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Household Food Consumption in Mozambique:
A Case Study in Three Northern Districts

by

Donald Rose, Paul Strasberg, José Jaime Jeje, David Tschirley

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Sérgio Chitará
National Director
Directorate of Economics
Ministry of Agriculture and Fisheries

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Duncan Boughton
Country Coordinator
Department of Agricultural Economics
Michigan State University

MAP/MSU RESEARCH TEAM MEMBERS

Sérgio Chitará, National Director, Directorate of Economics

Pedro Arlindo, Research Associate

José Jaime Jeje, Research Associate

Anabela Mabote, Research Associate

Ana Paula Manuel Santos, Research Associate

Higino Francisco De Marrule, Research Associate

Paulo Mole, Research Associate

Rafael Achicala, SIMA Technician

Simão C. Nhane, SIMA Technician

Maria da Conceição Almeida, Administrative Assistant

Francisco Morais, Assistant

Silvestre Davas, Assistant

Abel Custódio Frechaut, Assistant

Duncan Boughton, MSU Country Coordinator

Julie Howard, MSU Visiting Assistant Professor

Donald Rose, MSU Visiting Associate Professor

David L. Tschirley, MSU Visiting Associate Professor

Michael T. Weber, MSU Professor

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Summary

This report presents results from a detailed exploration of household food consumption behavior in a rural area of northern Mozambique. Smallholder households were studied 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.

Repeated visits on close to 400 households in 16 villages were made from 1995-96 as part of a larger study to identify the impacts of various smallholder cotton growing schemes on household incomes and food security. Information was collected on household demographic characteristics, agricultural production and sales, expenditures on food and other necessities, and daily food consumption at three different periods during the year — harvest, post-harvest, and hungry season. Household food consumption was measured using a 24-hour recall technique, which included trained enumerators, detailed interviews with the person in charge of food preparation, volumetric measurements, and 2 separate visits during each period.

Households in the study areas employed a diverse set of strategies to acquire maize, the principal dietary staple. While the largest share of maize was attained through production on their own farms, households also purchased maize, received it as payments for work or in small businesses, exchanged it in mutual assistance activities with others in the village, acquired it through remittances from family members living outside the household, or received it as donations.

Despite the variety of methods used to obtain maize and other foods, the diets themselves were very limited. Of over 75 individual food items in the nutrient database, households consumed, on average, only 4 different foods per day. Furthermore, just four foods — maize, manioc, beans, and groundnuts — accounted for 86 to 88 percent of calorie intakes. Besides these four staples, only fruits and vegetables were consumed on a majority of interview days, yet only supplied 2 percent of calorie intakes. Animal products, including fish, milk, eggs, chicken, and meat contributed only 1 to 2 percent of household calories.

In both study areas, consumption patterns changed dramatically across the seasons. Maize was the most important food source during the harvest season, supplying about 60 percent of the calories, but dropping to 35 to 39 percent of calories in the hungry season. The important food security role of manioc was seen in the study districts, especially in Monapo/Meconta, where it furnished 45 percent of calories in the hungry season. In Montepuez, manioc's share was also highest in the hungry season, 27 percent, though much lower than in Monapo/Meconta. Groundnuts and sorghum made up the difference in Montepuez, supplying about 20 percent of the calories during the hungry season.

Shortfalls in calorie and protein intakes occurred in the study districts, especially during the hungry season. Average intakes reached only 1,427 calories per capita in the hungry season in Montepuez and 1,733 in Monapo/Meconta, both considerably lower than the 2,200 calories per capita recommended for Mozambique. Hungry-season shortfalls in protein were also seen — average intakes reached only 75 to 79 percent of recommendations. The findings are consistent with data from the Mozambican national nutrition monitoring system, which show that growth-faltering rates peak in the hungry season.

Hungry season consumption in the study districts was also consistent with previous reports of nutritional deficiencies related to specific micro-nutrients, such as iron-deficiency anemia and niacin deficiency. Although there have been no previous reports of calcium deficiency in Mozambique, intakes in the study communities were well below internationally recommended levels. Shortfalls of calcium persist throughout the year and are not surprising given the virtual absence of dairy products from the diet.

A number of socio-economic factors were related to overall food intake at the household level as measured by per capita calorie consumption. Descriptive statistics show that calories per capita decreased with increasing household size and that households in the top third of the income distribution had the highest calorie intakes throughout the year. Households owning more than 1.5 hectares of land per capita had higher calorie intakes than those owning less than this amount. The value of staple food crops produced by the household as well as income from the sale of cash crops were also related to calorie intakes; those with the highest income from each source had the highest calorie intakes in Montepuez throughout the year and in the harvest and hungry seasons in Monapo/Meconta.

The relationship of calorie consumption to household income was examined using various forms of a statistical model that controlled for household size and composition, season of the year, and village of residence. In both districts, per capita calorie consumption was positively, though modestly, related to per capita income. In Montepuez, the analysis showed that for an average household, a 10 percent increase in income would result in a 1.7 percent increase in calorie intake. A similar increase in income would be expected to result in a 2.0 percent increase in Monapo/Meconta.

The findings presented here have important implications for policies directed at improving consumption in Mozambique. Some analysts in other countries have argued that the relationship between calorie intakes and incomes is not very strong and that increases in income may result in purchases of higher-priced foods, but not necessarily more nutritious ones. The findings reported here suggest that increasing the incomes of rural households should have positive effects on calorie intakes in rural Mozambique. Improvements in nutrition may also be effected through specific educational and health interventions. In Montepuez, vitamin A intakes were actually *higher* in the hungry season, due to the ready availability of leaves and other inexpensive vegetable sources of the nutrient. The finding suggests a possible role for nutrition education in combating deficiency of this micro-nutrient, since low intakes at other times of the year, at least in some parts of the country, are presumably due to tastes and preferences rather than economic constraints.

There are three important conclusions that bear on future research and analysis in the area of household food security. First, results from this study highlight the difficult situation that many Mozambican households face, specifically during the hungry season. Thus, monitoring of the food security and nutrition situation in Mozambique, as well as policies to improve this situation, will need to focus on the seasonal nature of food consumption. Second, a currently used method for assessing vulnerability to drought and other climatic events in Mozambique starts with an assumption that 80 percent of calories come from staple foods. In the study districts, staple foods — including cereals, legumes, nuts, roots, and tubers — accounted for upwards of 93 percent of calories. Should this pattern be common throughout Mozambique, district-wide vulnerability may

be much more widespread than previously thought and may call for revisions in current vulnerability analysis. Third, findings reported here indicate that the largest share of expenditures are on food and that the largest source of this food comes from own production. These results emphasize the need for accurate estimates of food consumption as well as accurate methods of valuing food produced for own consumption in determining economic assessments of well-being.

Household Food Consumption in Mozambique:
A Case Study in Three Northern Districts

I. Introduction

There are clear indications that Mozambique is developing quickly after decades of internal conflict. Since the signing of the peace accords in 1992 and the first democratic elections in 1994, the economy has grown at impressive rates; recent estimates indicate GDP growth of 14 percent in 1997. Several good years of agricultural output have also improved aggregate food security. Once dependent on food aid to meet close to half of its domestic food needs, this assistance accounted for only 4 percent of aggregate food consumption in 1996/97 (Tschirley, 1997).

Despite this impressive progress, important and difficult problems remain. On a per capita basis Mozambique is still one of the world's poorest nations. As in most countries, this poverty is most concentrated in rural areas, despite the improved production and better marketing opportunities of recent years. Poverty and hunger continue to be serious problems in many areas of the country. This situation has received a great deal of attention from policymakers in the country. The Ministry of Planning and Finance has an active program to assess poverty and to develop strategies to reduce it. In addition, PROAGRI, the Ministry of Agriculture's plan to coordinate international donor assistance, has a focus on the rural poor.

Food security has been an important focal point in recent policy work to improve living standards in Mozambique. Led by the Ministries of Agriculture and Fisheries, Health, and Planning and Finance, an interdisciplinary working group has developed a vulnerability assessment report for Mozambique which focuses attention on problem areas for food insecurity and malnutrition (GISMAV, 1998). The report makes use of current information on agricultural production, food prices, nutrition monitoring, as well as other data from ongoing collection systems. Another inter-ministerial working group has assembled an overall food security and nutrition strategy for the nation (GRM, 1997). The strategy outlines possible interventions in the short- and long-run to address the core issues of food supply, access, and utilization.

Understanding household food consumption habits is a key entry point for developing and evaluating policies to improve food security. Data on household and individual intakes can be aggregated to formulate food security targets at a national level. Indeed, an understanding of consumer behavior is a key to formulating macro-economic models which seek to improve food security. Information on the determinants of household consumption are also essential for understanding and formulating micro-level interventions to improve shortfalls in caloric and/or other nutrient intakes. Since food is a basic need, measurement of food consumption also can be used as an alternative to income in evaluating household well-being.

This report presents a detailed exploration of food consumption behavior in a rural area of northern Mozambique. The report includes quantitative estimates of household food consumption, calorie and other nutrient intakes in relation to recommended norms, and the proportion of households consuming below minimally adequate intakes. These estimates are calculated at three times during the agricultural cycle: at the beginning of the maize harvest; after the maize and cotton harvests have been completed; and in the hungry season, when availability of

food from own production and purchases are at their lowest.[1] Evidence is also presented on the relation of these food consumption variables to socio-economic characteristics of the household, including land tenure, annual income, and household demographics.

The data for this report come from an in-depth panel study of smallholders in Monapo and Meconta Districts of Nampula province and of Montepuez District in the province of Cabo Delgado. Repeated visits of approximately 400 households in 16 villages were made from 1995-96 as part of a larger study to identify the impacts of various cotton growing schemes on household incomes.[2] These villages are roughly representative of the maize- and manioc-based cropping systems of interior areas of northern Mozambique where cotton and cashew have historically been the most important cash crops.

The following section provides background information on the study communities, situating them in the larger context of rural northern Mozambique. Section III describes food consumption patterns in the study areas, while section IV lays out the results of these patterns on nutrient intake. Section V explores the relationship between total food consumption and key socio-economic factors. Analytical results of a statistical model on the relationship between calorie intakes and income are presented in Section VI.

II. The Study Communities

Selection of villages, and households within villages, was based on the original research goal of identifying the impacts of a range of cash-cropping schemes on household incomes. These schemes were focused on reviving smallholder cotton production through investment by three multi-national firms operating within geographic zones of influence. The firms signed agreements with the Mozambican Government in the late 1980s to rehabilitate cotton gins and associated rural infrastructure.[3] Three districts — Montepuez, Monapo, and Meconta — within the areas of influence of these cotton joint venture companies were purposively selected. A sample of villages and households was then obtained using a stratified random cluster design. A

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[1] Data used in this report come from surveys conducted in May, 1995, September, 1995, and January, 1996. The terms *harvest*, *post-harvest*, and *hungry* seasons are used as a convenient way to describe these periods. This terminology is convenient, though imperfect, since it refers to the calendar for some crops, such as maize, but not to other important crops in the region, such as manioc, which have a different cropping calendar.

[2] The larger study was conducted from 1994-96 and consisted of 5 rounds of data collection. See Strasberg (1997) for a detailed description of this research project.

[3] The joint venture companies were given exclusive rights to purchase cotton in their area of influence in return for providing growers with reliable input supplies, extension advice for cotton and food crops and timely purchase of seed cotton. One of the firms, operating in Montepuez, also supported smallholder maize production and marketing. The areas of influence are sizable, covering over one-third of the land area of Nampula and Cabo Delgado provinces. Montepuez is within the LOMACO (Lonrho Mozambique Agro-Industrial Company) area of influence, Meconta and part of Monapo are within the SODAN (Sociedade Algodoeira de Namialo) area, and the rest of Monapo is within the SAMO (Sodiedade Algodoeira de Monapo) area.

Table 1. Demographic and economic characteristics of households in the study districts and in north-central Mozambique

	Montepuez	Monapo/ Meconta	North-Central Mocambique
Household size (# of persons)	5.0	5.0	5.2
Age of household head (years)	40	40	43
Household land owned (hectares/person)	0.76	0.90	0.54
Cashew tree ownership (% of hholds)	49	60	48
Number of cashew trees, hholds with trees	10	65	41
Percent of income by source:			
Staple food retained (%)	64	50	53
Staple food sales (%)	6	3	5
Cash crop sales (%)	8	24	8
Off-farm labor sales (%)	7	9	2
Small enterprise profits (%)	11	7	10

Source: Marrule et al, 1998.

key objective of this design was to obtain reliable information on households using different cotton production schemes as well as households that didn't grow cotton within the JVC's areas of influence. See the Ministry of Agriculture and Fisheries' Working Paper No. 22 (MAP/MSU, 1996) for an extensive description of sampling procedures used in this study.

Montepuez district in Cabo Delgado and Monapo and Meconta districts in Nampula are part of the broad interior areas of northern Mozambique that rely on maize- and manioc-based cropping systems and where cotton and/or cashew are potential cash crops. To situate these districts in the context of northern and central Mozambique, demographic and economic characteristics of households in Montepuez and Monapo/Meconta were compared with those in north-central Mozambique. Data on the latter were obtained from a recent national agricultural survey, known as TIA96 (Marrule et al, 1998).[4]

Demographically, households in the study districts were similar to households in the rest of north-central Mozambique. Household size was about the same, although average age of household

[4] The Trabalho de Inquerito Agricola, TIA96, is a nationally representative survey of smallholders in Mozambique. TIA96-sampled households in Nampula, Zambezia, Manica, Sofala and Mutarara district of Tete were used for the description of the north-central area presented here.

heads was slightly lower in the study districts (Table 1). Land ownership was higher in the study districts, 0.76 hectares per capita in Montepuez and 0.90 hectares per capita in Monapo/Meconta, compared to the 0.54 figure found in the north-central region. Another important asset was cashew trees. Although the percent of households that own trees was roughly the same in Montepuez as in north-central Mozambique, the actual number of trees owned by those households possessing trees was much lower in Montepuez. Cashew tree ownership was much more frequent and much higher in number among households in the Nampula districts of Monapo/Meconta. The production and consumption of staple foods represented the largest source of income throughout the north-central part of rural Mozambique, and this included the study districts. Yet the sales of these foods during the study period comprised a relatively small share of total income, which was also true of all three areas.[5] On average, cash cropping contributed much more to income, in percentage terms, in Monapo/Meconta than in either Montepuez or in the rest of north-central Mozambique. In sum, households in the study districts were not unlike those throughout a large section of north-central Mozambique with respect to a number of demographic and economic characteristics.

III. Food Consumption

An examination of the acquisition patterns of maize in the study districts reveals a complex food system based on production, purchase and exchange. Overall, the most important source of maize for consumption by households was through their own production. In Montepuez, retained production accounted for an average of 429 kilograms of maize per household per year (Table 2), or about 92 percent of the total. In Monapo/Meconta, where retained production accounted for 76 percent of total consumption, purchases of maize were much more important than in Montepuez — on the order of 23 percent of the total. Indeed, 76 percent of households purchased maize in Monapo/Meconta, close to three times the rate in Montepuez.

In addition to acquiring maize through production and purchase, households received maize as payment for work off-farm or for micro-enterprise activities, as donations, as payment for work-exchange with neighbors ("ajuda mutua"), or as remittances from family members living outside the household. On average, the latter two activities resulted in net deficits to the household, that is, households gave out more maize in exchange for work or as remittances, than they received. A sizable variation existed among households, both in the acquisition strategies employed and in the role that such strategies played in overall consumption. For example, about one-fourth of households in Monapo exchanged maize in the form of remittances, resulting in an average deficit of 26 kilograms per maize per year for these households. But some households only received maize as remittances, they did not send it out to others. For the small percentage of households in this category — 2.4 percent of the total in Monapo/Meconta — a significant amount of maize, 72 kilos per year, was obtained in this way. Similarly, only about 15 percent of households in Montepuez received maize as payment for micro-enterprise activities, but for these households this resulted in average receipts of 153 kilograms per year — about a third of the average household consumption in this district.

[5] Had the survey had been done in 1997 or 1998, it is likely that maize sales would have been more important in terms of quantity, and still more important in terms of value, due to increased prices from the maize trade with Malawi.

Table 2. Annual household consumption of maize from production, purchases, and in-kind transfers[a]

	Montepuez			Monapo/Meconta		
	% of hholds using this strategy	Mean quantity consumed from this source (kg/year)		% of households using this strategy	Mean quantity consumed from this source (kg/year)	
Maize source/ acquisition strategy		Hholds using the strategy	All hholds		Hholds using the strategy	All hholds
Retained production	100.0	429	429	100.0	307	307
Hholds selling maize	54.8	515		40.7	365	
Hholds not selling	45.2	326		59.3	267	
Purchases	29.2	80	23	76.4	121	92
Work off-farm	17.5	13	2	34.6	32	11
Micro-enterprise	14.8	153	23	5.0	39	2
Donations	0.9	29	0	0.0	0	0
Mutual Help	83.4	- 11	- 9	41.6	- 6	- 2
Receivers only	9.6	23		12.6	15	
Givers only	53.8	- 20		26.1	- 16	
Receive and give	20.1	- 4		2.9	- 5	
Remittances	17.1	- 25	- 4	24.6	- 26	- 6
Receivers only	4.5	14		2.4	72	
Givers only	6.8	- 55		18.3	- 49	
Receivers and givers	5.8	- 19		4.0	19	
Total Consumption			464			404

[a] The data in this table come from various survey instruments, including agricultural production and household purchases, taken at three times during the year. Results from each of these surveys were summed to provide annual household consumption from each source. Total consumption is a sum of retained production, purchases, maize received from work off-farm, maize received in microenterprise activities, donations, net remittances, and net labor exchange. Note that the data used to derive this annual consumption are different than the 24-hour recall data on which the rest of the report is based.

Information from analysis of 24-hour recall data on consumption revealed that, similar to many other parts of Mozambique, maize was of primary importance in the diets of households in Montepuez and in Monapo/Meconta. Maize was the most frequently consumed food, eaten on

74 percent of interview days (Table 3).[6] The quantities of maize products consumed on a weight basis were also greater than any other foods. On average, 258 and 302 grams per person per day were consumed in Montepuez and Monapo/Meconta, respectively. In Montepuez, this amount accounted for 42 percent of the household calories consumed, and 47 percent in Monapo/Meconta.

A number of indicators demonstrate that diets in the study areas were limited. On average, only about 4 individual food items were consumed per day. Four foods — maize, manioc, beans, and groundnuts — accounted for 86 percent of caloric intakes in Montepuez and 88 percent in Monapo/Meconta. Besides these four staples, only fruits and vegetables were consumed on a majority of interview days, yet only supplied 2 percent of calorie intakes.[7] Although fish was consumed on a third of interview days in Monapo/Meconta, this was mostly from dried fish used for seasoning and was not significant in actual quantities or calories supplied to the household. Overall, animal products — including fish, milk, eggs, chicken, and meat — contributed less than 2 percent of calories in Monapo/Meconta and less than 1 percent in Montepuez. Other nuts and seeds, a food group which includes cashew nuts and sesame, sunflower, and squash seeds, as well as oils from these products, contributed only about 1.5 percent of total calorie consumption.

Table 3. Food consumption patterns in the study districts

Food Group	Montepuez				Monapo/Meconta			
	Days consumed (%)	Daily amount per capita (g)	Share of calories (%)	Share of food expend (%)	Days consumed (%)	Daily amount per capita (g)	Share of calories (%)	Share of food expend (%)
Maize	73.9	258	42.4	27.4	73.7	302	46.7	24.7
Manioc	42.5	119	16.1	32.1	44.7	184	20.8	20.4
Beans	51.2	72	9.9	4.7	59.0	100	13.0	17.5
Peanuts	57.1	79	17.5	9.0	35.2	45	7.5	3.8
Sorghum	14.9	39	6.3	8.9	9.1	30	5.0	5.8
Fruits & Vegetables	64.6	105	1.6	1.3	68.8	106	1.8	3.7
Animal products	13.8	10	0.7	4.9	50.0	25	1.7	13.1
Nuts & Seeds	4.7	6	1.6	1.1	7.9	5	1.4	3.7
Other foods	22.2	54	3.7	10.6	18.1	38	2.0	7.3

[6] Household food consumption was measured using a 24-hour recall technique. See appendix A for a detailed description of the methods used.

[7] See appendix table A-1 for a complete listing of the specific food items that make up each of the 9 groups in Table 3.

Although the limited variety in the Mozambican rural diet is not surprising, quantitative estimates of it found here are more striking than had been previously thought and may suggest the need for reconsidering "rule of thumb" estimates used in food policy analysis. Current vulnerability assessment methodology in rural Mozambique includes a determination of the ability of rural districts to supply 6 months of their staple food needs. The staple food needs are estimated based on district population, per capita calorie needs, and the assumption that about 80 percent of calories are obtained from staple foods (GISMAV, 1998). Data from the study districts, however, indicate that staple foods — including cereals, legumes, nuts, roots, and tubers — account for over 93 percent of the calories consumed on a daily basis. Revising the 80-percent assumption upwards is not likely to change the ordering of vulnerable districts, but may cause a much larger number of such districts to be considered for interventions based on vulnerability.

Food expenditures occupy the largest share of total expenditures by households in the study districts. In Montepuez, expenditures on food, including the value of food consumed from own production, accounted for 79.5 percent of all non-housing expenditures.[8] In Monapo/Meconta the food share was 76.7 percent. Of the total amount spent on food, the four principal foods — maize, manioc, beans, and peanuts — accounted for 73 percent in Montepuez and 66 percent in

Table 4. Seasonal food consumption patterns: percent of calories from 9 food groups

	Montepuez			Monapo/Meconta		
Food Group	Harvest	Post-Harvest	Hungry Season	Harvest	Post-Harvest	Hungry Season
Maize	59.1	29.2	38.6	60.4	42.9	34.6
Manioc	3.9	22.6	26.6	6.7	17.8	44.7
Beans	13.0	8.9	6.9	15.6	14.2	7.7
Peanuts	17.7	18.6	11.5	11.7	6.3	3.1
Sorghum	0.8	11.2	8.0	1.0	10.7	0.9
Fruits & vegetables	1.2	0.7	5.2	2.3	1.6	2.3
Animal products	0.7	1.0	0.1	1.1	2.7	1.8
Nuts and seeds	0.5	2.2	1.6	0.4	1.4	2.2
Other foods	3.1	5.6	1.6	1.0	2.5	2.5

[8] Collection of data on household purchases for food and other goods was made at all three times during the year. Data on these purchases were combined with various sources of information to yield a variable for total annual expenditures. Such sources included food retained from own production, livestock consumed, in-kind receipts of food and other goods from working off the farm or from small enterprises, in-kind donations and gifts, the net value of goods obtained from mutual help, and the net value of goods that were sent from/to other household members.

Monapo/Meconta. Expenditure shares on animal products were much larger than calorie shares, especially in Monapo/Meconta, owing largely to purchases of dried fish — results that are consistent with findings from an earlier study in Nampula Province (Tschirley and Weber, 1994).

Seasonality is an important aspect of food consumption patterns in Mozambique, as it is in many parts of the developing world. Households were interviewed at three different times during the year: during the maize harvest in May, 1995; after the maize (and cotton) harvests in September, 1995; and in the so-called hungry season in January, 1996. In both study districts, the pattern of intakes changed dramatically across these three periods. Not surprisingly, maize was the most important source of calories during the harvest season, supplying about 60 percent of the calories to households in Montepuez and Monapo/Meconta (Table 4). In the hungry season, the share of calories from maize dropped to 39 and 35 percent in these districts, respectively.

Manioc is often referred to as a key food security crop in this region, since it can survive in years of poor rainfall and has a wide range of harvesting time, often left in the fields until needed for consumption. The important food security role of manioc can also be seen in the study districts, especially in Monapo/Meconta, where it furnished 45 percent of calories in the hungry season. In Montepuez, the percentage of calories from manioc, 27 percent, was also highest in the hungry season, though much lower than in Monapo/Meconta. Groundnuts and sorghum made up the difference in Montepuez, supplying about 20 percent of the calories during the hungry season.

IV. Nutrient Intake

An examination of calorie intakes provides the most useful way of studying the overall quantitative adequacy of diets in the study districts. Table 5 presents various measures of calorie consumption. Calculation of mean calories per capita allows one to relate consumption in the study communities to aggregate needs projected by food policy planners. For Mozambique, recent planning documents cite 2,200 calories per capita as the recommended level of daily intake (GRM, 1997). This level was attained in the post-harvest season in both districts and in the harvest season in Monapo/Meconta. In the hungry season, mean levels in neither district reached this recommended level.

Another indicator of food energy consumption is the number of calories per adult equivalent, an alternative way of expressing intakes which accounts for the age-sex distribution of members in a household. A recommended desirable level of intake for an 18-30 year old male from Mozambique is 2,987 calories per day.[9] Mean calorie levels were above desirable levels in both study areas in the post-harvest season as well as in Monapo/Meconta in the harvest season.

[9] This recommendation is based on reference weight data for Mozambique (James and Schofield, 1994) and includes 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.

Perhaps most striking about the calorie consumption data is the variation from one season to the next. Both districts exhibited strong evidence of a "hungry season." Data collected in January of 1996 showed that calorie consumption was 63.3 percent of the recommended desirable level in Montepuez and 77.4 percent in Monapo/Meconta (Table 5). In contrast, average levels were slightly above norms in the post-harvest season, 104 and 110 percent, respectively.

Mean levels of intake for a population do not tell the whole story because they do not inform one of how many households fall below recommended levels. To explore this issue, households were

Table 5. Calorie intake by season

Nutrient measure	Montepuez			Monapo/Meconta		
	Harvest	Post-Harvest	Hungry Season	Harvest	Post-Harvest	Hungry Season
Mean calories per capita	2079	2404	1427	2343	2496	1733
Mean calories per adult equivalent	2715	3120	1890	3106	3288	2312
Mean calorie adequacy ratio (%)[a]	90.9	104.5	63.3	104.0	110.1	77.4
%<maintenance calorie level[b]	44.5	26.7	69.2	33.2	21.5	56.0

[a] Calories consumed by the household divided by its recommended intake, expressed in percentage terms, and then averaged over all households. Recommended intake is the sum of desirable intakes for each person in the household. For an adult male in Mozambique, this would be 2987 calories per day.

[b] Percentage of households with intakes below a maintenance level, the amount needed for a minimal level of activity that does not include energy for occupational activities. For an adult male, this corresponds to 1.4 times the energy needed for basal metabolic functions.

categorized into whether their calorie intakes fell below a maintenance level, the amount needed for a minimal level of activity that does not even include energy for occupational activities.[10] Fully 69 percent of households in Montepuez, and 56 percent in Monapo/Meconta, had consumption levels below maintenance needs in the hungry season. Even in the best of periods — the post-harvest — about a quarter of all households had consumption levels below these maintenance requirements.[11]

[10] A "maintenance" level of energy corresponds to the amount of energy needed for 3 hours of activities while standing, including dressing and washing, but does not include energy needed for occupational nor for desirable activities (FAO/WHO, 1985). For an adult male, this corresponds to 1.4 times the energy needed for basal metabolic functions.

[11] These figures may, in fact, *underestimate* the percentage of households below maintenance levels, since our adult equivalent unit was an adult male, for whom the maintenance level is lower relative to the desirable energy level than for other age-sex groups.

Calories provide a quantitative measure of overall food intake, but renewed emphasis has been placed on diet quality measures which include information on other required nutrients in the diet. The intakes of six other nutrients — protein, vitamin A, vitamin C, niacin, calcium, and iron — were also calculated. These were chosen because recent evidence indicates that they may be problem nutrients in at least some parts of the country (GISMAV, 1998).

Energy and protein deficiencies can result in growth faltering in young children. Several areas in Mozambique, including the northern interior of Niassa and Cabo Delgado Provinces, the interior of Nampula Province, and the southern interior of Inhambane Province are chronically at risk of malnutrition as evidenced by growth data from the national nutrition monitoring system (GISMAV, 1998). These data also indicate a seasonal pattern in growth faltering, elevated during the period before the harvest, or hungry season.[12] Nutrient intake data on protein point to a clear drop in adequacy levels in the hungry season in both Montepuez and Monapo/Meconta. While

Table 6. Adequacy of nutrient intakes by season

	Montepuez			Monapo/Meconta		
Nutrient adequacy (% of recommendation)	Harvest	Post-Harvest	Hungry Season	Harvest	Post-Harvest	Hungry Season
Protein	147.8	155.9	79.1	170.2	163.8	74.8
Vitamin A[a]	22.7	18.8	87.6	37.6	23.5	24.3
Vitamin C	108.4	123.0	159.8	212.6	182.0	103.6
Niacin	102.9	140.4	64.3	111.1	99.5	51.3
Calcium	41.5	57.0	42.5	66.1	75.3	49.0
Iron	92.4	107.2	64.3	125.3	134.8	77.5

[a] Vitamin A estimates are likely to be underestimated since diet recall methodology did not adequately collect data on the consumption of piri-piri, a condiment rich in vitamin A precursors.

mean intake was at or above 150 percent of recommended levels in both the harvest and post-harvest seasons, in the hungry season, intakes fell to 79 percent of recommendation in Montepuez and 75 percent in Monapo/Meconta (Table 6).

Apart from general calorie-protein malnutrition, a number of specific micro-nutrient deficiencies are common in the developing world. Vitamin A deficiency has been signaled as a problem in Mozambique in districts with limited availability of fruits and vegetables and/or animal sources of vitamin A or in areas in which the population is not in the habit of consuming these. Information from the study districts in northern Mozambique indicate that intakes of this nutrient are very

[12] For most of the country this corresponds to January through March, although the peak rates are a little later in Cabo Delgado and Nampula owing in part to the later harvests in these provinces.

low. Average levels in Monapo/Meconta never reached above 40 percent of recommended intakes. It should be noted that dietary methodology used in these recalls did not focus on collecting data on condiment use. Since piri piri, a hot sauce made form red peppers, is a common part of the Mozambican diet and a rich source of vitamin A, it is likely that estimates of vitamin A intake were underestimated. In Montepuez, intakes were very low during the harvest and post-harvest seasons but actually improved during the hungry season, reaching 88 percent of recommended levels. This apparent anomaly was caused by the increased consumption of leaves and other vitamin-A rich vegetables during the hungry season, a time when other foods are more difficult to acquire. The findings point to a possible role for nutrition education in combating deficiency of this micro-nutrient, since low intakes at other times of the year, at least in some parts of the country, are presumably due to tastes and preferences rather than economic constraints.

Vitamin C deficiency has been reported in the semi-arid districts in the south of the country (GISMAV, 1998). Data from the study districts in Nampula and Cabo Delgado do not indicate that vitamin C is a serious problem there; mean intakes are above 100 percent of recommended levels throughout the year in both districts.

Cases of pellagra, or niacin deficiency have been reported in a number of districts in the northern part of the country including Montepuez district in Cabo Delgado (GISMAV, 1998). Diets based largely on maize with a low consumption of protein could explain this finding and certainly data from this study would confirm that possibility. In the hungry season, mean intake of niacin reached only 64 percent of recommended levels in Montepuez and was even lower in Monapo/Meconta — 51 percent.

Iron-deficiency anemia is one of the most widespread nutritional deficiencies in the world and is a problem complicated by the frequency of malaria and parasitic infections in Mozambique. Iron intakes are especially low in the hungry season in both study districts. Although intakes in relation to recommendations are better at other times of the year, much of the iron in the diets in these study areas come from poorly absorbed vegetable sources.

Although calcium deficiency has not been reported previously in Mozambique, intakes in the study districts are very low. Even in the post-harvest season, when food consumption is at its greatest, mean intakes are only 57 percent of recommendations in Montepuez and 75 percent in Monapo/Meconta. These levels are not surprising given the virtual absence of dairy products from the diet.

V. Socio-Economic Correlates of Calorie Intakes

To gain a better understanding of food consumption behavior in northern Mozambique, the relationship of various socio-economic characteristics to overall household food consumption was investigated. Throughout this section, the average daily calories per capita is used as a measure of food consumption. The results are more convenient for interpretation by policy-makers and differ little from similar descriptions made with calories per adult equivalent.
Household size is perhaps the most important variable to use in predicting calorie intakes. Households in each district were ranked in order of their household size and were divided into three groups of equal size, or terciles. As is commonly found, calories per capita declined as

household size increased (Table 7).[13] In the hungry season in Monapo/Meconta, the smallest households consumed 1988 calories per capita as compared to 1376 for the largest households. This inverse relationship was seen across both districts in all three seasons and was true for either measure of household size — number of people or number of adult equivalents.

Table 7. Per capita calorie intakes by household size and season.

	Montepuez				Monapo/Meconta			
Household size terciles	Mean hhold size	Harvest	Post-Harvest	Hungry Season	Mean hhold size	Harvest	Post-Harvest	Hungry Season
1	3.2	2409	2506	1589	2.8	2754	2728	1988
2	5.0	1930	2475	1449	5.0	2387	2508	1788
3	7.2	1547	1948	1234	7.5	1815	2181	1376

Data from numerous sources were used to calculate total household incomes in the study districts, including: sales of staple foods, fruits and vegetables, and cash crops; production of these same crops that were retained for the household's own use; off-farm labor; small non-agricultural businesses; and animal production. After calculating income per capita for each household, all households in each district were grouped into terciles, as with household size. In the harvest season, calorie intakes increased from the lowest income tercile to the highest in both districts (Table 8). During the post-harvest season, mean intakes for households in the top tercile

Table 8. Per capita calorie intakes by total income and season

	Montepuez				Monapo/Meconta			
Per capita income terciles	Mean income per capita ($)	Harvest	Post-Harvest	Hungry Season	Mean income per capita ($)	Harvest	Post-Harvest	Hungry Season
1	18.55	1677	2153	1303	27.46	1969	2266	1677
2	32.97	1869	2027	1383	52.46	2298	2479	1651
3	88.13	2386	2742	1599	95.23	2731	2711	1875

[13] See Bouis and Haddad (1992) or Schnepf (1992) for other examples of the negative effect of household size on per capita calorie consumption.

were over 2700 calories per capita, higher than the other two thirds of the income distribution. In the hungry season, calorie intakes were again highest in the top income tercile, although all three groups had mean intakes below per capita recommendations.

Households were also ranked into three groups based on their total annual expenditures per capita. In the hungry season, calorie consumption increased with increasing expenditure (Table 9). The relationship was less smooth in the other seasons, but the top expenditure tercile still consumed the greatest amount of calories throughout the year. Not surprisingly, patterns between income and consumption and expenditures and consumption were similar in this way.

Table 9. Per capita calorie intakes by total expenditures and season

	Montepuez				Monapo/Meconta			
Per capita expenditure terciles	Mean expend per capita	Harvest	Post-Harvest	Hungry Season	Mean expend per capita	Harvest	Post-Harvest	Hungry Season
1	17.66	1828	2226	1273	30.50	2121	2279	1636
2	36.31	1694	1969	1377	50.87	2114	2346	1727
3	79.67	2405	2735	1630	90.03	2751	2832	1838

The amount of land owned by a household is perhaps the most important measure of asset wealth and is a key input into agricultural production, the principal source of income for these districts. Households in the study sample are smallholders; average landholdings are 3.8 hectares per household with a range from 0 to 16 hectares. Households were divided into four groupings based on their total *per capita* landholdings (Table 10). Although there is not as smooth a relationship between calorie intakes and landholdings as there was with household size, some definite patterns do emerge. In Montepuez, those households with greater than 1.5 hectares per person have higher calorie intakes throughout the year than those with less land. The differences range on the order of 1000 calories per day at harvest and post-harvest times and close to 500 calories per day in the hungry season. This clear break between the highest landholding group and the other three is a pattern seen throughout the year in Montepuez as well as in the post-harvest season in Monapo/Meconta. However, in the hungry season in Monapo/Meconta, the relationship is characterized by a progressive increase in the caloric intakes as landholdings increase.

Data were collected on the production of eight staple food products: maize, sorghum, millet, beans, manioc, groundnuts, sunflower, and sesame. The value of production was calculated for each of these products based on market prices and then summed at the household level. This variable was then converted to per capita terms and households were categorized into three groups. In both districts throughout the year, except for the post-harvest season in Monapo/Meconta, those with the highest value of staple food production had the highest mean

Table 10. Per capita calorie intakes by household land ownership and season

	Montepuez				Monapo/Meconta			
Household land owned (hectares per capita)	Mean land per capita	Harvest	Post-Harvest	Hungry Season	Mean land per capita	Harvest	Post-Harvest	Hungry Season
0 - 0.5	0.40	1790	2148	1414	0.36	2182	2314	1578
0.5 - 1.0	0.72	2030	2341	1402	0.73	2068	2482	1687
1.0 - 1.5	1.30	1880	2126	1380	1.23	2602	2344	1850
> 1.5	2.33	3001	3609	1879	1.77	2964	2985	1944

calorie intakes (Table 11). This is not surprising, given the important role of own production in total consumption that was reported in section III. In the hungry season, when consumption from own production dropped to its lowest, the difference in calorie intakes between the top tercile and the other two terciles of staple food production was less dramatic than it was in the harvest season.

Table 11. Per capita calorie intakes by value of staple food crop production and season

	Montepuez				Monapo/Meconta			
Per capita value of staple food crop production ($)	Mean staple food crop value ($)	Harvest	Post-Harvest	Hungry Season	Mean staple food crop value ($)	Harvest	Post-Harvest	Hungry Season
< 20	13.77	1761	2083	1357	14.13	2174	2459	1710
20 - 40	29.00	1863	2217	1336	28.73	2197	2497	1604
> 40	65.95	2523	2858	1664	55.47	2968	2499	2062

Cash income is important in these districts, since households often meet a percentage of their calorie needs through the purchase of foods. One important source of cash income is the production and sale of cotton, tobacco, and cashew. Households were categorized based on their annual per capita income from these sources. In Montepuez (Table 12), households with the highest cash crop income had the highest consumption during all three periods. In Monapo/Meconta, this was true for the harvest and hungry seasons, although this group had the lowest consumption during the post-harvest season.

Table 12. Per capita calorie intakes by cash crop income and season

	Montepuez				Monapo/Meconta			
Per capita income from cash crops ($)	Mean cash crop income ($)	Harvest	Post-Harvest	Hungry Season	Mean cash crop income ($)	Harvest	Post-Harvest	Hungry Season
< 20	1.76	1914	2261	1393	6.69	2245	2506	1731
20 - 40	28.40	2328	1980	1466	27.03	2497	2595	1491
> 40	74.50	2921	3753	2152	69.10	2637	2096	2204

Calorie intakes among households in the different cotton production categories in the region were also studied. Cotton growers grew their crop on dispersed fields or on blocks of land owned by the large cotton joint venture companies. There were also those that grew their cotton with intensive inputs, known as PUPI, the Portuguese acronym for small units of intensive production (Pequena Unidades de Producao Intensiva). Interestingly, in Monapo/Meconta,

Table 13. Calorie intakes by cotton production category and season

	Montepuez			Monapo/Meconta		
Cotton production category	Harvest	Post-Harvest	Hungry Season	Harvest	Post-Harvest	Hungry Season
Block/PUPI-block	1988	2305	1719	2149	2159	1716
PUPI-dispersed	1810	2251	1896			
Dispersed	2214	2372	1647	2405	2554	1642
Non-growers	1894	2287	1342	2631	3108	2068

those that did not grow cotton at all had higher calorie intakes throughout the year than cotton growers (Table 13). The opposite was true of non-growers in Montepuez during the hungry season -- they had the lowest intakes. No clear pattern emerged during the other seasons in Montepuez.

VI. The Income-Calorie Relationship

One important research issue that has generated a lot of study in recent years is the relationship between income and calorie intakes. Since the 1970s, World Bank policy documents have argued

that improving household incomes is an important way to improve nutrition in the developing world (Knudsen and Scandizzo, 1979; Reutlinger and Selowsky, 1976). Others have argued that the relationship between calorie intakes and incomes is not very strong and that increases in income may result in purchases of higher-priced foods, but not necessarily more nutritious ones (Behrman and Wolfe, 1984; Behrman and Deolalikar, 1987). While few would doubt the importance of nutrition for the development of people and societies, the best way to achieve improvements in this area are still controversial. For example, given a non-existent or weak calorie-income relationship, improving household incomes will do little to improve nutrition, whereas nutrition and health education efforts or improvements in potable water supplies are likely to have a much greater impact. The wide variation in analytical results on this question suggest, in part, that the income-calorie relationship is situation specific; different levels of income, or sources of income, for that matter, may condition the relationship.

To get a better understanding of the situation in Mozambique, the relationship between calorie intakes and household incomes was studied using information from Montepuez and Monapo/Meconta districts. Standard analytical techniques[14] were used to model the relationship of household calorie intakes to annual household income, while controlling for household size and composition, the season of the year, and the village in which the information was obtained. Controlling for the village in which the data were collected was important, since differences in food prices were likely to result from village-level differences in location, transportation, and thus access to major food markets.

In both Montepuez and Monapo/Meconta districts there was a positive and significant relationship between household calorie intakes and household incomes. A convenient way to express the results of this analysis is in terms of a "calorie-income elasticity," which indicates the percentage change in household calorie consumption, for a one percent change in income. For Montepuez the mean calorie-income elasticity was 0.17, indicating that for a ten percent increase in household income, one would expect a 1.7 percent increase in household calorie consumption. In Monapo/Meconta district the mean calorie-income elasticity was somewhat higher — 0.20.

Previous studies have found a broad range of results, calorie-income elasticities ranging from 0.01 to 0.88. Bouis and Haddad (1992) have argued that part of the reason for this range may be due to methodological approaches. For example, they favor the use of calorie intake data based on the 24-hour recall rather than that calculated from food expenditure surveys, since upward biases in calorie-income elasticity estimates obtained from the latter are more likely to occur. Research in rural Kenya using calorie data from a 24-hour recall instrument, found calorie-income elasticities of 0.15, similar in magnitude to those found here (Kennedy and Cogill, 1987).

Another way to express this calorie-income relationship is through calculation of the "marginal propensity to consume" calories out of income. This measure indicates the additional calories that would be consumed for an additional dollar of income. In Montepuez, an additional dollar of annual income per household member would increase consumption by approximately 6 calories per person per day, while in Monapo/Meconta the resulting increase would be about 9.5 calories.

[14] See appendix B for a more detailed description of the analytical models used here.

These findings suggest that increases in incomes of the rural poor will improve calorie intakes. In percentage terms these improvements would be relatively modest. But income levels among the rural poor are low enough that significant increases in nutrient intake could occur with relatively modest absolute increases in income.

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Appendix A. Food and Nutrient Consumption Methods

Household food consumption was measured using a 24-hour recall technique. Trained enumerators asked the person who most often did the food preparation/cooking to identify the type and quantity of each food ingredient prepared and consumed during the previous 24 hours. To facilitate recall of the quantities used, the household respondent indicated the amounts of each ingredient used with reference to their own household measuring units (for example, a cup, a can, a spoon). A quantitative determination of the volume of every unit of measurement indicated by the household was then made by weighing the units with foods of known densities, such as maize, beans, or water. Interviews were always conducted at the household, which facilitated this recall and volumetric measurement. Two consumption interviews, separated by about one week, were conducted during each of rounds 2-5. This report presents data collected in the final three rounds: May, 1995; September, 1995; and January, 1996.

Although detailed information was collected on individual food items (and this information was used to calculate the nutrient intakes discussed in section IV), it is useful to aggregate specific food items into food groups to summarize food consumption patterns in the study districts. Results in section III were presented using nine such food groups: maize, manioc, beans, peanuts, sorghum, fruits and vegetables, animal products, nuts and seeds, and other foods. Table A-1 lists each of the individual food items in these nine groups.

Table A-1. Food items in each of the nine food groups

Food group	Food items
Maize	dried maize, maize flour, fresh maize on the cob, trincas de milho, farelo de milho
Manioc	fresh manioc, manioc flour, dried manioc, trincas de mandioca
Beans	dried beans, fresh beans
Peanuts	dried peanuts, fresh peanuts
Sorghum	sorghum, sorghum flour, trincas de mapira
Fruits and vegetables	squash, cucumber, tomato, couve, manioc leaves, bean leaves, squash leaves, sweet potato leaves, enheue leaves, cashew leaves, mushroom, verdura quiabo, fava, onion, enenkelo, legume inhame, piri piri, banana, papaya, limao, mango
Animal products	dried fish, fresh fish, beef, chicken, rat, passarinho, pombo, caracol, crustaceo, frog, milk, egg
Nuts and seeds	sesame seeds, sunflower seeds, cashew nuts, squash seeds, cucumber seeds, oils
Other foods	bread, pasteis, sugar, sugar cane, honey, inlekero, dried pea, fresh pea, rice, rice flour, salt, gafanhoto, coffee, tea, coconut, oteka, bebida

The nutrients consumed from each food were obtained by multiplying the weight of the food consumed times the nutrients per 100 grams of that food. The latter information on the nutrient

content of foods was obtained from standard food composition tables used in Mozambique and in Africa (MISAU, 1991; Leung et al, 1968). The weight of each food was calculated by multiplying the volume of the food consumed by its density. For some foods (e.g. tomatoes, bananas), volumetric information was not used since weight information was obtained directly by multiplying the number consumed (e.g. 3 tomatoes) by mean weights of these items. Nutrients for all foods listed in the 24-hour period were summed for each interview day and then averaged over the 2 interview days to get a mean daily household consumption for each round.

To understand the food security and nutrition situation in a household or community, it is important to compare actual nutrient intakes with norms or standards, i.e. intakes recommended by expert committees. Two types of calorie recommendations were used. The first, expressed in per capita terms, i.e. 2,200 calories per capita, comes from a food security planning document for Mozambique (GRM, 1997). The second, expressed in adult equivalent terms, was also based on the latest internationally-accepted standards (FAO/WHO/UNU, 1985) and assumed desirable levels of activity and reference weights for Mozambique (James and Schofield, 1994).

For calculation of calories per adult equivalent, the age-sex appropriate energy recommendations for all household members who consumed food on the recall day were summed. Dividing this household recommendation by 2,987, the calories recommended for an 18-30 year old male, gave the number of adult male equivalents per household. The total calories consumed by household members was then divided by the number of adult equivalents to get the number of calories per adult equivalent. An alternative measure, the calorie adequacy ratio, was calculated by dividing total household consumption by total household energy recommendation, where recommendations were based on the desirable levels discussed previously. Thus, households with calorie adequacy ratios less than 1 consumed fewer calories than recommended.

Note that the mean calories per adult equivalent will be higher than the mean calories per capita, whenever the reference person has the largest calorie needs of those in the sample, so that the number of adult equivalents in a household will be less than the number of persons. For example, in a three-person household consisting of a 28 year-old male, a 25 year-old female and 4 year-old girl, *calories per capita* is obtained by dividing total consumption by 3. But the recommended calorie intake levels for the three individuals are very different: 2987, 2183, 1546 calories for the male, female, and girl, respectively. In this example, the adult female's recommendation is 0.73 of the adult male's, while the girl's recommendation is 0.52. Thus, the recommended intake of this household is equivalent to that of 2.25 adult males (1 + 0.73 + 0.52). *Calories per adult equivalent* will be greater since it is calculated by using the same numerator as *calories per capita*, but with a smaller denominator.

Nutrient adequacy ratios were also calculated for 6 other nutrients: protein, vitamins A and C, niacin, calcium, and iron. Similar techniques were used, although recommended intakes were obtained from different sources (FAO/WHO, 1988; FAO/WHO/UNU, 1985; FAO/WHO, 1970; FAO/WHO, 1967; FAO/WHO, 1962).

Appendix B. Calorie-Income Analytical Methods

The demand for nutrients is a well-explored area in consumption analysis. Results presented here are based on a standard reduced form demand equation for calories, *k*:

$$k = f(y, \boldsymbol{v}, \boldsymbol{d}, \boldsymbol{s}) \quad ,$$

where *y* is household income, ***v*** is a vector of village dummies to account for the spatial variation that may exist in prices, ***d*** is a vector of demographic characteristics, and ***s*** is a vector of seasonal dummies.

Ordinary least squares regression analysis was used to explore this demand relationship. Unweighted regressions were run separately for each district. The dependent variable was the number of calories per capita per day consumed by the household. In most cases, this value was an average from two interview days in a given season. Income was the sum of all sources of earned income for the year and expressed in per capita terms. There were six village dummy variables in Montepuez and seven village dummies in Monapo/Meconta. Demographic variables included household size, the proportion of household members less than or equal to 12 years of age, and the proportion of members greater than 50 years of age. Dummies were included for the post-harvest and hungry seasons.

Four functional forms were considered for the regression model — linear, quadratic, semi-log, and double-log. The linear specification does not allow for either the marginal propensity to consume, $\mathbf{mpc_k}$, or the calorie-income elasticity, $\mathbf{e_{yk}}$, to decline with increasing income, which are to be expected in food and nutrient consumption behavior. The double-log specification does allow the $\mathbf{mpc_k}$ to decline with increasing income, but restricts calorie-income elasticities to be constant over the range of incomes. Both semi-log and quadratic specifications do allow for a declining $\mathbf{mpc_k}$ and $\mathbf{e_{yk}}$. However, preliminary runs with the quadratic specification showed the latter increased with increasing income. Thus the semi-log was chosen as the preferred specification. In addition to being the only form consistent with prior expectations, the semi-log specification also yielded the highest R^2 in Montepuez and second-highest in Monapo/Meconta.

Table B-1 presents results of the regression analyses. Household size was inversely related to per capita calorie consumption as was the proportion of household members twelve years or younger. Also as expected, calorie consumption was greater in the post-harvest season and lower in the hungry season, in comparison to harvest season intakes. In both districts, income per capita was significantly and positively related to calorie consumption.

Calorie-income elasticities and marginal propensities to consume calories out of income were calculated for each observation based on the coefficients in Table B-1. Households were ranked into quintiles based on per capita income and the mean $\mathbf{mpc_k}$ and $\mathbf{e_{yk}}$ were calculated for each quintile (Table B-2). Overall mean values for calorie-income elasticities are 0.17 for Montepuez and 0.20 for Monapo/Meconta. Mean marginal propensities to consume were 6 calories per capita for each additional dollar of income in Montepuez and 9.5 in Monapo/Meconta.

Table B-1. Results from calorie-income regressions

Variable	Montepuez		Monapo/Meconta	
	coefficient	t-statistic	coefficient	t-statistic
Constant	2297	8.354	2789	6.597
Log per capita income	256	5.474	336	4.421
Log household size	- 714	- 8.538	- 870	- 7.209
Proportion of members <= 12 years	- 381	- 2.104	- 673	- 2.572
Proportion of members > 50 years	15	0.076	- 231	- 1.029
Post-harvest season	204	2.636	280	2.767
Hungry season	- 495	- 6.347	- 618	- 6.104
Village 111	- 120	- 0.974		
Village 112	268	1.957		
Village 113	- 211	- 1.778		
Village 114	- 301	- 2.355		
Village 121	80	0.588		
Village 122	- 44	- 0.302		
Village 215			- 216	- 1.179
Village 221			398	2.062
Village 231			- 23	- 0.133
Village 232			132	0.759
Village 312			- 107	- 0.646
Village 313			- 288	- 1.686
Village 321			- 509	- 2.892
Village 332			- 198	- 0.985
N	602		515	
F-statistic	27.35		24.03	
Adj-R^2	0.345		0.386	

Dependent variable: Calories per capita per day.

Table B-2. Marginal propensities to consume and calorie-income elasticities at different income levels

Per capita income quintile	Montepuez				Monapo/Meconta			
	Mean income per cap	Mean calories per cap	$\mathbf{mpc_k}$	$\mathbf{e_{yk}}$	Mean income per cap	Mean calories per cap	$\mathbf{mpc_k}$	$\mathbf{e_{yk}}$
1	19.86	1692	14.2	0.227	18.45	1783	22.7	0.287
2	37.17	1835	7.0	0.173	35.33	2064	9.7	0.211
3	57.23	1922	4.5	0.160	48.64	2226	7.0	0.191
4	94.33	1986	2.8	0.150	67.54	2457	5.0	0.171
5	213.93	2513	1.5	0.126	114.77	2970	3.2	0.148
Mean	84.44	1989	6.0	0.167	57.02	2301	9.5	0.202

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