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A Simplified Method for Assessing Dietary Adequacy in Mozambique

by

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Executive Summary

A well-nourished population is important to a country's long-term development and is a desirable outcome objective in itself. Unfortunately, monitoring of progress in meeting this objective can be expensive, since large-scale quantitative surveys are time-consuming and resource-intensive. In this paper, we demonstrate a simple, inexpensive technique for assessing household diets in Mozambique. The core of this technique is a *dietary adequacy prediction model* that allows one to use information on food group consumption and household size to get assessments of overall dietary adequacy in a population. The new information needed to apply this model is easy to collect and can be included in a range of household surveys with differing objectives.

To develop the prediction model, we used data from a previously-conducted study of food consumption in northern Mozambique. This earlier field study, conducted in Nampula and Cabo Delgado provinces, employed a quantitative 24-hour food recall technique with volumetric measurements in which households were interviewed in each of 3 different seasons. We organized the data from this Nampula/Cabo Delgado (NCD) study to describe household intakes of various nutrients in relation to international norms. We then explored statistical relationships between these dietary adequacy variables and other easy-to-collect variables in the NCD dataset. These relationships are the basis for the dietary adequacy prediction model.

We studied 4 key nutrients — energy, protein, vitamin A, and iron — because of widespread deficiencies of these nutrients documented in Mozambique and in other developing countries. Using data across all seasons in the NCD study, 41 percent of observations on households demonstrated low energy intakes, whereas rates of low-intake for protein, vitamin A, and iron, were 24, 91, and 38, respectively. These estimates were based on the quantitative measurement procedures from the original NCD study.

We then predicted the prevalence of low intakes in the same sample using only the easy-to-collect variables mentioned previously and our dietary adequacy prediction model. The model did quite well. It predicted that 42 percent of the sample would have low energy intakes and that 28, 93, and 34 percent would have low protein, vitamin A, and iron intakes, respectively.

Policymakers often need simple summary measures of nutrition, rather than details about specific nutrients, so they can assess overall progress in the area. We developed a composite measure of diet quality, which summarizes key nutrients important to public health in Mozambique. We evaluated diets in the NCD study using this Mozambique Diet Quality Index and found that 40 percent of diets were acceptable, 32 percent were low quality, and 28 percent were very low quality. Using the easy-to-collect variables and our dietary adequacy prediction model, we found that predictions were quite close to the quantitative measurements. In particular, we predicted that 42 percent would have acceptable diets, 34 percent would have low quality diets and 24 percent would have very low quality diets.

This work demonstrates the potential for using low-cost methods for monitoring dietary status in Mozambique. Future research could be used to test the geographic and temporal applicability of these techniques.

A Simplified Method for Assessing Dietary Adequacy in Mozambique

Introduction

How adequate are the diets of rural Mozambicans? Although little is known about the answer to this question, it is of vital importance. A well-nourished population is a key factor in long-term development. Previous research has shown that malnutrition reduces work performance and long-run productivity, decreases resistance to infections, increases child mortality, and can cause impairments in behavior and intellectual development of young children.[1] In addition to facilitating long-term development, improvement in a population's nutritional status is also a worthy outcome objective in itself. For these reasons, monitoring of progress in meeting the nutrition objective can serve as a way to assess the effects of development policies and programs.

A full and accurate assessment of the nutritional adequacy of a diet is a costly and time-consuming activity. However, relatively simple and inexpensive methods exist to do this. One such measure uses food variety to assess the adequacy of nutrient intakes. In Mali, researchers weighed the food intakes of household members — the most exhaustive, expensive, and accurate way to collect dietary intake data — and compared the nutrients consumed in this food to simple measures of dietary diversity (Hatløy et al., 1998). Although proxy measures are not perfect, these researchers found that the number of different food groups consumed in a 3-day period was useful for distinguishing those with inadequate diets from those with adequate ones.

While the concept of a simplified technique to assess diets may be applicable to many countries, the calibration of particular measures will vary from one country to the next. The Mali researchers found that those consuming foods from 6 or more different food groups in a 3-day period were less likely to have nutrient intakes below given reference standards. Unlike the approach in Mali, analysts in Zambia developed a scoring system that weighted foods differently depending on the food group to which they belong. For example, consumption of foods from the nutrient-rich meats group received 4 points, whereas those from the cereals group received 2 points. After adding up the points from all the foods consumed in a 24-hour period, household diets were evaluated based on pre-established cut-points (FHANIS/CSO, 1998). In rural Mozambique, the types of foods, their availability and nutritional content as well as the consumption patterns and nutritional problems in the population are not the same as those in Mali or Zambia. Neither are the constraints and opportunities with regards to national data collection efforts.

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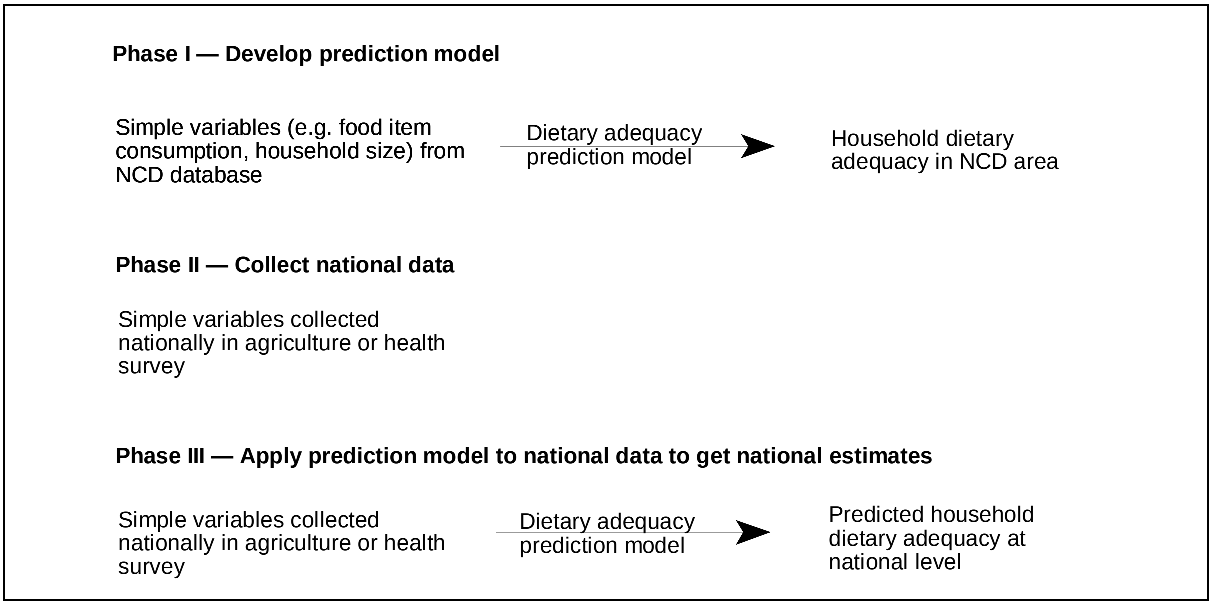
[1] There are a wealth of studies that document the effects of malnutrition. Viteri and Torun (1974) showed that iron-deficiency anemia can cause functional impairments in work capacity among Guatemalan sugar-cane cutters. A more recent study in urban Brazil showed that calories consumed, height (a long-term indicator of nutritional status), and body mass index (a short-run indicator of calorie balance) had strong effects on productivity as measured by subsequent wages (Thomas and Strauss, 1997). Pinstrup-Andersen and colleagues (1993) calculated that nutritional stunting accounts for an annual loss in productivity on the order of $8.7 billion. Dallman (1987) has studied the effects of iron-deficiency on resistance to infections and Pelletier and colleagues (1995) highlight the important influence that malnutrition has on child mortality. Malnutrition also affects behavior and intellectual development of young children (Walter et al., 1989) and may cause delays in primary school enrollments (Glewwe and Jacoby, 1995). The importance of nutrition in long-term development has also been recognized in historical studies (Fogel, 1994).

Our objective in this report is to outline a relatively inexpensive way to assess household dietary adequacy in rural Mozambique. The inclusion of 24-hour food consumption questions in a national survey would provide an opportunity to do this. Due to cost-considerations, food consumption information collected on a national scale needs to be simple, especially given the other information demands on most agricultural or health surveys. Thus, a full quantitative assessment of the foods eaten by a household in the previous 24 hours is not possible. However, a survey that just collected information on *which* foods were consumed at which meals in the previous day would be sufficient.[2] How do we translate qualitative information on the types of foods eaten into a quantitative assessment of dietary adequacy? This paper demonstrates a technique calibrated with data from a previous intensive study of food consumption in rural Mozambique.

The method proposed in this report is based on data collected in the 1995-96 Nampula/Cabo Delgado (NCD) study (see the next section for a description of this study). Because the NCD study collected quantitative information on food consumption, it allows us to get reasonable estimates of household nutrient intake in the Nampula and Cabo Delgado areas. We then explore the relationships between easy-to-collect variables in the NCD database, variables similar to those that could be collected nationally, with these quantitative measures of household nutrient intake. From this analysis, we develop a technique that allows us to predict a household's dietary adequacy level given some relatively simple information, such as the types of foods eaten by the household in a 24 hour period or the number of members in the household. This technique — we refer to it as a *dietary adequacy prediction model* — will be written into a set of arithmetic operations in a computer program. It could then be used with information from

Figure 1 — Overview of strategy to get national estimates of dietary adequacy



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[2] Although the technique developed here uses simple variables that could be incorporated in the 1999-2000 Censo Agro-Pecuario (CAP), it is not limited to being used with the CAP. It could be used with any national, regional or local household survey which includes a non-quantitative 24-hour food recall and information on the age and sex composition of households. See Appendix C for a sample of the type of questionnaire module that could be used in this work.

a national survey to get predictions of household nutrient intake at the national level. **Figure 1** summarizes this basic approach.

The rest of this report details the results from Phase I of this work. In the following section, we describe the Nampula/Cabo Delgado Study. After that, we discuss a summary measure of diet quality. Then we review the dietary adequacy prediction model and its application. We close with a section outlining some limitations to this approach and highlighting future research that could be conducted to improve this work.

The Nampula/Cabo Delgado Study

The Nampula/Cabo Delgado (NCD) study was originally designed to identify the impacts of various smallholder cotton schemes on household incomes and food security in Mozambique (MAF/MSU, 1996; Strasberg, 1997). The study was conducted in Montepuez District in Cabo Delgado and in Monapo and Meconta Districts of Nampula. These areas are typical of the interior of northern Mozambique, where maize- and manioc-based cropping systems predominate and where cotton and cashew are often grown. Using repeated visits on close to 400 households in 16 villages from 1994-96, the study collected information on demographic characteristics, agricultural production and sales, expenditures on food and other necessities, and daily food consumption at three different periods during the year — May (“harvest”), September (“post-harvest”), and January (“hungry season”). Household food consumption was measured using a 24-hour recall technique, in which trained enumerators conducted detailed interviews with the person in charge of food preparation. These interviews were made on 2 separate visits during each period and included the volumetric measurement of foods consumed. A detailed exploration of household food and nutrient consumption behavior was undertaken using data from the 1995-96 portions of this larger study (Rose et al., 1999).

Quantitative data on household food consumption was used to calculate nutrient intakes for each household during each period of the year. These intakes were compared with international reference standards to assess their adequacy. **Table 1** displays the mean intakes of four

Table 1. Mean nutrient intakes in the Nampula/Cabo Delgado sample by season

	Mean Intake (as a % of recommended intake)			
Nutrient	All seasons	Harvest season	Post-Harvest season	Hungry season
Energy	90.0	93.2	104.1	72.4
Protein	129.5	149.9	154.6	83.1
Vitamin A	29.8	29.7	20.8	39.3
Iron	115.9	105.6	150.8	90.2

nutrients — energy, protein, vitamin A, and iron — expressed as a percent of recommendations.[3] Combining data from all three seasons, one sees that mean intakes of protein and iron are above 100 percent of recommended levels, while mean intakes of energy and vitamin A are below that level. Mean intakes of all nutrients except vitamin A fall in the hungry season, a time when households in Cabo Delgado consume more pumpkin squash and other vitamin A-rich vegetables.

Note that values in Table 1 are averages and that many households consume less than these amounts. For example, while *mean* protein intakes may appear adequate when averaged across all seasons, 24.2 percent of households had *low intakes*, that is, intakes that were below 75 percent of recommended levels (**Table 2**). Viewing the column for *all seasons* in Table 2, one sees that 41.1 percent of the sample had low intakes of energy, about the same level of prevalence as for iron, whereas a large majority of households had low intakes of vitamin A. As expected, the percent of the NCD sample with low intakes increased in the hungry season for all nutrients except vitamin A.

Table 2. Frequency of low nutrient intakes in the Nampula/Cabo Delgado sample by season

	Percent of sample with low intake (< 75% of recommended)			
Nutrient	All seasons	Harvest season	Post-Harvest season	Hungry season
Energy	41.1	40.1	25.1	58.4
Protein	24.2	10.3	7.8	55.2
Vitamin A	91.0	93.4	97.7	81.6
Iron	37.5	39.1	20.2	53.6

An Overall Diet Quality Index for Mozambique

While information on intakes of specific nutrients is useful for designing applied interventions to address specific nutrition problems, policymakers often need simple summary measures of nutrition, so they can assess overall progress in this area over time and in relation to progress made in meeting other social objectives in health or education, for example.

Various authors have used indices of dietary quality or dietary adequacy to summarize the overall healthiness of a diet. One of the oldest summary measures is the *mean adequacy ratio*

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[3] The main body of this report highlights these four nutrients because of their importance for public health nutrition in Mozambique. Data on other nutrients studied in the Nampula/Cabo Delgado survey are presented in the Appendix A. Data on nutrient intakes were obtained at the household level. Recommended intakes for each person in attendance at household meals were summed for each household. International recommendations used in this report are presented in Appendix B. All analyses in this report were performed unweighted and combine data from both Nampula and Cabo Delgado provinces.

(MAR), a simple average of the nutrient adequacy ratios of various nutrients (Guthrie and Scheer, 1981).[4] Hatløy and coauthors (1998) used this measure with ten nutrients to evaluate the diets of preschoolers in an urban area of Mali. One of the problems with such an index is that it weights all nutrients equally. For example, in determining the score, riboflavin is given as much weight as vitamin A. Although all nutrients are essential, some nutrients or food components are more important than others with respect to public health priorities in specific countries or areas. In developing countries, vitamin A deficiency is widespread, but cases of riboflavin deficiency are rare.

More recent indices have been created that take into account the relative importance of nutritional problems. For example, in the United States, the Department of Agriculture uses a Healthy Eating Index (HEI), in which diets are evaluated on a scale of 0 to 100 points. In this index, 40 percent of the score is made up of issues related to dietary excess, reflecting the types of nutritional problems found in the U.S. (Kennedy et al., 1995). Drewnowski and coauthors (1996) used a 5-point diet quality index to evaluate French diets, in which scores were based on issues related almost exclusively to dietary excess. Haines and coauthors (1999) adapted a dietary quality index for use in the U.S. which reflects problems of both underconsumption (iron or calcium) and overconsumption (saturated fat or cholesterol).

To reflect local public health nutrition realities, the following diet quality index is proposed for use in Mozambique. The index has five components, which reflect the intakes of energy, vitamin A, iron, protein, and a summary measure of dietary variety based on seven other nutrients.

This Mozambique Diet Quality Index (MDQI) recognizes that the most important nutritional problems in Mozambique (other than iodine deficiency, which cannot be assessed with our dietary instruments) are protein-energy malnutrition, vitamin A deficiency, and iron-deficiency.[5] It also gives weight to a summary measure of diet variety — a mean adequacy ratio composed of seven nutrients (MAR7) — since other nutritional deficiencies, such as niacin deficiency and vitamin C deficiency, have also been documented in Mozambique (GISMAV, 1998). Zinc deficiency is common in developing countries and is likely to be a problem in Mozambique, although it has not been documented. We have not included it in our index, since our food composition databases do not have information on this nutrient. Dietary fats — found in nuts, animal products, and pressed oils — might also be important to include in a diet quality index for Mozambique, since they facilitate the absorption of vitamin A and are a rich source of calories. Because vitamin A and energy are already included in our index and because a desirable *minimum* percentage of calories from fats (for situations of undernutrition) has not been established, we decided not to include fats as a component in our index.

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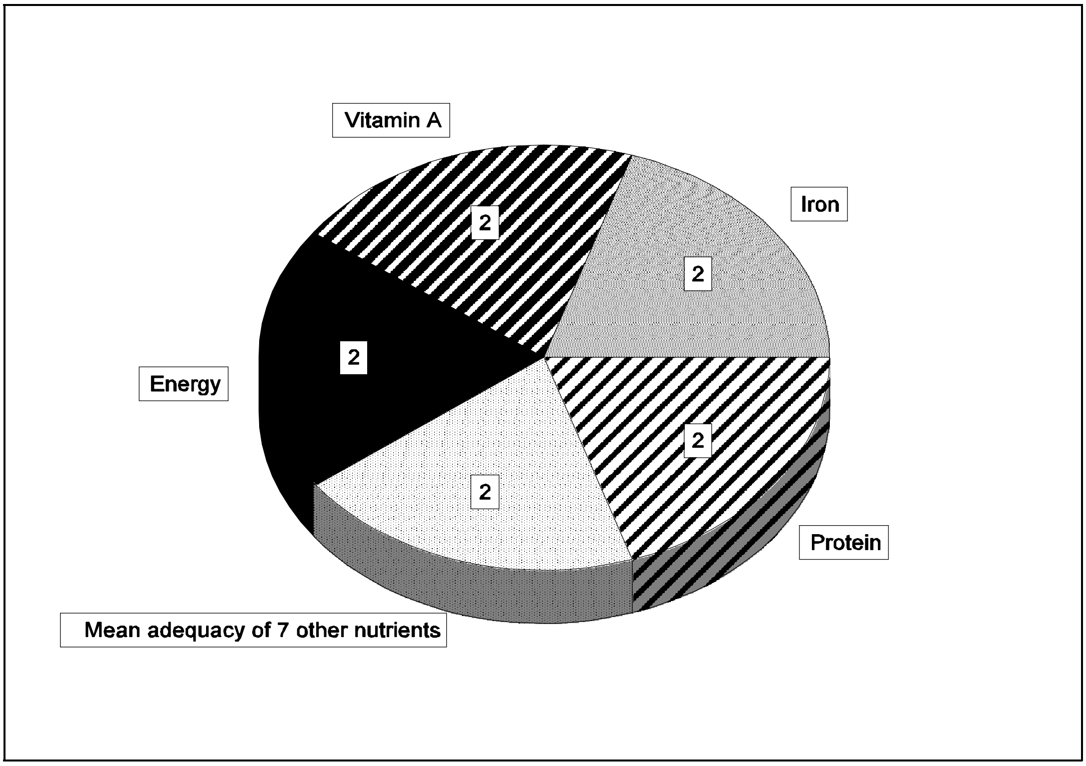
[4] The intake of each nutrient is divided by the recommendation in order to calculate the nutrient adequacy ratio (NAR) for a specific nutrient. An average of NARs from different nutrients is then taken to form the mean adequacy ratio (MAR). Before this average is taken, NARs over 1.0 are usually truncated at 1.0 to reflect the fact that excesses in one nutrient do not substitute for deficiencies in another.

[5] Although iron deficiency-anemia is an important nutritional problem, it should be noted that there are important determinants of this problem other than diet, such as malaria and intestinal parasites.

Figure 2 — Components of a 10-point Mozambique Diet Quality Index (MDQI)



The score on this Mozambique Diet Quality Index (MDQI) ranges from 0 to 10 and is a sum of each of the component scores listed in Figure 2.[6] To compute each component score, the nutrient adequacy ratio is first computed, then truncated at 1.0 if the household consumed more than the recommended amount, and then multiplied by 2. Truncation reflects the fact that excesses in consumption of one nutrient do not make up for deficiencies in other nutrients. Multiplying each of the ratios by 2 is simply a means of converting the MDQI to a more convenient range of 0-10, rather than 0-5.

This diet quality index was calculated for each household for each season that they were observed in the Nampula/Cabo Delgado survey. With 1140 observations across three seasons, the mean score on this index was 6.8 with a standard deviation of 1.6. Based on the scores on this index, household diets were divided into 3 categories: acceptable, low quality, and very low quality. Households that scored 7.5 or greater on this index were considered to have acceptable diets. Households that scored 6.0 or greater, but less than 7.5 points on this index were considered to

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[6] A sizable part of this index reflects concerns over protein-energy malnutrition, which is a complex syndrome. Protein is unlikely to be a problem for adults or older children who meet their energy requirements. Although protein intakes are a concern for small children, our food consumption measure is at the household level and thus not very sensitive to variations in their intakes. Given this reality, we experimented with an index which gave greater weight to energy (3 points) and less weight to protein (1 point). The prevalence rate of low scores on this modified index was very close to the final index discussed above. Thus, in the interest of simplicity, we have chosen an index with equal weighting for all of the components.

have low quality diets. Those that scored less than 6.0 points on the diet quality index were considered to have very low quality diets.

These cut-off points were based on a combination of scientific judgement and practical policy concerns. Based on reasonable assumptions about requirement distributions for various nutrients, and certain statistical conditions that are met by our data, 75% of the recommended dietary intake is an approximate cut-off point for indicating an inadequate intake.[7] This would correspond to 7.5 on a 10-point scale as a cut-off point for an acceptable diet. Of course, one could argue also on scientific merits that a higher cut-off, such as 8.0, should be used.[8] Yet from a practical policy perspective it is important that cut-offs not be set so high that proportions of the populations approaching 100 percent are classified as having inadequate diets. If this were the case, the technique would provide little information for the targeting of interventions and very little sensitivity for monitoring impacts over time of development policies on dietary outcomes. On this basis it was decided to use a cut-off of 7.5. Practical concerns about interventions that could be targeted to areas of highest priority also motivated our decision to split inadequate intakes into two categories, those that were low (6.0—7.5) and those that were very low (< 6.0). Thus, this system should be viewed as a useful categorization, based on scientific judgement and practical policy considerations, for monitoring diet quality.

Using this classification system, and evaluating household diets throughout the year in the Nampula/Cabo Delgado study, 27.5 percent had very low quality diets, whereas 32.2 percent of households had low quality diets (**Table 3**). About 40 percent of households had acceptable diets.

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[7] The Food and Nutrition Board (FNB) of the U.S. National Research Council outlined conditions for when the *mean nutrient requirement* can be used as a cutoff point indicating inadequate intakes (FNB, 1986). Using a typical assumption about the requirement distribution of a nutrient, it can be shown that the mean nutrient requirement is 76.9 percent of a recommendation for a safe level of intake. We use 75 percent as a rough approximation to this figure, largely to facilitate comparisons with other literature on this topic. See, for example, Hatløy et al., 1998.

This calculation is based on the concept that recommendations for a "safe level" of intake are made at the mean plus two standard deviations of the requirement distribution. Assuming a standardized mean requirement of 1.0 and a coefficient of variation (standard deviation ÷ mean) of 0.15, then the recommendation for a typical nutrient would be set at 1.3 (Mean + 2 SD = 1.0 + 2 × 0.15). Thus, the mean requirement is 76.9 percent of the recommendation ((1.0 ÷ 1.3) × 100). Note that this argument does not apply to energy, because international recommendations are already set at the mean of the requirement distribution.

There are three conditions for when this cut-off approach make sense: (1) the requirement distribution is reasonably symmetrical; (2) the mean requirement does not fall in the tail of the intake distribution; and (3) the variance of dietary intake is greater than the variance of the requirement for that nutrient (FNB, 1986). Evidence is scanty on condition 1, but the FNB indicates that it is met for a number of nutrients. The iron requirement distribution for menstruating women is a notable exception, but requirements for adult women make up only a part of the entire requirement used for our household calculations. Given some basic assumptions (e.g. a typical requirement distribution has a coefficient of variation of 0.15), conditions 2 and 3 are also met for our data. It should be noted that the preferred method to calculate the prevalence of nutrient inadequacy is a probability approach (FNB, 1986). However, this approach requires, among other things, information on the distribution of nutrient requirements, which is not available for most nutrients.

[8] For example, one could argue that the 75 percent cut-off might make sense for other nutrients, but not for energy, since energy recommendations are set at the mean of the requirement distribution. Thus an "acceptable" intake of energy would be 100 percent of the recommendation, or the full 2 points allocated to this nutrient on the MDQI. Since other nutrients account for 8 points on the 10-point scale, one could then argue that 8.0 should be the cut-off for an acceptable diet (100% of 2 points + 75% of 8 points = 8 points).

Table 3. The Mozambique Diet Quality Index (MDQI) in the Nampula/Cabo Delgado sample

	All seasons	Harvest season	Post-Harvest	Hungry season
MDQI, sample mean	6.8	7.1	7.4	5.9
		Percent of households		
Acceptable diets (MDQI ≥ 7.5)	40.4	46.7	52.6	21.3
Low quality diets (6.0 ≤ MDQI < 7.5)	32.2	33.8	35.0	27.7
Very low quality diets (MDQI < 6.0)	27.5	19.5	12.4	50.9

Development of the Dietary Adequacy Prediction Model

To begin developing a prediction model, we considered variables that would be easy to collect and process, and which were also included in the NCD survey. Such variables could be included at relatively low cost in national surveys (such as the agricultural census, or the periodic agricultural surveys implemented by the Ministry of Agriculture and Fisheries), or in more focused surveys executed by ministries, provincial governments, NGOs, or research institutions. For example, the 1999-2000 Agricultural and Livestock Census is slated to collect information on each food that is consumed by a household at each meal over a 24-hour period, but no information will be collected on the amount consumed of that food. There will also be information on household size and other agricultural production and sales variables.

To develop a prediction model that would map food consumption to nutrient intakes we used linear regression models, in which the household intake of a nutrient (expressed as a percent of its recommendation) was the dependent variable and the consumption of foods and other easy-to-collect variables were the independent variables. There were 4 main nutrients of interest: energy, protein, vitamin A, and iron. There were also 7 nutrients that made up the summary measure of dietary variety, that we referred to as MAR7 in the previous section. Thus we estimated a total of 11 regression models, one for each nutrient.

Since there are over 70 different food items in the original NCD food consumption database, our first task was to reduce this number into a manageable number of food groups. We experimented with a number of different food grouping systems — ones that contained 7, 11, 13, and 15 different food groups. Our goal was to find reasonably aggregated food groups, which would be broad enough to encompass local foods from different parts of the country. On the other hand, we needed to disaggregate food groups enough so that nutrient content was relatively homogenous within a group, a necessity for getting good predictions of nutrient intakes. We developed a system of 11 food groups which balanced these concerns. For example, in this system, maize products, sorghum, breads and other cereals were grouped into a *grains* food group and foods such as pumpkin, dark green leafy vegetables, and mango, into a food group known as *vitamin A-rich fruits and vegetables*. The complete list of food groups and individual food items in each group is listed in **Table 4**.

Table 4. Food items in each of the 11 food groups

Food group	Food items
Grains	dried maize, maize flour, other maize products, sorghum, sorghum flour, fresh sorghum, bread, rice, pasta, cookies
Tubers	manioc flour, dried manioc
Beans	dried beans, dried peas
Nuts and Seeds	dried peanuts, coconut, pumpkin seeds, sesame seeds, sunflower seeds, cashew nuts,
Animal Products	dried fish, fresh fish, beef, chicken, rat, bird, pigeon, snail, crustaceans, grasshopper, frog, milk, eggs
Vitamin A-rich Fruits & Vegetables	pumpkin, dark leafy greens, red pepper leaves, manioc leaves, bean leaves, pumpkin leaves, sweet potato leaves, cashew leaves, red peppers, mango
Vitamin C-rich Fruits & Vegetables	papaya, lime, fresh manioc, fresh sweet potato (pale), tomato, fresh beans, fresh peas, fava beans
Other Fruits and Vegetables	mushrooms, onions, bananas, fresh maize, fresh yams, okra, apples, fresh peanuts
Sugars	sugar, sugar cane, honey
Oils	oil
Other Foods	beverages (including maize beer, cashew juice, cashew wine, tea, coffee), salt, candy

We tested several different expressions of the food consumption variables. One variable was simply a count of the number of different food groups consumed in the previous day. One set of variables were dichotomous indicators of whether or not the household consumed a food from each food group on the previous day. Since there were 11 food groups, this gave us 11 variables. Another set of variables expressed the number of times per day the household consumed a food from each food group. The variables indicating the number of times per day a food was eaten from each of the 11 food groups performed best among the different food variable alternatives.

We also experimented with a number of socio-economic variables, such as those related to household size (measured in consumption adult equivalents),[9] land tenure, agricultural production and agricultural sales as well as seasonal indicators. Household size was a significant predictor in every nutrient intake model, but none of the other socio-economic variables improved prediction significantly enough to warrant inclusion in the final models.

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[9] See the note on Appendix Table B-2 for a description of how household size in adult equivalent units was calculated.

Table 5. Dietary Adequacy Prediction Model for Selected Nutrients

	Dependent Variable			
Independent Variable[1]	Energy	Protein	Vitamin A	Iron
	Coefficient Estimates			
Grains	.3166	.2889	.0064	.2008
Beans	.2975	.6115	.0895	.7455
Tubers	.3944	-.0073	-.0141	.4925
Nuts/Seeds	.2401	.3237	-.0328	.1640
Animal Products	.1224	.2091	.0843	.1188
Vitamin A-Rich Fruits and Vegetables	-.0499	-.0349	.4458	-.0117
Vitamin C-Rich Fruits and Vegetables	.0615	.0706	.1047	.0878
Other Fruits and Vegetables	.1005	.1003	.0500	.1288
Sugars	-.0163	-.0714	-.0823	-.1025
Oils	.0887	-.1443	.0177	-.1417
Other Foods	.0980	.1456	.0964	.1531
Household size	-.1469	-.1447	-.0543	-.1622
Intercept	-.7391	-.4570	.1161	-.5453
Model Statistics				
Adjusted R^2	.554	.646	.565	.477
N	1140	1140	1140	1140
F	118.68	174.16	124.14	87.46

[1] Food group variables refer to the number of times a food was consumed from each group per day. Household size is expressed in adult equivalents (see Appendix Table B-2).

The preferred set of models derived from this work are displayed in **Table 5.**[10] Each column describes a model that predicts the intake of a particular nutrient. The numbers in the table are coefficients estimates. Coefficient estimates are fixed numbers for a sample which describe the relationship between an independent variable (e.g. the number of times a household consumed grains) and the dependent variable (e.g. intake of protein as a percent of the recommended intake). In some cases it is easy to see the relationship between these two variables. For

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[10] Other than for vitamin A and calcium, which were estimated linearly, all models were estimated with dependent variables in logarithmic form. All models were estimated with Ordinary Least Squares regression using all independent variables listed in Table 5 and the “regression” command in SPSS (method = Enter). Complete regression results for these models are listed in Appendix E.

example, the largest coefficient in the vitamin A model, 0.4458, is on the vitamin A-rich fruits and vegetable group. Consumption of beans and nuts and seeds, which are good sources of protein, positively affects the intake of this nutrient. This can be seen by the sizable positive coefficients on these foods.

The coefficients in Table 5 do not only reflect the nutrient content of the particular foods, but may also reflect the amount of food consumed from a group at a given eating occasion. For example, animal products are a rich source of protein, but relatively small quantities are consumed at any one time in Nampula and Cabo Delgado. Thus, the coefficient on animal products in the protein equation is smaller than the coefficients on some other food groups, such as nuts and seeds or grains.

The coefficients in Table 5 also reflect substitutions between the various food groups. For example, there is a negative coefficient on the oils food group in the protein model. Obviously this does not mean that oils have negative amounts of protein. Rather, oils have no protein content and when substituted for other foods that do have significant protein content, they could lower overall protein intake of households. This might occur if respondents substitute oils for the amount of peanuts they use in the preparation of vegetable dishes like *matapa*.

The coefficients in Table 5 form the basis of the dietary adequacy prediction model. The following section describes the application of this model.

Using the Dietary Adequacy Prediction Model

An example of how the coefficients in Table 5 can be used to predict dietary adequacy for one nutrient, vitamin A, for a specific household from the NCD database is shown in **Table 6**. Column 2 shows the number of times that the household consumed each of the 11 food groups in a 24-hour period during the post-harvest season. For example, the household consumed grains twice during the day, nuts and seeds one time, and vitamin A-rich fruits and vegetables one time.[11] In column 3, we have simply placed the coefficients from the vitamin A column of the prediction model in Table 5. Column 4 is the product of the number of times per day and the vitamin A-food group coefficient. At the bottom of column 4, we summed all the values in the column to get 0.4485. In other words, using the dietary adequacy prediction model, we would predict that this household consumed 44.8 percent of its vitamin A recommendation. As actually measured from the full quantitative dietary recall, this particular household consumed 37.8 percent of its recommended level of vitamin A.

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[11] Note that the NCD survey collected information on two different days during each season. The values presented for this household, as well as all other households in the database, are averages over the two days. Although not the case for this particular household, many other households in the database have fractions for the number of times they consumed foods from different food groups, because of this averaging process.

Table 6. An example of how the prediction model works for a specific household for vitamin A intake

Food Group	Number of times per day household consumed items from this group (NTIMEDAY)	Coefficient estimates from vitamin A column of Dietary Adequacy Prediction Model (VITACOEF)	NTIMEDAY X VITACOEF
Grains	2.00	.0064	0.0128
Beans	0.00	.0895	0.0000
Tubers	0.00	-.0141	0.0000
Nuts/Seeds	1.00	-.0328	-.0328
Animal Products	0.00	.0843	0.0000
Vitamin A F & V	1.00	.4458	0.4458
Vitamin C F & V	0.00	.1047	0.0000
Other F & V	0.00	.0500	0.0000
Sugars	0.00	-.0823	0.0000
Oils	0.00	.0177	0.0000
Other Foods	0.00	.0964	0.0000
Household size	1.72	-.0543	-.0934
Intercept	1.00	.1161	0.1161
Sum of values in column 4			0.4485

In practice the calculations made in Table 6 will be automated with a computer program. This program will make a similar calculation for every nutrient for the household listed in Table 6 as well as for all other households in the data base under consideration. We made these calculations and compared the results from using the prediction model with the actual results of nutrient intake from the detailed quantitative survey method in the Nampula/Cabo Delgado survey. The results of this comparison are presented for vitamin A in **Table 7**. There were 1140 household-observations in the NCD database and of these observations, 1037 (91.0 percent) had low intakes of vitamin A and 103 had adequate intakes as determined by the quantitative recall measurement technique implemented in that study (see the far right column of Table 7). The dietary adequacy prediction model predicted that from this sample, 1063 (93.2 percent) would have low intakes and 77 would have adequate intakes (see the bottom row of this table).

Table 7. Comparing the predictions of low intakes of vitamin A with those obtained with a quantitative measurement method in Nampula/Cabo Delgado

			PREDICTIONS		
			Adequate ≥75% RDA	Low < 75% RDA	Totals
MEASURED RESULTS	Adequate ≥75% RDA	Count	45	58	103
		Row %	43.7 %	56.3 %	100.0 %
		Col %	58.4 %	5.5%	9.0 %
	Low < 75% RDA	Count	32	1005	1037
		Row %	3.1 %	96.9 %	100.0 %
		Col %	41.6 %	94.5 %	**91.0 %**
	Totals	Count	77	1063	1140
		Row %	6.8 %	**93.2 %**	100.0 %
		Col %	100.0%	100.0 %	100.0 %

We summarize the information on frequency of low intakes as actually measured and compare this with results obtained by prediction for the four main nutrients in **Table 8.** The first two columns display statistics for all seasons combined. For the most part, the predicted percent of the sample with low intakes is fairly close to the results derived from measurements of dietary intake.

Table 8. Measured frequency of low intakes compared with predicted frequency from the prediction model

	All Seasons		Post-Harvest		Hungry	
Nutrient	Measured (% low)[1]	Predicted (% low)	Measured (% low)	Predicted (% low)	Measured (% low)	Predicted (% low)
Energy	41.1	41.7	25.1	25.9	58.4	61.6
Protein	24.2	27.6	7.7	11.9	55.2	62.4
Vitamin A	91.0	93.2	97.7	99.2	81.6	88.0
Iron	37.5	34.0	20.2	17.9	53.6	53.1

[1] A low intake refers to intakes less than 75 percent of the recommendation.

Measured and predicted low-intake rates for the post-harvest and hungry seasons are also displayed in Table 8. These predictions track the measured results reasonably well. It is important to note that the calculations made for these predictions were based on the *same* *coefficients* from the dietary adequacy prediction model (i.e. Table 5) that were used for the "all seasons" predictions. The difference in forming the prediction for the specific seasons is that the easy-to-collect variables on food consumption (i.e. column 2 from Table 6) come from the specific season of interest.

Predictions were also made on the Mozambican Diet Quality Index (MDQI) scores for each household.[12] As can be seen in **Table 9**, across all seasons our methodology predicted that 57.5 percent of households consumed low or very low quality diets, which is quite close to the measured results of 59.6 percent. Even when looking separately at the percentages of the population with low quality and very low quality diets, the predictions do reasonably well. For example, across all seasons, the methodology predicted that 23.9 percent would have very low quality diets as opposed to the measured results of 27.5 percent. Predictions of the aggregate percent of the population with either low or very low quality diets at different times of the year ─ postharvest or hungry seasons ─ were also close to measured results. In the hungry season, the model predicted that 80.0 percent of the sample would have low or very low intakes, which is quite close to the 78.7 that were actually measured to have intakes falling in this category. The prediction of very low quality diets during the hungry season is somewhat less accurate, but still captures the basic patterns. The proportion of households with very low quality diets during this time is about four times what it is during the post-harvest season, and about twice the level over all seasons.

Table 9. Measured and predicted results on the Mozambique Diet Quality Index (MDQI)

	All Seasons		Post-Harvest		Hungry	
Percent of Households with:	Measured (%)	Predicted (%)	Measured (%)	Predicted (%)	Measured (%)	Predicted (%)
Acceptable diets (MDQI ≥ 7.5)	40.4	42.5	52.6	52.1	21.3	20.0
Low or Very Low (MDQI < 7.5)	59.6	57.5	47.4	47.9	78.7	80.0
Low quality diets (6.0 ≤ MDQI < 7.5)	32.2	33.7	35.0	35.8	27.7	36.0
Very Low quality diets (MDQI < 6.0)	27.5	23.9	12.4	12.2	50.9	44.0

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[12] We used the dietary adequacy prediction model developed from the nutrient regressions to make a prediction of each household’s nutrient adequacy ratio for each of the 11 nutrients that form the MDQI, that is, energy, protein, vitamin A, iron, and the seven nutrients that make up the diet variety measure, known as MAR7. We then calculated the MDQI for each household as described in the section on the overall diet quality index, but used predicted nutrient adequacy ratios rather than observed values.

Conclusions

This paper demonstrates an inexpensive method for assessing dietary adequacy in Mozambique. It uses a previously-conducted, intensive and quantitative study of dietary intake to develop a prediction model, that allows one to go from simple easy-to-collect information on food group consumption to assessments of overall dietary quality in a population.

Comparisons of predictions using this technique with results obtained from the quantitative measurements of dietary intake in Nampula and Cabo Delgado provinces indicates that we have a model with a relatively robust set of coefficients. As shown in Tables 8 and 9, it does well at predicting nutrient intakes at vastly different times of the year, that is, at both the low (hungry) and high (postharvest) points in terms of consumption. Underlying the success of this technique is a relatively monotonous rural diet with limited variety both in food selection and in recipes. What varies from one season to the next is which foods get included in the daily diet and how many times per day they are consumed, rather than the nutrient content of an average serving. This reality allows us to be successful at predicting dietary adequacy by collecting only information on the former and using the prediction model to provide estimates of the latter.

In order to have the most representative prediction model, we estimated our regressions pooling observations from three different times during the year — the harvest, post-harvest, and hungry seasons. This allows one to use the coefficients from this model to develop estimates of nutrient intake adequacy for any time during the year in which food consumption data can be collected. The advantage of such a system is that dietary quality can be monitored whenever it is feasible for the monitoring agency, provided that subsequent monitoring surveys are conducted at the same time of the year to ensure comparability.

One concern with this approach is that it may result in estimates from only the least food insecure period of the year (post-harvest season), since that is typically the most convenient time to do agricultural surveys. Yet this period may not be representative of the households' nutrient intake adequacy over an entire year, and especially not during the hungry season. Does this matter? From a policy point of view, probably not. Even at the best of times in the Nampula/Cabo Delgado sample (i.e. the post-harvest season), close to 50 percent of households had low or very low quality diets. Thus, if this tool were to be used as a means for targeting resources to areas of need, there would be no problem in finding priority areas, i.e. areas with high prevalences of low quality diets. The same could be said if the tool were used to monitor improvements over time. Of course, monitoring agencies could, if they wished, collect data during the hungry season to obtain estimates valid for that most vulnerable season.

As economic conditions in Mozambique improve, we expect that the harvest or the post-harvest season will be the time of year in which it first becomes difficult to find households with low quality diets. At that point in time, it will become necessary either to schedule diet monitoring surveys during the hungry season, or to devise prediction models that can predict dietary outcomes beyond the survey time. For example, alternative prediction models could be used to predict dietary outcomes in the hungry season with data collected in the post-harvest season. Even more desirable would be a model that predicts dietary quality throughout the year, i.e. an annual average, with data from just the post-harvest season. See appendix D for our results demonstrating such an alternative prediction model.

Another concern with this approach is that simple dietary surveys are likely to be based on just one day of data. As has been shown previously, there is significant intra-individual variation in intakes from one day to the next (FNB, 1986). Thus a distribution of intakes based on one day of data will be more dispersed than a distribution based on averages of intakes on two or more days from the same households. We found this to be the case in the NCD survey when we looked at the frequency of low intakes based on one day of data as compared with two days of data, the latter being what we report on in this document. However, our prediction model was not affected by this. That is, predicted intakes based on one day of simple food consumption data were very close to measured intakes. In practice, this means that prevalence estimates of low intakes based on just one day of data will be higher than our results reported here for NCD. This should not be a problem, as long as monitoring agencies that begin collecting one-day consumption data continue to collect one-day data in the future to ensure comparability.

As with all prediction models there are limitations to this one. The coefficients at the heart of this model were developed from data collected in Nampula and Cabo Delgado provinces. While clearly it is better to develop assessment tools for Mozambique using data from this area than to use data from Zambia or Mali, it would have been even better to have calibrated the model on a nationally representative dataset. Unfortunately no such dataset exists. The household income and expenditure survey conducted in 1996-97, *Inquérito aos Agregados Familiares* (IAF), is nationally-representative and does have food consumption data. But the survey did not collect information on how many times per day each food was consumed and the quality of data does not permit nutrient intake assessments, other than for calories. A panel survey of cashew producers in Nampula, Gaza, and Inhambane provinces, known as the *Inquérito de Caju*, does have good quality food consumption data in the 1998 round, but it is not nationally representative.

In addition to geographic representation, a second concern is the validity of the model over time. The data from the NCD study come from 1995-96. While there may have been food consumption changes in the late 1990s in the upper income brackets of urban centers in Mozambique, we believe that change has been quite slow in the rural settings of the country. Thus, it seems reasonable to use a prediction model calibrated on these data for a few more years.

At present, we have not tested whether there is a geographic or temporal bias in our model. Future analyses could begin to address these issues. The IAF dataset does have data on calorie consumption. A revised prediction model for energy intake developed on NCD data with variables in the same form as those collected on IAF could then be tested on that nationally representative dataset. This would enable us to see how well a model developed in one part of the country does at predicting dietary adequacy nationwide, at least for energy. A similar line of research could explore spatial variation in consumption habits by looking exclusively at models developed with data from the cashew survey, since the provinces selected for that survey represent very different parts of Mozambique. The cashew survey could also be used to look at changes in consumption over time, since Nampula province was studied in that 1998 survey as well as in the 1995 NCD. A dietary adequacy prediction model developed with Nampula data from NCD could be used to make predictions with simple food consumption data from the cashew survey. Comparing these predictions with actual nutrient intakes for Nampula in 1998 would provide insights into how well our model functions over time. Depending on the outcomes of these analyses, there may be justification for pooling of data from various surveys in order to develop a more robust prediction model.

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Appendix A — Results on Other Nutrients

This appendix contains information on the 7 nutrients that comprise the dietary variety component of the Mozambique Diet Quality Index (see page 6). These appendix tables are analogous to text tables 1, 2, 5, and 8.

Table A-1. Mean intakes of other nutrients in the Nampula/Cabo Delgado sample by season

	Mean Intake (as a % of recommended intake)			
Nutrient	All seasons	Harvest season	Post-Harvest season	Hungry season
Thiamin	140.2	159.4	167.0	93.3
Riboflavin	37.4	38.6	44.4	29.1
Niacin	97.7	111.9	117.7	62.8
Vitamin B-6	103.2	108.0	91.4	110.4
Folic Acid	133.1	171.3	164.2	62.2
Vitamin C	193.6	188.6	211.2	180.6
Calcium	67.3	65.6	75.9	60.2

Table A-2. Frequency of low intakes of other nutrients in the Nampula/Cabo Delgado sample

	Percent of sample with low intake (< 75% of recommended)			
Nutrient	All seasons	Harvest season	Post-Harvest season	Hungry season
Thiamin	21.4	10.0	6.5	48.3
Riboflavin	95.4	94.5	93.5	98.4
Niacin	46.0	40.4	26.7	71.5
Vitamin B6	16.9	4.5	23.1	23.2
Folic Acid	37.6	19.3	21.8	72.5
Vitamin C	31.1	35.6	29.8	28.0
Calcium	72.4	73.4	67.1	76.8

Table A-3. Dietary Adequacy Prediction Model for Other Nutrients

Food Group	Thiamin	Ribo-flavin	Niacin	Vitamin B6	Folic Acid	Vitamin C	Calcium
			Coefficient Estimates				
Grains	.2923	.1959	.2411	-.0063	-.0448	-.0822	.0053
Beans	.5050	.4467	.3176	-.0924	1.6488	-.0313	.3001
Tubers	.1186	.2309	.1959	-.2324	-.1728	.2303	.2712
Nuts/Seeds	.4971	.1977	.7361	.0545	.5544	.1901	.2510
Animal Products	.0469	.1317	.1397	.0613	.1854	-.0914	.2986
Vitamin A Fr &Veg	-.0102	.0009	-.0406	.2614	.0263	.5691	.0713
Vitamin C Fr & Veg	.0807	.1415	.0606	-.0349	.2534	.8694	.1308
Other Fr & Veg	.1012	.1111	.1809	.1701	.0962	.3803	.0357
Sugars	-.1134	-.1178	-.0774	-.0189	-.0739	-.0734	-.0448
Oils	-.1069	-.1085	-.1456	.0642	-.0911	.1450	.1031
Other Foods	.1185	.2057	.1803	.0572	.1294-	.3171	-.0550
Household size	-.1655	-.1522	-.1771	.0092	.1743	-.1641	-.1319
Intercept	-.3726	-1.4573	-.7711	-.1456	-.6944	-.3962	.4911
			Model Statistics				
Adjusted R^2	.630	.515	.627	.234	.632	.537	.276
N	1140	1140	1140	1140	1140	1140	1140
F	162.88	101.67	160.29	29.969	163.81	110.786	37.263

Table A-4. Frequency of low intakes of other nutrients in the Nampula/Cabo Delgado sample compared to predictions

Nutrient	All Seasons		Post-Harvest		Hungry	
	Measured (% low)[1]	Predicted (% low)	Measured (% low)	Predicted (% low)	Measured (% low)	Predicted (% low)
Thiamin	21.4	22.1	6.5	10.1	48.3	47.7
Riboflavin	95.4	98.9	93.5	98.4	98.4	100.0
Niacin	46.0	48.4	26.7	35.2	71.5	74.7
Vitamin B6	16.9	12.0	23.1	16.6	23.2	18.7
Folic Acid	37.6	49.2	21.8	33.2	72.5	85.4
Vitamin C	31.1	32.7	29.8	39.9	28.0	15.5
Calcium	72.4	63.2	67.1	51.8	76.8	72.0

[1] A low intake refers to an intake less than 75 percent of the recommendation. Measured results are based on the intensive quantitative 24-hour recall technique. Predictions are based on the dietary adequacy prediction model.

Appendix B — Nutrient Reference Standards

Table B-1. Recommended Levels of Energy Intake (Calories/day)[1]

Age	Males	Females	Age	Males	Females
< 1	785	741	12	2180	1974
1	1307	1107	13	2297	2029
2	1456	1255	14	2397	2087
3	1604	1397	15	2449	2143
4	1729	1546	16	2528	2143
5	1812	1698	17	2618	2150
6	1910	1785	≥ 18, < 30	2987	2183
7	1992	1771	≥ 30, < 59	2928	2186
8	2056	1835	≥ 60	2018	1834
9	2066	1810			
10	2088	1901	Pregnant		+ 285
11	2152	1914	Lactating		+ 500

1 These recommendations are based on reference weight data for Mozambique (James and Schofield, 1994) and include energy needed to maintain weight as well as energy necessary for occupational and "socially desirable" activities. For adults, examples of the latter include "attending community meetings or walking to health clinics or places of worship." For children, additional energy is needed for "the normal process of development, for activities such as exploration of the surroundings, learning, and behavioral adjustments to other children and adults." (FAO/WHO/UNU, 1985). Occupational activities are assumed to be characteristic of a rural population in a developing country, i.e. requiring moderate to heavy energy expenditures.

Note that household size in adult equivalent units can be calculated with information from this table. We started with the age-sex grouping of individuals with the highest daily energy recommendation — adult males from 18 to 30 years of age. Individuals in this group were the standard, that is, equivalent to 1.0 adults. For each other age-sex grouping we calculated the adult equivalence by dividing their energy recommendation by that of 18-30 year old men. For example, a 16 year-old male would be 0.85 of an adult equivalent (2528/2987), a 3 year-old female would be 0.47 of an adult equivalent (1397/2987), etc. By adding up these adult equivalent values for each household, one gets a value for household size that gives a better indication of the household's total energy needs, than just using a count of the number of individuals.

Table B-2. Recommended Protein Intake (g/day) [1]

Age	Males	Females	Age	Males	Females
< 1	14.0	13.3	12	43.8	44.0
1	23.6	19.1	13	49.7	48.5
2	26.6	23.4	14	50.4	50.2
3	29.2	26.5	15	54.1	55.5
4	32.8	30.2	16	55.8	51.7
5	32.5	31.8	17	59.1	52.1
6	35.8	35.5	≥ 18, < 30	56.6	49.7
7	30.0	29.1	≥ 30, < 59	56.6	49.7
8	33.4	33.2	≥ 60	56.6	49.7
9	35.9	36.5			
10	38.2	41.6	Pregnant		+ 7
11	42.9	44.6	Lactating		+ 18

[1] These levels are safe intakes (average requirement plus 2 standard deviations) based on recommendations in FAO/WHO/UNU, 1985, as applied to a Nigerian cassava-diet, i.e. corrected for a reduced digestibility of 85%, and for reduced protein quality of 72% for ages 1-6 years, and 95% for ages 6-12 years (see Table 40 in FAO/WHO/UNU, 1985). Additional protein requirements for pregnancy and lactation are from the same source and assume a digestibility of 85% (see Table 50 in FAO/WHO/UNU, 1985). Since protein recommendations are listed in grams of intake per kilograms of body weight, assumptions about weight were needed to calculate values in the above table. We used reference weight data for Mozambique (James and Schofield, 1994).

Table B-3. Recommended Levels of Intake for 8 Nutrients [1,2]

	Vitamin A	Iron[3]	Thiamin	Riboflavin	Niacin	Folate	Vitamin C	Calcium
Children								
≤ 3	400	8	0.5	0.8	9.0	50	20	450
>3, ≤ 6	400	9	0.7	1.1	12.1	50	20	450
>6, ≤ 9	500	16	0.9	1.3	14.9	102	20	450
Males								
>9, ≤ 12	500	16	1.0	1.6	17.2	102	20	650
>12, ≤ 15	600	24	1.2	1.7	19.1	170	30	650
>15, ≤ 19	600	15	1.2	1.8	20.3	200	30	650
>19	600	15	1.2	1.8	19.8	200	30	450
Females								
> 9, ≤ 12	500	16	0.9	1.4	15.5	102	20	650
> 12, ≤ 15	600	27	1.0	1.5	16.4	170	30	650
> 15, ≤ 19	500	27	0.9	1.4	15.2	170	30	550
> 19, ≤ 50	500	29	0.9	1.3	14.5	170	30	450
> 50	500	13	0.9	1.3	14.5	170	30	450
Pregnant	+ 100	29	+ 0.1	+ 0.2	+ 2.3	+ 200	30	+ 650
Lactating	+ 250	29	+ 0.2	+ 0.4	+ 3.7	+ 100	30	+ 650

1 Recommended levels of intake listed in the table are in milligrams, except for vitamin A (micrograms of retinol equivalents) and folate (micrograms). These are safe levels, i.e. average requirements plus a safety factor, to meet the needs of most healthy people.

2 Sources for these recommendations are the following: vitamin A, folate, and iron (FAO/WHO, 1988); thiamin, riboflavin, and niacin (FAO/WHO, 1967); vitamin C (FAO/WHO, 1970); calcium (FAO/WHO, 1962).

3 Iron standards are based on the requirement to prevent anemia from a low bioavailability diet (5%). For pregnancy and lactation, the requirement for menstruating women is assumed. For women over age 50, the iron standard is reduced to 13 mg/day.

Appendix C — An Example of a Simplified Food Consumption Module

ALIMENTOS CONSUMIDOS POR O AGREGADO FAMILIAR NAS ÚLTIMAS 24 HORAS.

Inquiridor: Peça a pessoa entrevistada para chamar a pessoa no AF que teve a responsabilidade de preparar as refeições da familia no dia anterior. Na listagem dos alimentos deve incluir todos os ingredientes de cada prato de cada refeição. Por exemplo, incluir todos os produtos usados para fazer o caril ou a chima. Tambem incluir todos alimentos consumidos entre refeições, como frutas, cana de açucar, etc..

Agora vamos falar sobre o que o AF COMEU ONTEM

Tabela XX: Alimentos Consumidos

ALIMENTOS CONSUMIDOS DO DIA ANTERIOR		
MATABICHO ATÉ ANTES DO ALMOÇO *(Listar TODOS OS ALIMENTOS E INGREDIENTES consumidos de manhã até antes do almoço)*	ALMOÇO ATÉ ANTES DO JANTAR *(Listar TODOS OS ALIMENTOS E INGREDIENTES consumidos depois do matabicho e até antes do jantar)*	JANTAR E DEPOIS *(Listar TODOS OS ALIMENTOS E INGREDIENTES consumidos no jantar)*
XX1	**XX2**	**XX3**

Appendix D — Predicting Annual Dietary Adequacy Using Only Post-Harvest Data

Since it may be useful to have estimates of nutritional adequacy based on an average of consumption throughout the year, we developed an alternative dietary adequacy prediction model. The objective of this alternative model is to provide estimates of annual dietary adequacy based only on observations from the post-harvest season. We developed this model by averaging each household's nutrient intake observations from three seasons (harvest, post-harvest, and hungry) to get an annual average intake per household. We then proceeded as described in the section entitled, "Development of the Dietary Adequacy Prediction Model."

The dependent variables in our regression models were nutrient intake averages across the year. Rather than having about one observation per household per season, we had just one observation per household. Our sample size for running the regression models was 365, rather than the 1140 that we had with disaggregated observations in the regression models used for the main text of this paper. We used the simple food group consumption variables collected in the post-harvest season as the independent variables.

As described earlier, we used a system of 11 food groups with independent variables indicating the number of times per day the household consumed from each group.

As with the main text models, we experimented with a number of socio-economic variables to get improved predictions. In this context, where we attempted to make predictions about consumption during the entire year with simplified data from just one season, we found that other information about the socio-economic status of the household was indeed useful. In addition to household size, four other variables were often significantly related ($p < 0.05$ in at least three of the 11 equations) to nutrient intakes. One of these was land area cultivated by the household. The three others were dichotomous variables indicating whether the household had members that worked off-farm in agriculture, in non-agricultural activities, or in their own micro-enterprise.

In addition to these socio-economic variables, we experimented with models that also included a set of 5 agricultural production variables. One of these was a quantitative estimate of the household's maize harvest for the year. The other four were dichotomous variables indicating whether or not manioc, sorghum, beans, or peanuts was the crop yielding the greatest production (in weight) for the household in that year. These dichotomous variables met our previous criteria (significant at a p-value < 0.05 in at least three of 11 equations). The quantitative estimate of maize production was included (though only significant in 2 equations), because using it in future predictions could incorporate important information about general agricultural conditions in a given year. We found that including this set of variables in the regression models improved predictions slightly.

In further tests, we found that we could get an even better improvement (i.e. predictions closer to measured results), by simply splitting out sorghum products from the grains group and running models with 12 food group variables instead of 11. Sorghum is higher in iron than other grains, so this configuration improves the prediction of the prevalence of low iron intakes (though not changing other predictions). These models did not include the agricultural production variables described in the paragraph above. Development and use of

Table D-1. An Alternative Dietary Adequacy Prediction Model for Selected Nutrients

Independent variable [1]	Dependent variable				
	Energy	Protein	Vitamin A	Iron	MDQI
	Coefficient Estimates				
Grains except sorghum	.1377	.1893	.0173	.0157	.3192
Sorghum	.1156	.2154	.0436	.2968	.5742
Beans	.0760	.2870	.0048	.3159	.5454
Tubers	.2004	.0844	.0453	.1935	.5141
Nuts/Seeds	.0068	.0368	.0297	-.0143	.1889
Animal Products	.0704	.1029	-.0139	.0748	.1411
Vitamin A-Rich Fruits and Vegetables	.0161	.0094	.0920	.0867	.1924
Vitamin C-Rich Fruits and Vegetables	.0455	.0046	.0497	.0845	.2831
Other Fruits and Vegetables	.1029	.0421	.0228	.0524	.2842
Sugars	.0159	-.1501	-.0156	.0054	.0931
Oils	.0040	-.1204	.0522	.0031	.1227
Other Foods	.0082	.2484	.2961	.0497	.6277
Household size	-.1285	-.1691	-.0497	-.1372	-.4406
Area cultivated	.0112	.0171	-.0040	.0026	.0155
Works off-farm in agriculture	-.1141	-.1077	-.0057	-.1529	-.3140
Works off-farm in non-agriculture	.0670	.1736	.0034	.0190	.1563
Has micro-enterprise	-.0231	-.0133	-.0091	-.0352	-.1075
Intercept	-.1434	1.2637	.3517	.1268	7.4506
Model Statistics					
Adjusted R^2	.427	.358	.223	.444	.458
N	365	365	365	365	365
F	16.93	12.93	7.14	18.10	19.13

[1] Food group variables refer to the number of times a food was consumed from each group per day. Household size is expressed in adult equivalents (see Appendix Table B-2). Area cultivated is expressed in hectares. Other variables are dichotomous.

a nutrient adequacy prediction model based on these latter regressions would require much less work in future data collection and processing, since the agricultural production variables would not be needed. Thus the final models that we chose include 12 food group variables, household size, land area cultivated, and the 3 indicators on working off-farm in agriculture, non-agriculture, and micro-enterprise.

Table D-1 lists the coefficients of this alternative prediction model. Unlike the model for the main text, we got better predictions on the Mozambique Diet Quality Index (MDQI) when we regressed the index *directly* on the independent variables and used the coefficients from that regression to make predictions. Thus, we also include a column in this table with a description of the MDQI coefficients. (In the main text model, we ran regressions for each nutrient that forms part of the MDQI and then used predictions on the intakes of these nutrients to calculate a predicted MDQI. See footnote 12.) Full statistical results for these models are included in Appendix F.

Table D-2 lists the measured frequency of low-intakes when the intake of nutrients is first averaged over the year for each household. Table D-2 also displays the predicted frequency of low intakes from the prediction model using simple food group consumption variables from the post-harvest season along with the socio-economic variables described above. Table D-3 compares the measured MDQI with the predictions from this model.

Table D-2. Measured frequency of low intakes when nutrient intakes are averaged over the year for each household compared with predicted frequency from the prediction model using data from the post-harvest season only

Nutrient	Measured (% low)[1]	Predicted (% low)
Energy	36.4	27.1
Protein	7.1	3.8
Vitamin A	94.8	99.7
Iron	25.5	13.7

[1] A low intake refers to intakes less than 75 percent of the recommendation.

Table D-3. Measured and predicted results on the Mozambique Diet Quality Index (MDQI) using the Alternative Dietary Adequacy Prediction Model

	All Seasons	
Percent of Households with:	Measured (%)	Predicted (%)
Acceptable diets (MDQI ≥ 7.5)	52.9	47.9
Low or Very Low quality diets (MDQI < 7.5)	47.1	52.1
Low quality diets (6.0 ≤ MDQI < 7.5)	37.0	48.2
Very Low quality diets (MDQI < 6.0)	10.1	3.8

Appendix E — Regression Results for Main Text Model

```
Model Summary — ENERGY
--------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .747    | .558     | .554              | .341809                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
ANOVA
------------------------------------------------------------------------------
 | Model           | Sum of Squares | df   | Mean Square | F       | Sig.    |
 | -- | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 | 1  | Regression | 166.393        | 12   | 13.866      | 118.683 | .000    |
 |    | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 |    | Residual   | 131.671        | 1127 | .117        |         |         |
 |    | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 |    | Total      | 298.064        | 1139 |             |         |         |
 | -- | ---------- | -------------- | ---- | ----------- | ------- | ------- |
Coefficients(a)
-------------------------------------------------------------------------------------------------------------------------------
 |                                        | Unstandardized Coefficients             | Standardized Coefficients | t       | Sig. |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- |         |      |
 | Model                                  | B                        | Std. Error | Beta                      |         |      |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                        | -.739                    | .046       |                           | -15.940 | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS        | .317                     | .018       | .554                      | 17.986  | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS         | .297                     | .025       | .265                      | 11.950  | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS        | .394                     | .022       | .517                      | 17.922  | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS   | .240                     | .020       | .246                      | 11.803  | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL  | .122                     | .024       | .119                      | 5.141   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG | -4.985E-02               | .019       | -.057                     | -2.579  | .010 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG | 6.146E-02                | .014       | .090                      | 4.447   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG  | .100                     | .029       | .072                      | 3.502   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS        | -1.628E-02               | .048       | -.007                     | -.341   | .733 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                          | 8.870E-02                | .052       | .036                      | 1.711   | .087 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS   | 9.802E-02                | .089       | .022                      | 1.101   | .271 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                            | -.147                    | .007       | -.434                     | -21.415 | .000 |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: LENAR
```

```
Model Summary — PROTEIN
---------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .806    | .650     | .646              | .394090                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
ANOVA
-------------------------------------------------------------------------------
 | Model           | Sum of Squares | df   | Mean Square | F       | Sig.    |
 | -- | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 | 1  | Regression | 324.589        | 12   | 27.049      | 174.165 | .000    |
 |    | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 |    | Residual   | 175.031        | 1127 | .155        |         |         |
 |    | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 |    | Total      | 499.620        | 1139 |             |         |         |
 | -- | ---------- | -------------- | ---- | ----------- | ------- | ------- |
Coefficients(a)
----------------------------------------------------------------------------------------------------------------------------------
 |                                         | Unstandardized Coefficients            | Standardized Coefficients | t       | Sig. |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- |         |      |
 | Model                                   | B                        | Std. Error | Beta                      |         |      |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                         | -.457                    | .053       |                           | -8.548  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS         | .289                     | .020       | .391                      | 14.233  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS          | .612                     | .029       | .421                      | 21.308  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS         | -7.253E-03               | .025       | -.007                     | -.286   | .775 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS    | .324                     | .023       | .256                      | 13.799  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL   | .209                     | .027       | .157                      | 7.618   | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG  | -3.489E-02               | .022       | -.031                     | -1.566  | .118 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG  | 7.062E-02                | .016       | .080                      | 4.431   | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG   | .100                     | .033       | .056                      | 3.032   | .002 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS         | -7.144E-02               | .055       | -.025                     | -1.299  | .194 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                           | -.144                    | .060       | -.046                     | -2.416  | .016 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS    | .146                     | .103       | .026                      | 1.418   | .157 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                             | -.145                    | .008       | -.330                     | -18.290 | .000 |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: LPNAR
```

```
Model Summary — VITAMIN A
--------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .755    | .569     | .565              | .2339                      |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
ANOVA
------------------------------------------------------------------------------
 | Model           | Sum of Squares | df   | Mean Square | F       | Sig.    |
 | -- | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 | 1  | Regression | 81.519         | 12   | 6.793       | 124.142 | .000    |
 |    | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 |    | Residual   | 61.671         | 1127 | 5.472E-02   |         |         |
 |    | ---------- | -------------- | ---- | ----------- | ------- | ------- |
 |    | Total      | 143.189        | 1139 |             |         |         |
 | -- | ---------- | -------------- | ---- | ----------- | ------- | ------- |
Coefficients(a)
-----------------------------------------------------------------------------------------------------------------------------------
 |                                         | Unstandardized Coefficients            | Standardized Coefficients | t       | Sig. |
 | -- | ---------------------------------- | ------------------------- | ---------- | ------------------------- |         |      |
 | Model                                   | B                         | Std. Error | Beta                      |         |      |
 | -- | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                         | .116                      | .032       |                           | 3.658   | .000 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS         | 6.358E-03                 | .012       | .016                      | .528    | .598 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS          | 8.951E-02                 | .017       | .115                      | 5.254   | .000 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS         | -1.406E-02                | .015       | -.027                     | -.934   | .351 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS    | -3.280E-02                | .014       | -.048                     | -2.356  | .019 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL   | 8.433E-02                 | .016       | .119                      | 5.175   | .000 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG  | .446                      | .013       | .736                      | 33.708  | .000 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG  | .105                      | .009       | .222                      | 11.066  | .000 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG   | 5.000E-02                 | .020       | .052                      | 2.546   | .011 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS         | -8.232E-02                | .033       | -.053                     | -2.522  | .012 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                           | 1.772E-02                 | .035       | .010                      | .499    | .618 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS    | 9.639E-02                 | .061       | .032                      | 1.581   | .114 |
 |    | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                             | -5.425E-02                | .005       | -.231                     | -11.553 | .000 |
 | -- | ---------------------------------- | ------------------------- | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: RENAR  mean ret eq nut adeq ratio
```

```
Model Summary — IRON
---------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .694    | .482     | .477              | .482641                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
ANOVA
------------------------------------------------------------------------------
 | Model           | Sum of Squares | df   | Mean Square | F      | Sig.    |
 | -- | ---------- | -------------- | ---- | ----------- | ------ | ------- |
 | 1  | Regression | 244.468        | 12   | 20.372      | 87.457 | .000    |
 |    | ---------- | -------------- | ---- | ----------- | ------ | ------- |
 |    | Residual   | 262.526        | 1127 | .233        |        |         |
 |    | ---------- | -------------- | ---- | ----------- | ------ | ------- |
 |    | Total      | 506.994        | 1139 |             |        |         |
 | -- | ---------- | -------------- | ---- | ----------- | ------ | ------- |
Coefficients(a)
---------------------------------------------------------------------------------------------------------------------------------
 |                                         | Unstandardized Coefficients             | Standardized Coefficients | t       | Sig. |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- |         |      |
 | Model                                   | B                        | Std. Error | Beta                      |         |      |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                         | -.545                    | .065       |                           | -8.328  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS         | .201                     | .025       | .269                      | 8.077   | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS          | .746                     | .035       | .509                      | 21.210  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS         | .493                     | .031       | .495                      | 15.850  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS    | .164                     | .029       | .129                      | 5.710   | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL   | .119                     | .034       | .089                      | 3.533   | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG  | -1.170E-02               | .027       | -.010                     | -.429   | .668 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG  | 8.781E-02                | .020       | .099                      | 4.499   | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG   | .129                     | .041       | .071                      | 3.178   | .002 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS         | -.103                    | .067       | -.035                     | -1.522  | .128 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                           | -.142                    | .073       | -.045                     | -1.937  | .053 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS    | .153                     | .126       | .027                      | 1.217   | .224 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                             | -.162                    | .010       | -.367                     | -16.741 | .000 |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: LFNAR
```

Appendix F — Regression Results for Alternative Model in Appendix D

```
Model Summary — ENERGY
---------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .673    | .453     | .427              | .243477                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |

ANOVA
-----------------------------------------------------------------------------
 | Model          | Sum of Squares | df  | Mean Square | F      | Sig.    |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
 | 1  | Regression | 17.058         | 17  | 1.003       | 16.926 | .000    |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Residual   | 20.571         | 347 | 5.928E-02   |        |         |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Total      | 37.628         | 364 |             |        |         |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
```

```
Coefficients(a) — ENERGY
---------------------------------------------------------------------------------------------------------------------------------
 |                                        | Unstandardized Coefficients            | Standardized Coefficients | t       | Sig. |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- |         |      |
 | Model                                  | B                        | Std. Error | Beta                      |         |      |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                        | -.143                    | .074       |                           | -1.929  | .055 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS        | .138                     | .028       | .376                      | 4.919   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMMAPI                          | .116                     | .033       | .208                      | 3.455   | .001 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS         | 7.603E-02                | .032       | .108                      | 2.409   | .017 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS        | .200                     | .033       | .411                      | 6.116   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS   | 6.787E-03                | .027       | .011                      | .254    | .799 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL  | 7.037E-02                | .027       | .124                      | 2.634   | .009 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG | 1.606E-02                | .047       | .015                      | .342    | .733 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG | 4.552E-02                | .017       | .116                      | 2.689   | .008 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG  | .103                     | .038       | .117                      | 2.720   | .007 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS        | 1.590E-02                | .071       | .010                      | .225    | .822 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                          | 4.002E-03                | .058       | .003                      | .069    | .945 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS   | 8.231E-03                | .086       | .004                      | .095    | .924 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                            | -.129                    | .010       | -.562                     | -12.752 | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | AREAC  area cult 94/95            | 1.125E-02                | .006       | .087                      | 1.849   | .065 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | TFAG                              | -.114                    | .027       | -.173                     | -4.163  | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | TFNOAG                            | 6.704E-02                | .045       | .063                      | 1.505   | .133 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | CP                                | -2.314E-02               | .027       | -.035                     | -.851   | .395 |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: LENAR
```

```
Model Summary — PROTEIN
--------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .631    | .398     | .369              | .285860                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |

ANOVA
----------------------------------------------------------------------------
 | Model           | Sum of Squares | df  | Mean Square | F      | Sig.    |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
 | 1  | Regression | 18.774         | 17  | 1.104       | 13.515 | .000    |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Residual   | 28.355         | 347 | 8.172E-02   |        |         |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Total      | 47.130         | 364 |             |        |         |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
```

```
Coefficients(a) — PROTEIN
---------------------------------------------------------------------------------------------------------------------------------
 |                                        | Unstandardized Coefficients           | Standardized Coefficients | t       | Sig. |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- |         |      |
 | Model                                  | B                        | Std. Error | Beta                      |         |      |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                        | .117                     | .087       |                           | 1.342   | .180 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS        | .151                     | .033       | .368                      | 4.597   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMMAPI                          | .176                     | .039       | .282                      | 4.466   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS         | .234                     | .037       | .299                      | 6.327   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS        | 5.065E-02                | .038       | .093                      | 1.317   | .189 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS   | 4.878E-02                | .031       | .069                      | 1.556   | .121 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL  | 8.300E-02                | .031       | .131                      | 2.647   | .009 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG | -1.824E-02               | .055       | -.015                     | -.330   | .741 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG | 1.436E-02                | .020       | .033                      | .722    | .470 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG  | 4.926E-02                | .044       | .050                      | 1.109   | .268 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS        | -6.764E-02               | .083       | -.037                     | -.815   | .416 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                          | -9.974E-02               | .068       | -.071                     | -1.474  | .141 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS   | 9.041E-02                | .101       | .038                      | .893    | .373 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                            | -.125                    | .012       | -.488                     | -10.567 | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | AREAC  area cult 94/95            | 1.372E-02                | .007       | .094                      | 1.921   | .056 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | TFAG                              | -8.558E-02               | .032       | -.116                     | -2.661  | .008 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | TFNOAG                            | .108                     | .052       | .090                      | 2.060   | .040 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | CP                                | -8.641E-03               | .032       | -.012                     | -.271   | .787 |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: LPNAR
```

```
Model Summary — VITAMIN A
--------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .509    | .259     | .223              | .1918                      |
 | ----- | ------- | -------- | ----------------- | -------------------------- |

ANOVA
---------------------------------------------------------------------------
 | Model           | Sum of Squares | df  | Mean Square | F     | Sig.    |
 | -- | ---------- | -------------- | --- | ----------- | ----- | ------- |
 | 1  | Regression | 4.468          | 17  | .263        | 7.141 | .000    |
 |    | ---------- | -------------- | --- | ----------- | ----- | ------- |
 |    | Residual   | 12.771         | 347 | 3.680E-02   |       |         |
 |    | ---------- | -------------- | --- | ----------- | ----- | ------- |
 |    | Total      | 17.239         | 364 |             |       |         |
 | -- | ---------- | -------------- | --- | ----------- | ----- | ------- |
```

```
Coefficients(a) — VITAMIN A
-----------------------------------------------------------------------------------------------------------------------------------
 |                                        | Unstandardized Coefficients          | Standardized Coefficients | t      | Sig. |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- |        |      |
 | Model                                   | B                        | Std. Error | Beta                      |        |      |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 | 1  | (Constant)                         | .352                     | .059       |                           | 6.001  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS         | 1.730E-02                | .022       | .070                      | .784   | .433 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMMAPI                           | 4.359E-02                | .026       | .116                      | 1.653  | .099 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMBEAN  # PER DAY BEANS          | 4.801E-03                | .025       | .010                      | .193   | .847 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS         | 4.527E-02                | .026       | .137                      | 1.754  | .080 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS    | 2.969E-02                | .021       | .070                      | 1.411  | .159 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL   | -1.389E-02               | .021       | -.036                     | -.660  | .510 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG  | 9.200E-02                | .037       | .125                      | 2.483  | .014 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG  | 4.966E-02                | .013       | .187                      | 3.723  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG   | 2.285E-02                | .030       | .038                      | .766   | .444 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS         | -1.561E-02               | .056       | -.014                     | -.280  | .780 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMOILS                           | 5.222E-02                | .045       | .061                      | 1.150  | .251 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS    | .296                     | .068       | .208                      | 4.357  | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | HHCAET                             | -4.972E-02               | .008       | -.321                     | -6.261 | .000 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | AREAC  area cult 94/95             | -4.023E-03               | .005       | -.046                     | -.839  | .402 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | TFAG                               | -5.749E-03               | .022       | -.013                     | -.266  | .790 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | TFNOAG                             | 3.430E-03                | .035       | .005                      | .098   | .922 |
 |    | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
 |    | CP                                 | -9.097E-03               | .021       | -.020                     | -.425  | .671 |
 | -- | ---------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
a Dependent Variable: RENAR
```

```
Model Summary — IRON
---------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .686    | .470     | .444              | .331666                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |

ANOVA
-----------------------------------------------------------------------------
 | Model           | Sum of Squares | df  | Mean Square | F      | Sig.    |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
 | 1  | Regression | 33.852         | 17  | 1.991       | 18.103 | .000    |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Residual   | 38.171         | 347 | .110        |        |         |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Total      | 72.023         | 364 |             |        |         |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
```

```
Coefficients(a) — IRON
---------------------------------------------------------------------------------------------------------------------------------
|                                        | Unstandardized Coefficients           | Standardized Coefficients | t      | Sig. |
| -- | --------------------------------- | ------------------------ | ---------- | ------------------------- |        |      |
| Model                                  | B                        | Std. Error | Beta                      |        |      |
| -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
| 1  | (Constant)                        | .127                     | .101       |                           | 1.251  | .212 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMGRAI  # PER DAY GRAINS        | 1.566E-02                | .038       | .031                      | .411   | .682 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMMAPI                          | .297                     | .046       | .386                      | 6.508  | .000 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMBEAN  # PER DAY BEANS         | .316                     | .043       | .325                      | 7.348  | .000 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMTUBE  # PER DAY TUBERS        | .194                     | .045       | .287                      | 4.336  | .000 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMNUTS  # PER DAY NUTS, SEEDS   | -1.428E-02               | .036       | -.016                     | -.393  | .695 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMOANM  # PER DAY OTHER ANIMAL  | 7.476E-02                | .036       | .096                      | 2.055  | .041 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMVAFV  # PER DAY VIT A FR, VEG | 8.666E-02                | .064       | .058                      | 1.353  | .177 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMVCFV  # PER DAY VIT C FR, VEG | 8.445E-02                | .023       | .155                      | 3.662  | .000 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMOFV  # PER DAY OTHER FR, VEG  | 5.236E-02                | .052       | .043                      | 1.016  | .310 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMSUGA  # PER DAY SUGARS        | 5.395E-03                | .096       | .002                      | .056   | .955 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMOILS                          | 3.073E-03                | .079       | .002                      | .039   | .969 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | NTIMOTHE  # PER DAY OTHER FOODS   | 4.970E-02                | .117       | .017                      | .423   | .673 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | HHCAET                            | -.137                    | .014       | -.434                     | -9.993 | .000 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | AREAC  area cult 94/95            | 2.615E-03                | .008       | .015                      | .316   | .752 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | TFAG                              | -.153                    | .037       | -.168                     | -4.097 | .000 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | TFNOAG                            | 1.897E-02                | .061       | .013                      | .313   | .755 |
|    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
|    | CP                                | -3.524E-02               | .037       | -.038                     | -.951  | .342 |
| -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------ | ---- |
a Dependent Variable: LFNAR
```

```
Model Summary — MOZAMBIQUE DIET QUALITY INDEX
---------------------------------------------------------------------------------
 | Model | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
 | ----- | ------- | -------- | ----------------- | -------------------------- |
 | 1     | .696    | .484     | .458              | .816194                    |
 | ----- | ------- | -------- | ----------------- | -------------------------- |

ANOVA
-----------------------------------------------------------------------------
 | Model           | Sum of Squares | df  | Mean Square | F      | Sig.    |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
 | 1  | Regression | 216.614        | 17  | 12.742      | 19.127 | .000    |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Residual   | 231.162        | 347 | .666        |        |         |
 |    | ---------- | -------------- | --- | ----------- | ------ | ------- |
 |    | Total      | 447.776        | 364 |             |        |         |
 | -- | ---------- | -------------- | --- | ----------- | ------ | ------- |
```

```
Coefficients(a) — MDQI
---------------------------------------------------------------------------------------------------------------------------------
 |                                        | Unstandardized Coefficients           | Standardized Coefficients | t       | Sig. |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- |         |      |
 | Model                                  | B                        | Std. Error | Beta                      |         |      |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 | 1  | (Constant)                        | 7.451                    | .249       |                           | 29.881  | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMGRAI  # PER DAY GRAINS        | .319                     | .094       | .253                      | 3.402   | .001 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMMAPI                          | .574                     | .112       | .299                      | 5.117   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMBEAN  # PER DAY BEANS         | .545                     | .106       | .225                      | 5.155   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMTUBE  # PER DAY TUBERS        | .514                     | .110       | .306                      | 4.681   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMNUTS  # PER DAY NUTS, SEEDS   | .189                     | .089       | .087                      | 2.111   | .035 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOANM  # PER DAY OTHER ANIMAL  | .141                     | .090       | .072                      | 1.575   | .116 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVAFV  # PER DAY VIT A FR, VEG | .192                     | .158       | .051                      | 1.220   | .223 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMVCFV  # PER DAY VIT C FR, VEG | .283                     | .057       | .209                      | 4.988   | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOFV  # PER DAY OTHER FR, VEG  | .284                     | .127       | .094                      | 2.240   | .026 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMSUGA  # PER DAY SUGARS        | 9.314E-02                | .237       | .017                      | .393    | .695 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOILS                          | .123                     | .193       | .028                      | .635    | .526 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | NTIMOTHE  # PER DAY OTHER FOODS   | .628                     | .289       | .087                      | 2.171   | .031 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | HHCAET                            | -.441                    | .034       | -.558                     | -13.042 | .000 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | AREAC  area cult 94/95            | 1.550E-02                | .020       | .035                      | .760    | .448 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | TFAG                              | -.314                    | .092       | -.138                     | -3.419  | .001 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | TFNOAG                            | .156                     | .149       | .043                      | 1.047   | .296 |
 |    | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
 |    | CP                                | -.107                    | .091       | -.047                     | -1.179  | .239 |
 | -- | --------------------------------- | ------------------------ | ---------- | ------------------------- | ------- | ---- |
a Dependent Variable: TMAR_B
```

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24. Strasberg, Paul, “Smallholder Cash-Cropping, Food-Cropping and Food Security in Northern Mozambique”, Ph.D.Dissertation, Dept. of Agricultural Economics, Michigan State University (**Reprint**), May 1997

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