coefficient	0.317**	0.259**	0.293**
Spearman correlation coefficient	0.357**	0.312**	0.338**
Parameter estimate, unique foods	1.424	1.174	1.310
	(52.05)**	(49.23)**	(69.52)**

e) Bangladesh (7-day recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.393**	0.358**	0.295**	0.251**	0.325**
Spearman correlation coefficient	0.415**	0.434**	0.391**	0.329**	0.419**
Parameter estimate, unique foods	1.919	1.711	2.182	2.010	1.914
	(14.41)**	(12.05)**	(5.81)**	(13.48)**	(13.52)**

f) Bangladesh (24-hour recall)

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.288**	0.255**	0.310**	0.271**	0.288**
Spearman correlation coefficient	0.300**	0.263**	0.308**	0.287**	0.297**
Parameter estimate, unique foods	0.927	0.829	0.946	0.785	0.846
	(15.96)**	(13.69)**	(17.24)**	(15.21)**	(30.57)**

(continued)

Table 21 (continued)

g) Egypt

	Urban subsample	Rural subsample	Pooled sample
Pearson correlation coefficient	0.259**	0.307**	0.280**
Spearman correlation coefficient	0.304**	0.339**	0.317**
Parameter estimate, unique foods	2.22	2.28	2.25
	(7.03)**	(9.21)**	(11.52)**

h) Mali

	Round 1	Round 2	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.294**			0.308**	0.304**
Spearman correlation coefficient	0.463**			0.382**	0.436**
Parameter estimate, unique foods	1.675			1.396	1.578
	(8.83)**			(6.12)**	(11.65)**

i) Malawi

Pearson correlation coefficient	0.178**
Spearman correlation coefficient	0.210**
Parameter estimate, unique foods	0.632
	(6.29)**

j) Accra

Pearson correlation coefficient	0.364**
Spearman correlation coefficient	0.366**
Parameter estimate, unique foods	1.531
	(8.12)**

k) Kenya

	Round 1	Round 3	Round 4	Pooled
Pearson correlation coefficient	0.274**	0.229**	0.233**	0.244**
Spearman correlation coefficient	0.421**	0.379**	0.404**	0.401
Parameter estimate, unique foods	1.947	1.726	2.120	1.920
	(9.47)**	(12.13)**	(9.09)**	(16.57)**

Notes: * = significant at the 5% level; ** = significant at the 1% level. Absolute value of t statistics is in parentheses for parameter estimates. Regressions control for log household size, log age of household head, education of head, location, and survey round. Standard errors are robust to cluster survey design.

APPENDIX 2

Associations between dietary diversity and food security and between unique food groups and dietary diversity: Figures

Figure 1: Elasticities of association between dietary diversity and per capita consumption

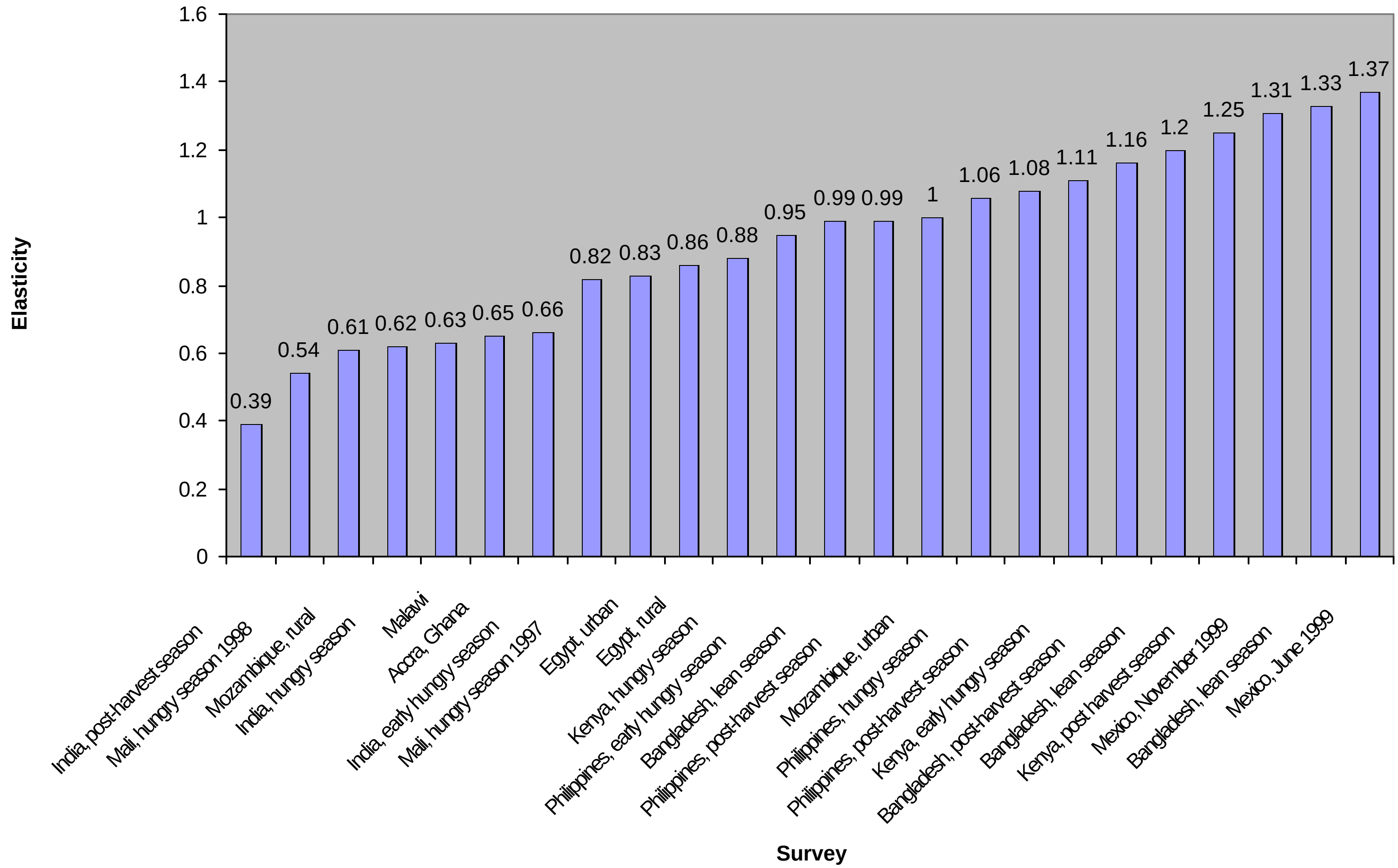


Figure 2: Elasticities of association between dietary diversity and per capita caloric availability

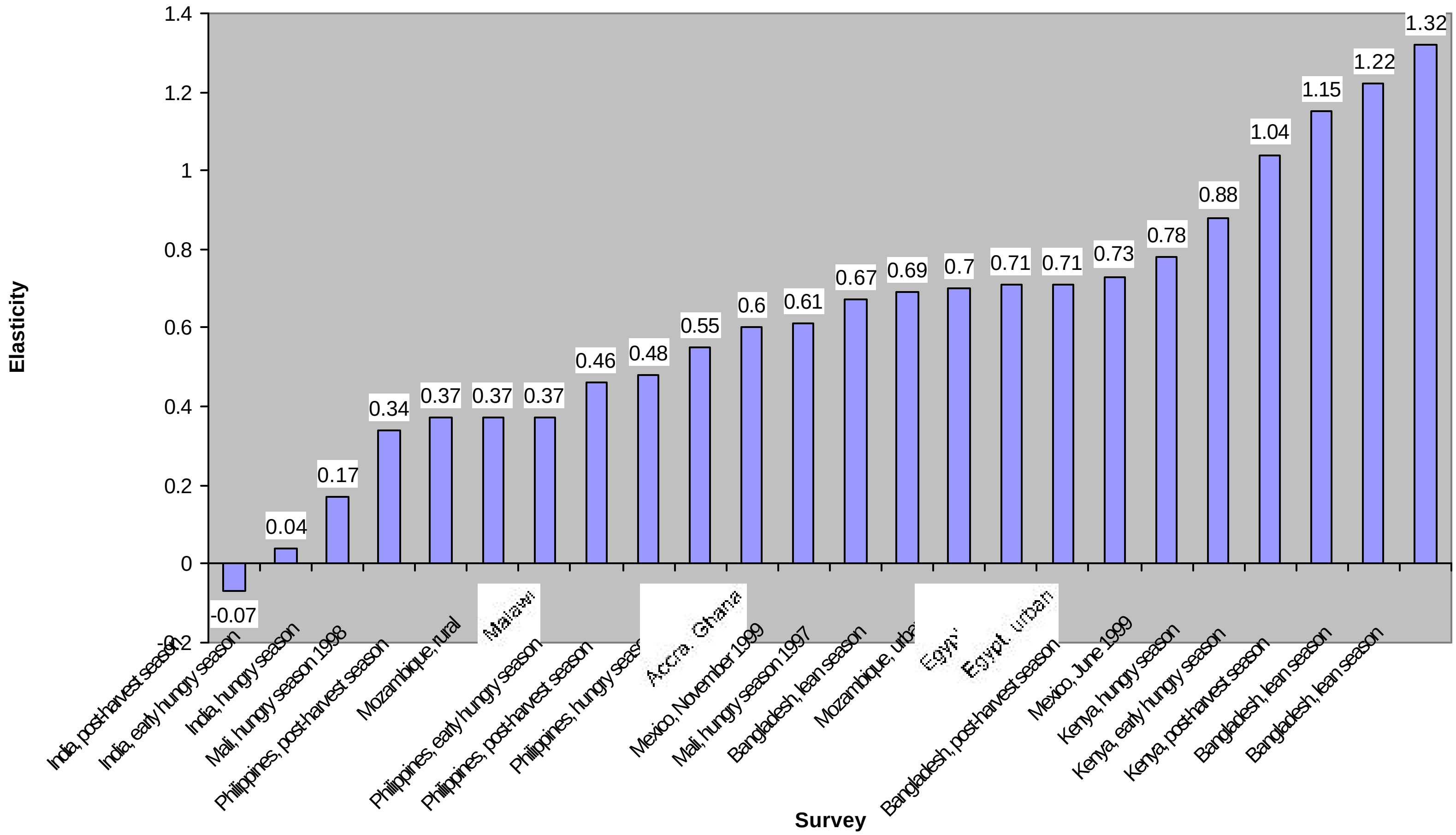


Figure 3: Elasticities of association between dietary diversity and per capita caloric acquisition of staples

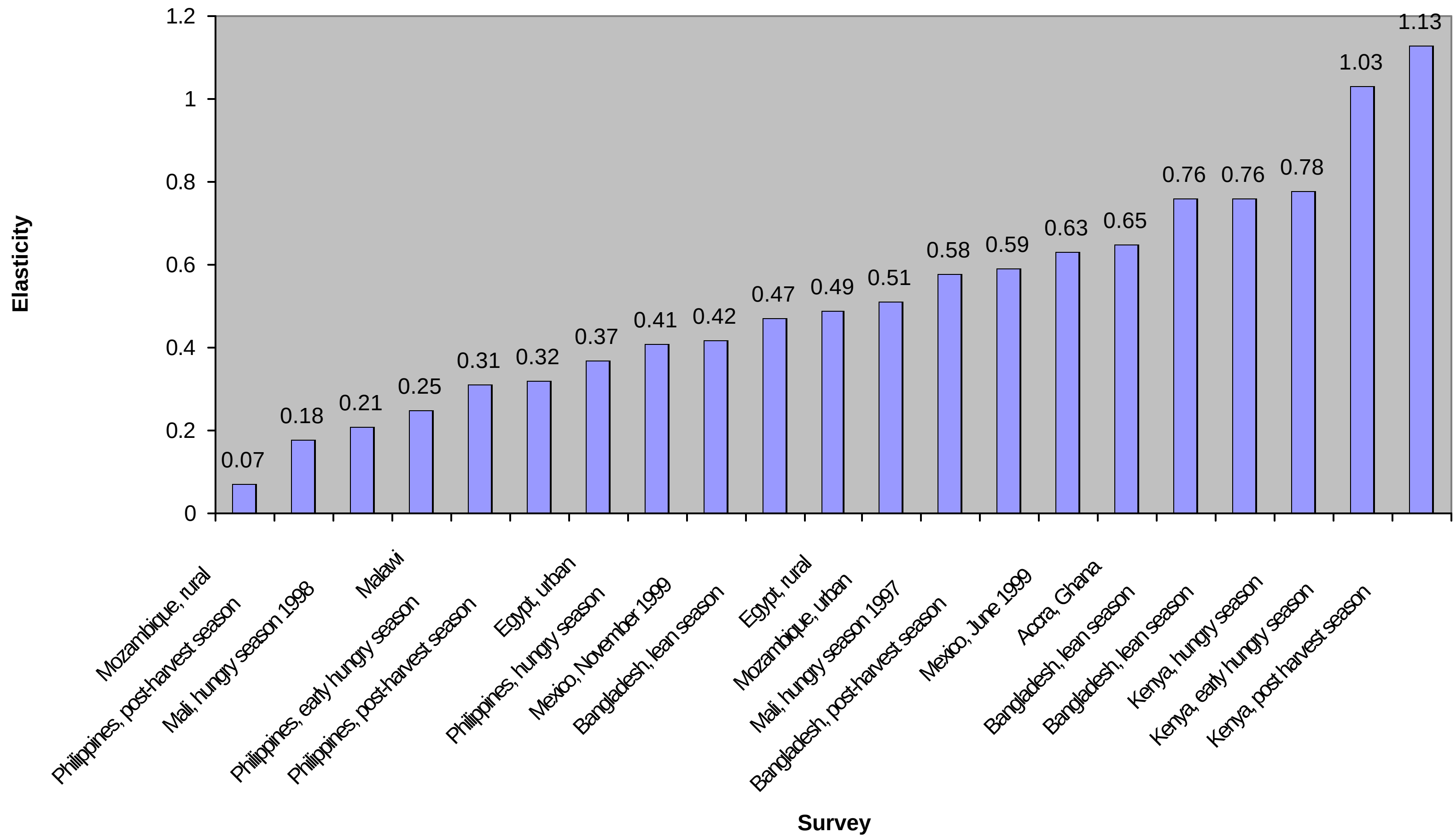


Figure 4: Elasticities of association between dietary diversity and per capita consumption of non-staples

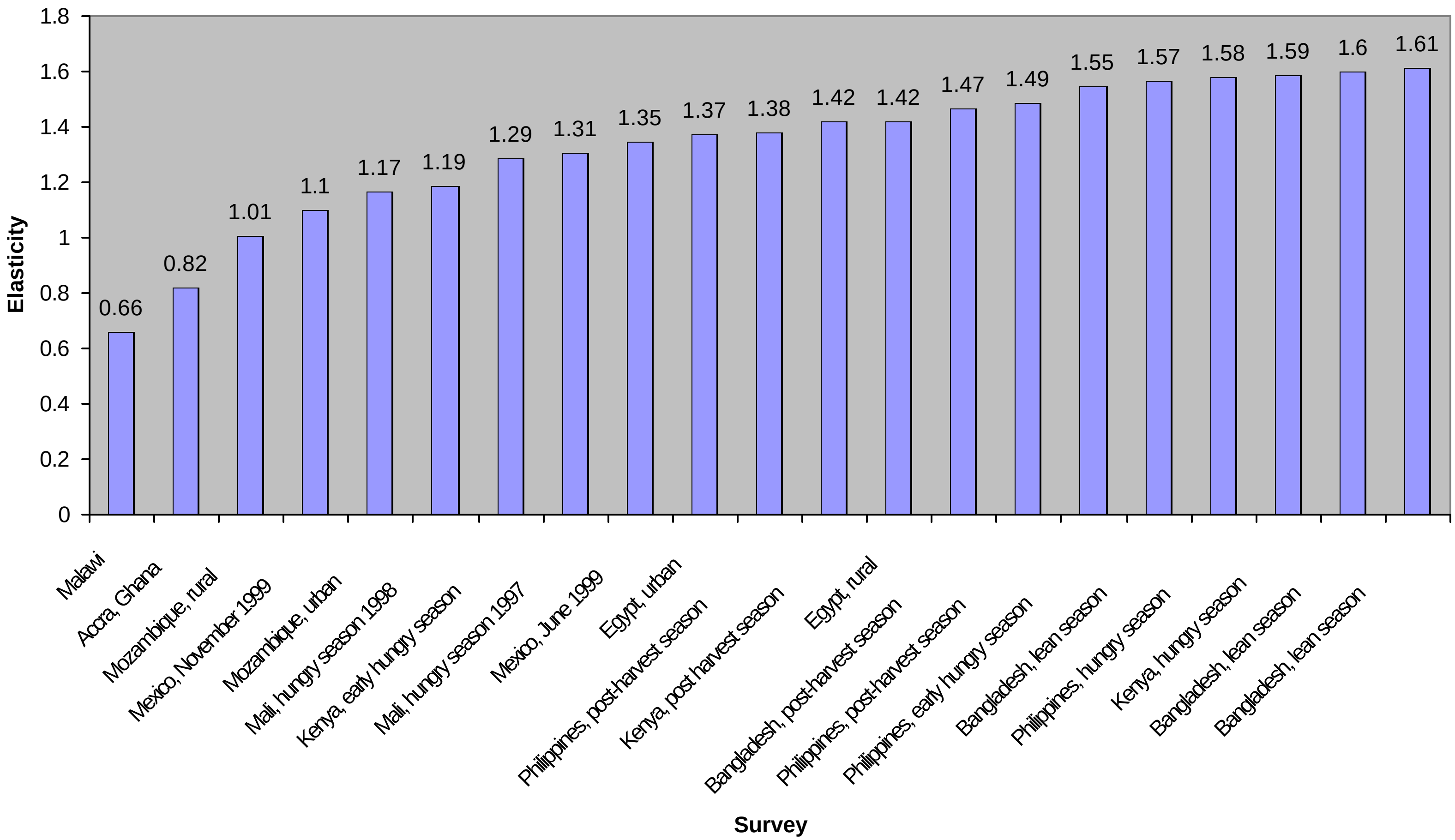


Figure 5: Elasticities of association between food groups and per capita consumption

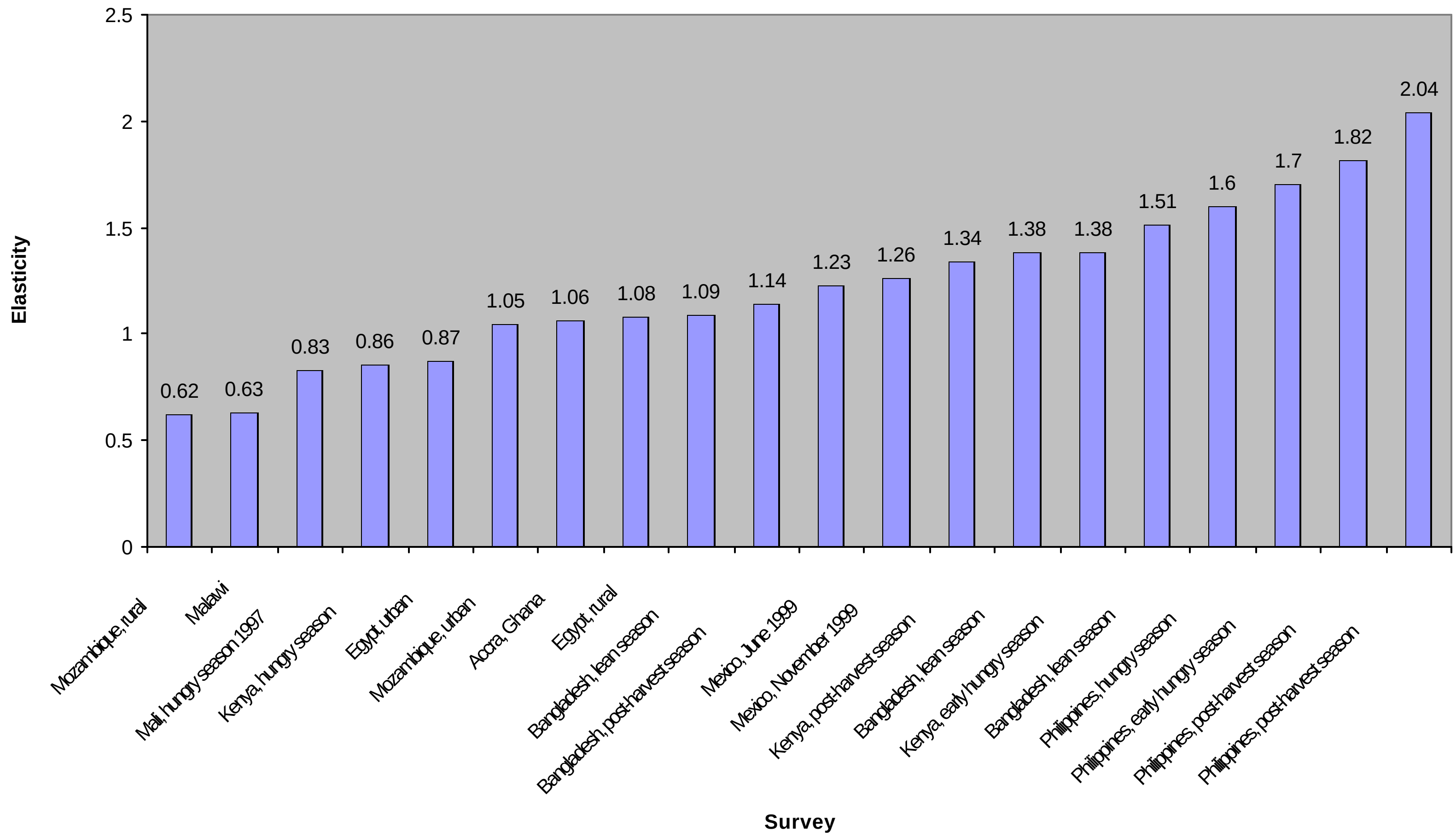


Figure 6: Elasticities of association between food groups and per capita caloric acquisition

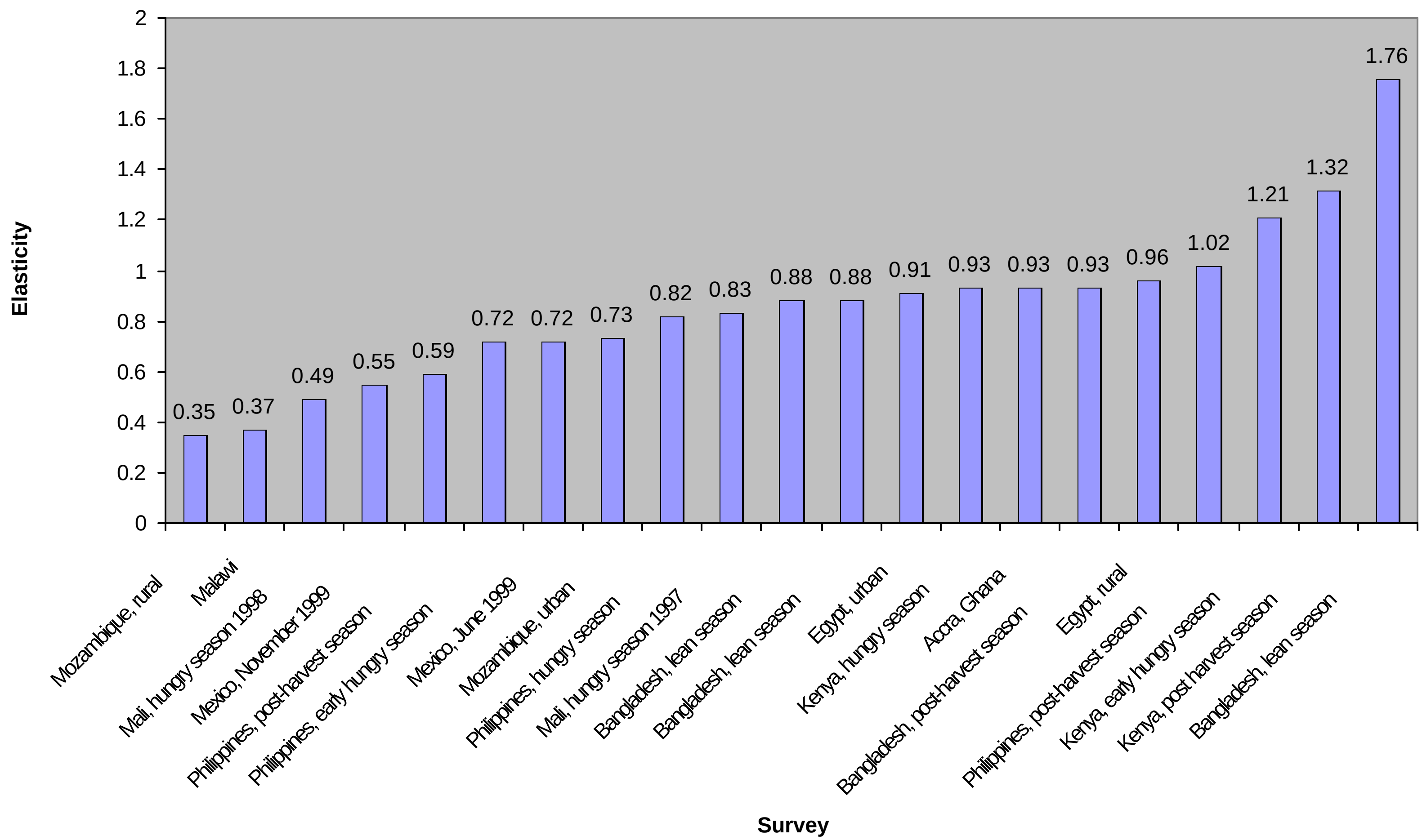


Figure 7: Elasticities of association between food groups and per capita caloric availability from staples

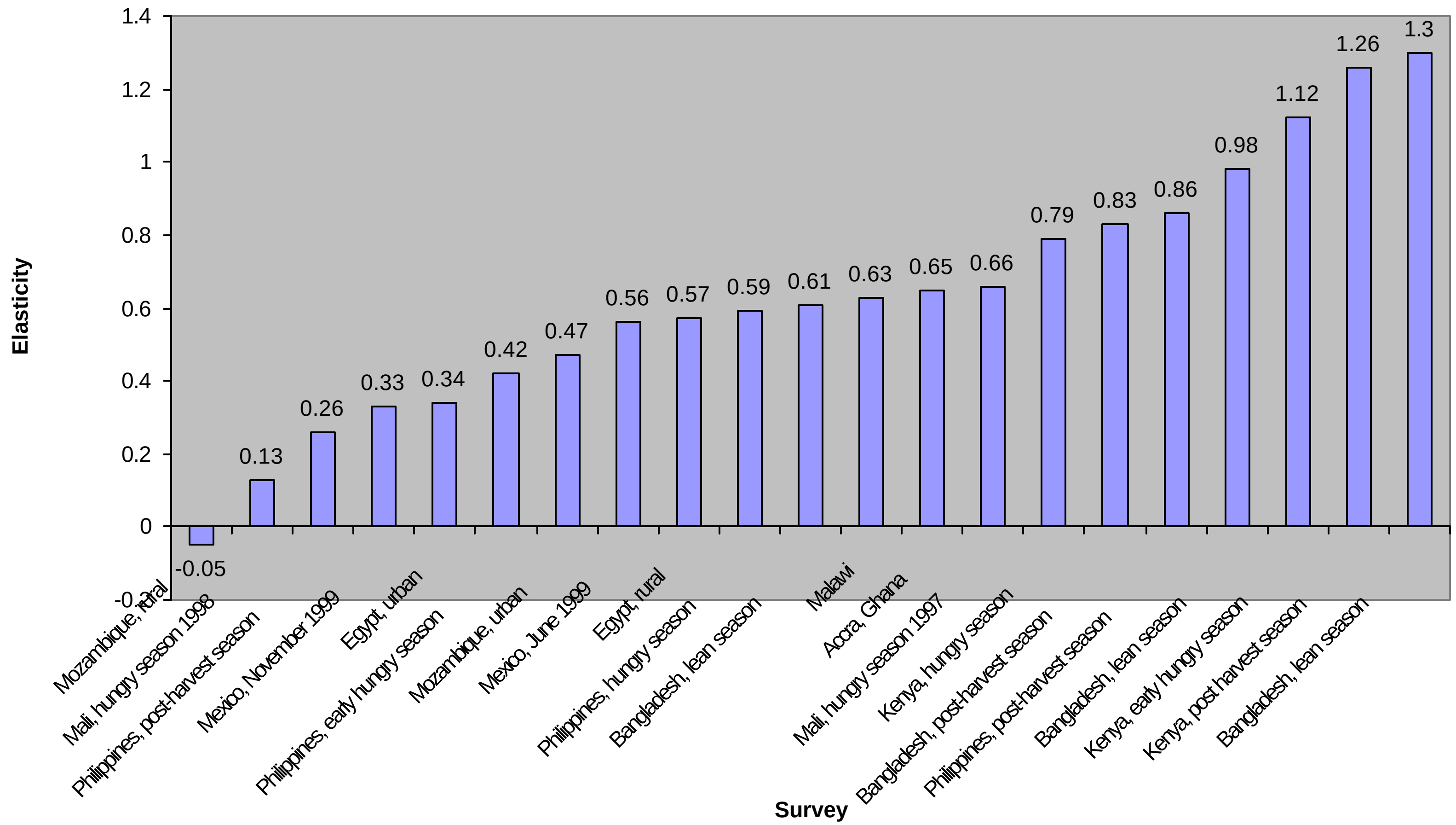
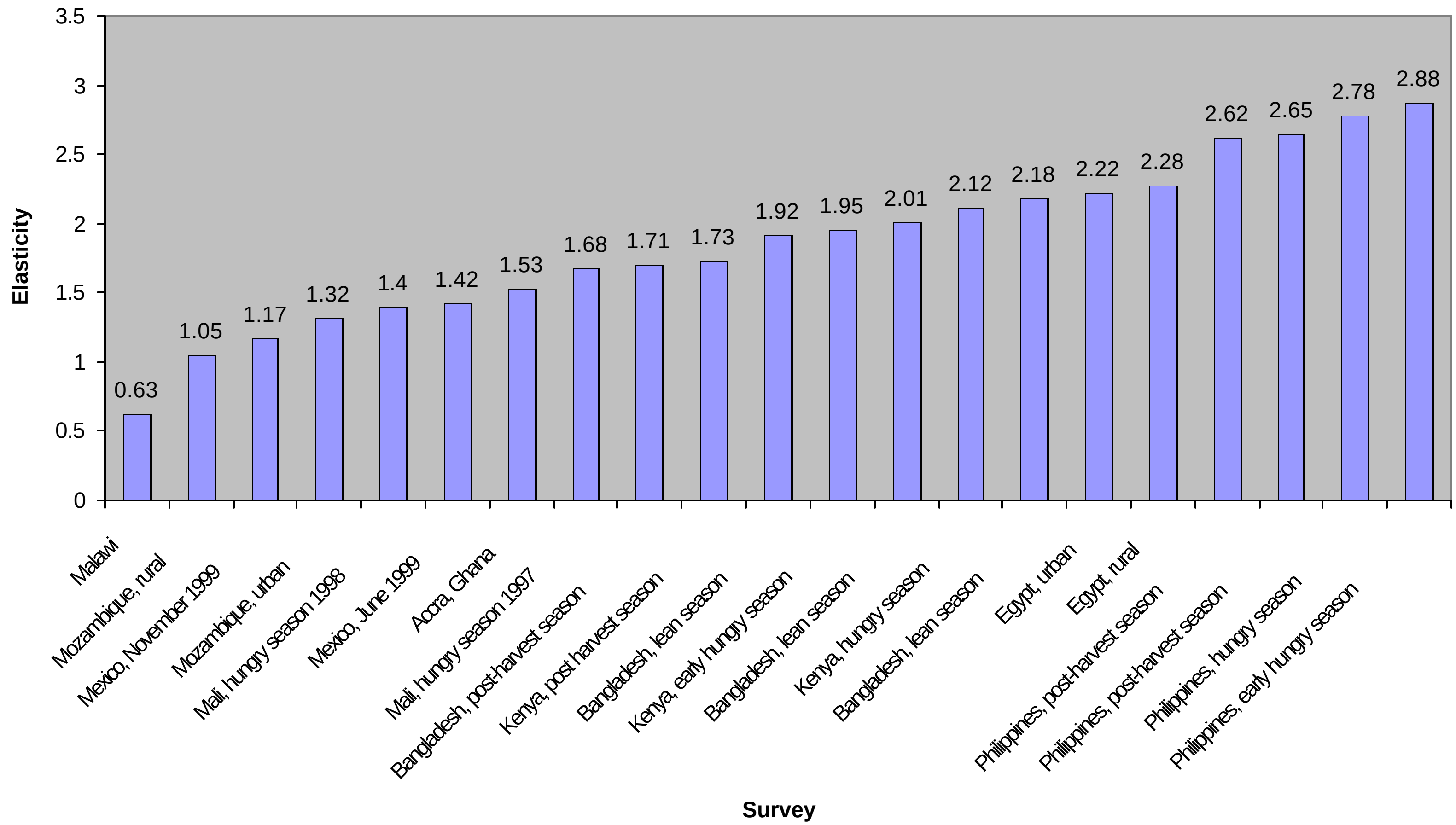


Figure 8: Elasticities of association between food groups and per capita caloric availability from non-staples



REFERENCES

Alderman, H., and K. Lindert (1998) The potential and limitations of self-targeted food subsidies. *World Bank Research Observer* 13 (2): 213-229.

Allen, L., A. Black, J. Backstrand, G. Pelto, R. Ely, E. Molina, and A. Chavez (1991) An analytical approach for exploring the importance of dietary quality versus quantity in the growth of Mexican children. *Food and Nutrition Bulletin* 13 (2): 95-104.

Behrman, J. 1988. *Nutrition and incomes: Tightly wedded or loosely meshed?* Pew/Cornell Lecture Series on Food and Nutrition Policy. Ithaca, N.Y., U.S.A.: Cornell University.

Behrman, J., and A. Deolalikar (1987) Will developing country nutrition improve with income? A case study for rural South India. *Journal of Political Economy* 95 (3): 492-507.

Bhargava, A., H. Bouis, and N. Scrimshaw (2001) Dietary intakes and socioeconomic factors are associated with the hemoglobin concentration of Bangladeshi women. *Journal of Nutrition* 131 (3): 758-764.

Bouis, H., and L. Haddad (1990) *Agricultural commercialization, nutrition and the rural poor*. Boulder, Colo., U.S.A.: Lynne Reinner.

Bouis, H., and M. J. Novenario-Reese (1997) *The determinants of demand for micronutrients: An analysis of rural households in Bangladesh*. Food Consumption and Nutrition Division Discussion Paper 32. Washington, D.C.: International Food Policy Research Institute.

Brownie, C., J. P. Habicht, and B. Cogill (1986) Comparing indicators of health and nutritional status. *American Journal of Epidemiology* 124 (6): 1031-1044.

Carletto, C. (1999) Malawi case study: Methodology and descriptives. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C. Photocopied.

Christiaensen, L. (1999) Mali case study: Methodology and descriptives. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C. Photocopied.

Chung, K., L. Haddad, J. Ramakrishna, and F. Riely (1997) *Identifying the food insecure: The application of mixed-method approaches in India*. Washington, D.C.: International Food Policy Research Institute.

Datt, G., D. Jolliffe, and M. Sharma (1998) *A profile of poverty in Egypt: 1997*. Food Consumption and Nutrition Division Discussion Paper 49. Washington, D.C.: International Food Policy Research Institute.

Datt, G., K. Simler, S. Mukherjee, and G. Dava (2000) *Determinants of poverty in Mozambique: 1996-97*. Food Consumption and Nutrition Division Discussion Paper 78. Washington, D.C.: International Food Policy Research Institute.

Dercon, S., and P. Krishnan (2000) In sickness and in health: Risk sharing within households in rural Ethiopia. *Journal of Political Economy* 108 (4): 688-727.

Drewnowski, A., S. Ahlstrom Henderson, A. Driscoll, and B. Rolls (1997) The dietary variety score: Assessing diet quality in healthy young and older adults. *Journal of the American Dietetics Association* 97 (3): 266-271.

FANTA (Food and Nutrition Technical Assistance) (1999) *Measuring household food consumption: Analyzing data.* Washington, D.C.: Academy for Educational Development.

FCND (Food Consumption and Nutrition Division) (2000) Documentation of FCND data sets collected between 1994 and 1999. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C. Photocopied.

Habicht, J. P., L. Meyers, and C. Brownie (1982) Indicators for identifying and counting the improperly malnourished. *American Journal of Clinical Nutrition* 35 (5): 1241-1254.

Haddad, L., E. Kennedy, and J. Sullivan (1994) Choice of indicators for food security and nutrition monitoring. *Food Policy* 19 (3): 329-343.

Hatløy, A., L. Torheim, and A. Oshaug (1998) Food variety—A good indicator of nutritional adequacy of the diet? A case study from an urban area in Mali, West Africa. *European Journal of Clinical Nutrition* 52 (12): 891-898.

Hatløy, A., J. Hallund, M. M. Diarra, and A. Oshaug (2000) Food variety, socioeconomic status and nutritional status in urban and rural areas in Koutiala (Mali). *Public Health and Nutrition* 3 (1): 57-65.

Hoddinott, J., and E. Skoufias (2000) The impact of PROGRESA on consumption: A preliminary report. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C. Photocopied.

Hoddinott, J., E. Skoufias, and R. Washburn (2000) The impact of PROGRESA on consumption: A final report. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C. Photocopied.

James, W., and E. Schofield (1990) *Human energy requirements: A manual for planners and nutritionists.* Oxford: Oxford University Press.

Kant, A., A. Schatzkin, and R. Ziegler (1995) Dietary diversity and subsequent cause-specific mortality in the NHANES I epidemiologic follow-up study. *Journal of the American College of Nutritionists* 14: 233-238.

Kant, A., A. Schatzkin, R. Ziegler, and M. Nestle (1991) Dietary diversity in the US population NHANES II, 1976-1980. *Journal of the American Dietetics Association* 91: 1526-1531.

Kennedy, E., and B. Cogill (1987) *Income and nutritional effects of the commercialization of agriculture in southwestern Kenya*. Research Report No. 63. Washington, D.C.: International Food Policy Research Institute.

Krebs-Smith, S., H. Smiciklas-Wright, H. Gutherie, and J. Krebs-Smith (1987) The effects of variety in food choices on dietary quality. *Journal of the American Dietetics Association* 87: 897-902.

Lorenzana, P., and D. Sanjur (1999) Abbreviated measures of food sufficiency validly estimate the food security level of poor households: Measuring household food security. *Journal of Nutrition* 129 (3): 687-692.

Maxwell, D., C. Levin, M. Armar-Klemesu, M. Ruel, S. Morris, and C. Ahiadeke (2000) *Urban livelihoods and food and nutrition security in Greater Accra, Ghana*. Research Report 112. Washington, D.C.: International Food Policy Research Institute.

Miller, W., B. Crabtree, and D. Evans (1992) Exploratory study of the relationship between hypertension and diet diversity among Saba islanders. *Public Health Reports* 107 (4): 426-432.

Morris, S. (1999) The impact of PLANDERO on food security in western Honduras. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C. Photocopied.

NIH (National Institute of Health) (1993) *Nutritive value of Indian foods*. Hyderabad, India: Indian Council of Medical Research.

Onyango, A., K. Koski, and K. Tucker (1998) Food diversity versus breastfeeding choice in determining anthropometric status in rural Kenyan toddlers. *International Journal of Epidemiology* 27 (3): 484-489.

Rao, S., C. S. Yajnik, A. Kanade et al. (2001) Intake of micronutrient-rich foods in rural Indian mothers is associated with the size of their babies at birth: Pune maternal nutrition study. *Journal of Nutrition* 131 (4): 1217-1224.

Smil, V. (1994) How many people can the earth feed? *Population and Development Review* 20 (2): 255-292.

Stanley, T. (2001) Wheat from chaff: Meta-analysis as quantitative literature review. *Journal of Economic Perspectives* 15 (3): 131-150.

Strauss, J., and D. Thomas (1995) Human resource: Empirical modeling of household and family decisions. In *Handbook of development economics*, vol. 3., eds. J. Behrman and T. N. Srinivasan. Amsterdam: North-Holland.

Subramanian, S., and A. Deaton (1996) The demand for food and calories. *Journal of Political Economy* 104 (1): 133-162.

Swindale, A., and P. Ohri-Vachaspati (1999) *Measuring household food consumption: A technical guide*. Food and Nutrition Technical Assistance, Title 2 Indicator Guides. Washington, D.C.: Academy of Educational Development.

Taren, D., and J. Chen (1993) A positive association between extended breastfeeding and nutritional status in rural Hubei Province, People's Republic of China. *American Journal of Clinical Nutrition* 58: 862-867.

Tarini, A., S. Bakari, and H. Delisle (1999) The overall nutritional quality of the diet is reflected in the growth of children of Niger. *Sante* 9 (1): 23-31.

USAID (U.S. Agency for International Development) (1992) *Policy determination 19, Definition of food security.* April 13. Washington, D.C.

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