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Vitamin A and iron consumption and the role of indigenous vegetables: A household level analysis in the Philippines

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Discussion papers in this series are intended to stimulate discussion among researchers, practitioners and policy makers. The papers mostly reflect work in progress. This paper has been reviewed internally by Dr. Alexander Stein and externally by Dr. John Msuya (Sokoine University of Agriculture, Tanzania).

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Abbreviations

ADB	Asian Development Bank
AE	Adult equivalent
AVRDC	World Vegetable Center
EAR	Estimated average requirement
FAO	Food and Agriculture Organization of the United Nations
FNRI	Food and Nutrition Research Institute of the Philippines
kcal	Kilocalories
NAR	Nutrient adequacy ratios
NSCB	National Statistical Coordination Board of the Philippines
OLS	Ordinary least squares
PEM	Protein-energy malnutrition
PhP	Philippine Pesos (Philippine Pesos per US Dollar 56.040, 2004)
RAE	Retinol activity equivalent
RDA	Recommended daily allowance
SD	Standard deviation
UN-SCN	United Nations - Standing Committee on Nutrition
US$	United States Dollar
WHO	World Health Organization

Abstract

Micronutrient malnutrition is a public health problem in many regions of the developing world. Severe vitamin A and iron deficiencies are of particular concern due to their high prevalence and their serious, multiple health effects on humans. This paper examines dietary patterns and nutrient intakes, as well as their socioeconomic determinants among households in the Philippines. Since promotion of indigenous vegetables is often considered as an avenue to reduce micronutrient malnutrition, special emphasis is placed on analyzing the contribution of this particular food group to household vitamin A and iron intakes. We use a sample consisting of 172 resource-poor households located in peri-urban areas of Laguna Province. A 24-hour food consumption recall allows for detailed, meal-specific examination of diets. Results of the dietary analysis suggest that fish is of major importance for vitamin A and iron intakes. But also vegetables, and especially indigenous vegetables, play an essential role for balanced household diets. In order to determine socioeconomic factors influencing vitamin A and iron intakes, we employ an econometric model, which shows that deficiencies are strongly associated with low household incomes and poverty. Thus, poverty alleviation will help reduce the problem of micronutrient malnutrition in the medium and long run. However, in the interim, more targeted interventions will be needed. Our results suggest that promotion of indigenous vegetables can play a role in this respect, especially among the poor, who can often not afford sufficient amounts of animal products.

Keywords: Micronutrient malnutrition, vitamin A intake, iron intake, indigenous vegetables, Philippines

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1. Introduction

Micronutrient malnutrition is a public health problem in many regions of the developing world. An estimated four billion people are iron deficient, 2.7 billion are at risk of zinc deficiency, two billion are iodine deficient, and hundreds of millions lack one or more essential vitamins (UN-SCN 2004). Here the focus is especially on vitamin A and iron deficiencies, which often lead to low physical and mental performance and increased risks of morbidity and mortality. Micronutrient malnutrition can also have substantial economic consequences for the individuals affected, their families, and the economy as a whole. Due to their high micronutrient requirements, young children as well as pregnant and lactating women are among the most vulnerable groups (Micronutrient Initiative 2004). The World Health Organization of the United Nations (WHO) estimates that 250 million preschool children are vitamin A deficient worldwide. In developing countries, every second pregnant woman and about 40% of preschool children are anemic, mostly due to iron deficiency (WHO 2006).[1]

The diets in low-income regions are often predominated by energy-rich staple foods, which usually contain low amounts of micronutrients. Meat and fish, rich in iron and vitamin A, are often not affordable for the poor. Nutrition intervention strategies to reduce mineral and vitamin deficiencies include food supplementation and fortification programs. Other actions aim at increasing dietary diversity through higher consumption of micronutrient-rich vegetables. Home and school gardens can provide good opportunities to assure stable

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[1] In the Philippines, used here as an example for a South-East Asian country, 40% of preschool children, 36% of 6-12 year old children, 18% of pregnant, and 20% of lactating women are affected by vitamin A deficiency (FNRI 2003). The prevalence of anemia among infants (6 months to 1 year) is alarmingly high at 66%. In addition, 29% of the preschool children, 37% of the children aged 6-12 years, 44% of pregnant, and 42% of lactating women suffer from anemia (FNRI 2004).

availability and accessibility to a nutrient-balanced diet for the poor. In this context, the cultivation of indigenous vegetables has received increased attention (cf. e.g. Chadha and Oluoch 2003, High and Shackleton 2000, Tontisirin et al. 2002, Weinberger and Msuya 2004).[2] However, since the determinants of micronutrient malnutrition in particular contexts are not yet fully understood, there is uncertainty as to how effective individual strategies are.

This study contributes to the discussion through an empirical analysis in the Philippines. We use household survey data from peri-urban areas to examine the intakes of vitamin A and iron in addition to calories and proteins. A meal-based 24-hour food intake recall allows a detailed analysis of the dietary composition. For vitamin A and iron, we explicitly consider the issue of bioavailability, since the nutrient amount that can be utilized by the human body is often much lower than the content found in foods. Especially for iron bioavailability, enhancing and inhibiting substances consumed during the same meal are important, so that iron contents found in food composition tables have to be adjusted. We use an innovative calculation procedure in estimating the nutritional status of household members from food consumption surveys. Then, we compare the calculated nutrient intakes with recommended intake levels established by the Philippine Food and Nutrition Research Institute (FNRI) to evaluate the prevalence and severity of nutrient deficiencies. Moreover, the dataset provides the basis for an econometric model applied to estimate the socioeconomic determinants of vitamin A and iron intakes.

Our paper focuses on the question whether food and nutrient intakes differ significantly between poor and non-poor households, and, if so, what socioeconomic and dietary factors influence micronutrient intakes. Within this framework, the role of vegetables, especially indigenous vegetables, receives particular attention. Section 2 describes the data and methodology used for dietary assessment. Section 3 presents the findings of the dietary analysis, while in section 4, the econometric model and estimation results are discussed. Finally, section 5 summarizes and concludes.

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[2] In this study, we refer to the following definition of indigenous vegetables: Indigenous vegetables are vegetable "native to or originating in a particular region or environment. It may include naturalized species or varieties that evolved from materials introduced to the region from another geographical area and which over a long period of time have developed into genotypes adapted to the new habitat probably through the process of natural selection or selection by farmers. However, the term indigenous should exclude products of scientific improvement" (Engle and Altoveros 2000: 65).

2. Data and methodology

2.1 Household survey data

The data base for this study is a household survey conducted in the Philippines in June 2004, which was carried out by the World Vegetable Center (AVRDC). A stratified sampling procedure was employed to gain information on food consumption of low-income households with special emphasis on the role of indigenous vegetables in peri-urban areas. The dataset includes observations from 172 households in Tranca (32), Paciano Rizal (67), and Masaya (73) districts, all located in the municipality Bay of Laguna Province. Household interviews were conducted with the persons in charge of meal preparation whereby 87% of all respondents were women and 72% were mothers of school children.[3] To characterize the interviewed households, data on socioeconomic attributes such as household size and composition, monthly household income as well as age and schooling years of the meal planner were collected. Additionally, information on food consumption patterns and other nutrition factors, especially related to indigenous vegetables, was gathered. A detailed 24-hour food consumption recall captured household food intakes. The 24-hour recall recorded each food item per meal including quantity, unit price, and source – such as purchased, self-produced, or collected.

A 24-hour food intake recall is a common method in nutrition economics to estimate food and nutrient intake of households on the basis of peoples' memory. This method has its strengths and weaknesses with respect to validity and reliability of the information obtained. Compared to food expenditure surveys on a weekly or monthly basis, which are often used in economic demand analyses, 24-hour recalls have advantages in examining diet-related issues for three reasons. First, due to a better memory of the respondent over a short period, errors through omitted or added food items and wrongly estimated quantities are less likely. Second, the itemization of foods is usually more disaggregated in 24-hour recalls and thus allows for a more detailed assessment of the dietary composition (Gibson and Ferguson 1999). Third, calculative adjustments for the absorption of micronutrients based on inhibiting and enhancing factors are possible, especially when the food intake is recorded by meal, as in our dataset. On the other hand, 24-hour recalls only provide a snapshot of nutrient consumption on one particular day, so that dietary variation cannot be accounted for (Foster and Leathers 1999, Karvetti and Knuts 1985, Thompson and Byers 1994). Furthermore, collecting data at

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[3] In the following we call this person the 'meal planner'.

the household level does generally not allow for considering individual nutrient intakes, that is, issues of intra-household distribution are neglected (Gibson and Ferguson 1999).

Given the lack of individual-specific intake data, we assume that food is distributed within households according to adult equivalent (AE) weights.[4] In order to differentiate dietary patterns by income groups, we divided households into poor and non-poor, using the official poverty line of Laguna Province for 2003 established by the Philippine National Statistical Coordination Board (NSCB 2005). The provincial poverty line of 13,902 Philippine Pesos (PhP) per year classifies the households in our sample into a group of 103 poor households with an average annual per capita income of PhP 7,529 and 69 non-poor households with an average annual per capita income of PhP 21,723.[5] The poverty rate in our sample thus amounts to 60%, which is significantly higher than the provincial and regional poverty incidence measured by the NSCB. In 2003, the regional poverty rate was estimated at 15% (NSCB 2005). The divergence between sample and population poverty rates is not accidental, since the survey purpose was to assess the nutritional situation of resource-poor households in peri-urban areas in the Philippines. Therefore, our analysis is clearly not representative for the Philippines or Laguna province as whole, but it might map the nutritional situation of vulnerable population groups in peri-urban areas.

2.2 Estimation of effective nutrient intakes

Our dietary analysis explicitly examines intakes of food energy, protein, vitamin A, and iron. For energy and protein, content levels for different food items given in FNRI food composition tables were directly used for intake calculations. For vitamin A and iron, however, adjustments had to be made in order to take account of bioavailability and bioconversion. These adjustments are described below. Since the vast majority of all foods are cooked, all nutrient conversion rates are based on values for cooked foods.

Vitamin A. The bioefficacy of provitamin A carotenoids has been intensively discussed recently (e.g., Failla and Chitchumroonchokchai 2005, Rodriguez-Amaya and Kimura 2004, West et al. 2002). As a result of these findings, estimating effective vitamin A intake requires

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[4] Adult equivalent (AE) is a conversion tool to compare nutrient requirements of people of different sex, age, and physiological condition. In our study, one AE is equal to the consumption of one male adult (15 years or older). Female adults have a weight of 0.8 AE, male children between 5 and 14 years have a weight of 0.7 AE, female children in the same age have a weight of 0.6 AE, and children under 5 years have a weight of 0.4 AE. These weights are based on food energy requirements established by FNRI (2002).

[5] PhP 13,902 amounts to US$ 248.07 (CIA 2004).

clarification on the used conversion factors. The absorption of vitamin A depends on the form of intake. Vitamin A can be consumed as retinol, the type of vitamin A contained in animal tissue which is directly available to the human body, or in its pre-staged form, known as provitamin A. Provitamin A is found in plants and has to be transformed in the intestinal tract for its utilization in the human body. The most important provitamin A is β-carotene. Conversion of β-carotene to vitamin A can vary considerably between different food types. FNRI food composition tables use a uniform conversion factor for β-carotene of 1/6. Other studies, however, argue that an average β-carotene conversion factor amounting to 1/6 employed on a plant-based diet in developing countries clearly overestimates the real absorption rate (e.g., West et al. 2002, De Pee et al. 1998). We therefore use food group specific conversion factors. These are incorporated in the food composition tables of the Nutrisurvey project of the University of Hohenheim (NutriSurvey 2005). The applied conversion factors for β-carotene measured in retinol activity equivalents (RAE) amounts to 1/6 for edible plant oils, 1/12 for all fruits, pulses, root vegetables, and squash, and 1/24 for onions and other vegetables. Over all foods from plant-based sources, the average value of conversion factors for β-carotene amounts to about 1/21 in our analysis.

Iron. Dietary iron is available in two forms: heme and non-heme iron. Heme iron is only present in meat products such as meat, poultry, fish, and sea food. It has a greater bioavailability than non-heme iron found in both animal and plant foods. The absorption of iron is highly variable. It depends on individual iron stores, the amounts of heme and non-heme iron contents in foods, and the amounts of inhibitors and enhancers in the meal (Hallberg and Hulthén 2000, Monsen and Balintfy 1982). Ascorbic acid and iron from meat, poultry, fish, and sea food enhance the absorption of total iron from the meal. Main inhibitory factors considered in our analysis are phytates, mainly found in grains, nuts, and legumes. To calculate intakes of bioavailable iron we follow the method suggested by Monsen et al. (1978) and Monsen and Balintfy (1982), which was refined by Tseng et al. (1997) and Bhargava et al. (2001). Accordingly, we distinguish between heme and non-heme components of the meal. For animal food items, we assume a heme iron content of 40% of the total iron in the tissue and an absorption rate of 28% in undernourished subjects with low iron stores (up to 250mg).[6] The absorption of non-heme iron from animal and plant foods is adjusted according to other ingredients in the meal. Enhancing effects of ascorbic acid and from the presence of meat,

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[6] Our data on household iron intake indicate that assuming low iron stores is more appropriate than assuming normal iron stores.

fish/sea food, or poultry on the absorption of non-heme iron is estimated by the following formula:

(1) $EF = (M + F + P) + AA.$

M, F, and P denote the edible quantities of meat, fish/sea food, and poultry in the meal measured in grams. AA represents the amount of ascorbic acid measured in milligrams. The calculated coefficient of the enhancing factors (EF) is used in formula (2). If EF exceeds the value of 75, it is set equal to 75 (Bhargava et al. 2001). The percentage of absorbable non-heme iron available per meal thus amounts to:

(2) $\%\text{ non-heme availability} = 4 + 14.296 \ln [(EF + 100)/100].$

The amount of available non-heme iron is further adjusted for inhibiting effects of phytates by introducing a correction term. Following Bhargava et al. (2001) we applied formula (3) to correct the availability of non-heme iron for phytates in the meal:

(3) $CT = 10^{[-0.2869 \log_{10} (\text{mg phytates in meal}) + 0.1295]}$

If phytate contents in the meal are below 2.89 milligrams, no inhibiting effects are assumed and the correction term (CT) is then set equal to one. Phytate values in foods are taken from Hallberg and Hulthén (2000).

Total bioavailable iron ($FeBIO$) is calculated as the sum of the amount of absorbable heme iron, given as share of total iron in meat products ($FeMFP$),[7] and the amount of absorbable non-heme iron, which is the difference between the amount of total iron ($FeTOT$) and heme iron. The amount of non-heme iron is adjusted for the enhancing effect resulting from meat products and ascorbic acid consumption and for the inhibiting effect resulting from phytates in meal components. The corresponding equation is thus given as:

(4) $$FeBIO = 0.112\ FeMFP + (4 + 14.296 \ln [(EF + 100)/100]) \\ \times 0.01\ CT\ (FeTOT - 0.4\ FeMFP).$$

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[7] Meat products include meat, poultry, fish, and sea food.

2.3 Estimation of nutrient deficiencies

Nutrient deficiencies are defined here as the difference between intake recommendations and calculated effective intakes per AE. As intake recommendations, we use thresholds of undersupply as defined by FNRI (2002) and NSCB (2003) for adult men; for energy and protein, the threshold is the estimated average requirement (EAR), while for vitamin A and iron it is 80% of the recommended daily allowance (RDA). For iron, FNRI recommendations refer to total iron intake, taking into account average iron bioavailability from mixed local diets. Since we calculate the bioavailable fraction of total iron intakes by using the more accurate procedure explained in the previous sub-section, the FNRI recommendations are not the appropriate threshold in our particular context. Instead, we use the RDA for bioavailable iron as given by FAO/WHO (2001) for adult women and take 80% of this value as the threshold of undersupply.[8]

Furthermore, we examine the severity of deficiencies by using nutrient adequacy ratios (NARs). Computing NARs is a commonly used measure of dietary quality. The concept was introduced by Madden and Yoder (1972) and has been used both in developed and developing countries (Ruel 2002). NARs are computed as the ratio of calculated nutrient intakes and requirements.

As a general caveat, it should be noted that estimating nutrient intakes and deficiencies based on food intake data has certain limitations. Compared to biochemical assessment, which requires examination of body fluids such as blood or urine and which usually provides an accurate picture of short-term nutrient deficiencies, dietary surveys can only give an indication of the prevalence of deficiencies. In practice, biochemical assessments are often not feasible due to their complexity, high costs, and possible ethical limitations (Foster and Leathers 1999). Food consumption surveys are practicable alternatives. As described above, 24-hour food intake recalls have clear advantages over food expenditure data and food balance sheets in identifying dietary patterns and nutritional intake. Meal-specific calculation of food intakes, as applied in our analysis, is a useful tool to provide simultaneously a comprehensive yet detailed picture of the nutritional status of population groups.

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[8] While for the other nutrients we compare actual intakes per AE with recommendations for adult men, women have higher physiological iron requirements than men, so that using recommendations for women as the reference seems more appropriate in the case of iron. This approach might lead to a slight overestimation of the prevalence of iron deficiency. On the other hand, iron deficiency is indeed far more prevalent among women. Due to the absence of more detailed data on individual household members, pregnancy and lactation, which lead to higher nutrient requirements, could not be considered in our analysis.

3. Nutrient deficiencies and dietary patterns

In this section, we first present calculated prevalence and severity of energy, protein, vitamin A, and iron deficiencies. Subsequently, the composition of the diets in poor and non-poor Filipino households is analyzed. Here, special emphasis is placed on the relevance of certain food groups and items as main nutrient sources. The frequency of consumption of main micronutrient contributors, namely vegetables and meat products, is examined in addition.

3.1 Nutrient deficiencies

In general, severe micronutrient malnutrition is highly prevalent in those areas that are affected by protein-energy malnutrition (PEM) as well. The underlying cause is obvious: lack of calories drastically reduces the performance of the human body and immediately creates a feeling of hunger, whereas micronutrient deficiencies do not. Consequently, resource-poor households endeavor to satisfy their energy requirements first, and only the remaining income is spent for non-staple foods and non-food products. Due to absence of a direct feeling of micronutrient undersupplies, people face the risk of a neglected nutritional balance in their diet. Hence, micronutrient deficiencies can also be prevalent in regions free of PEM. In the following, we therefore examine the effective intakes of energy and protein in addition to those of vitamin A and iron.

Figure 1 represents the macro- and micronutrient supplies of all sample households as well as differentiated by income group. Energy, protein, vitamin A, and iron supplies are given in absolute figures and as fractions of requirements. The average Filipino household in our sample is undersupplied with energy, vitamin A, and iron, and oversupplied with proteins.[9]

The overall energy undersupply in the sample is mostly related to the sample selection explained above. As the survey was focused on resource-poor households in peri-urban areas of the Philippines, average living standards are below the national and provincial average. Figure 1 shows that the average calorie undersupply does not differ much between the poor and non-poor, whereas the number of undersupplied households does. 41% of all households are lacking energy. Among the poor, 46% are undersupplied with calories and 35% among the non-poor. The average energy shortages amount to 31% among the deficient poor and to 23%

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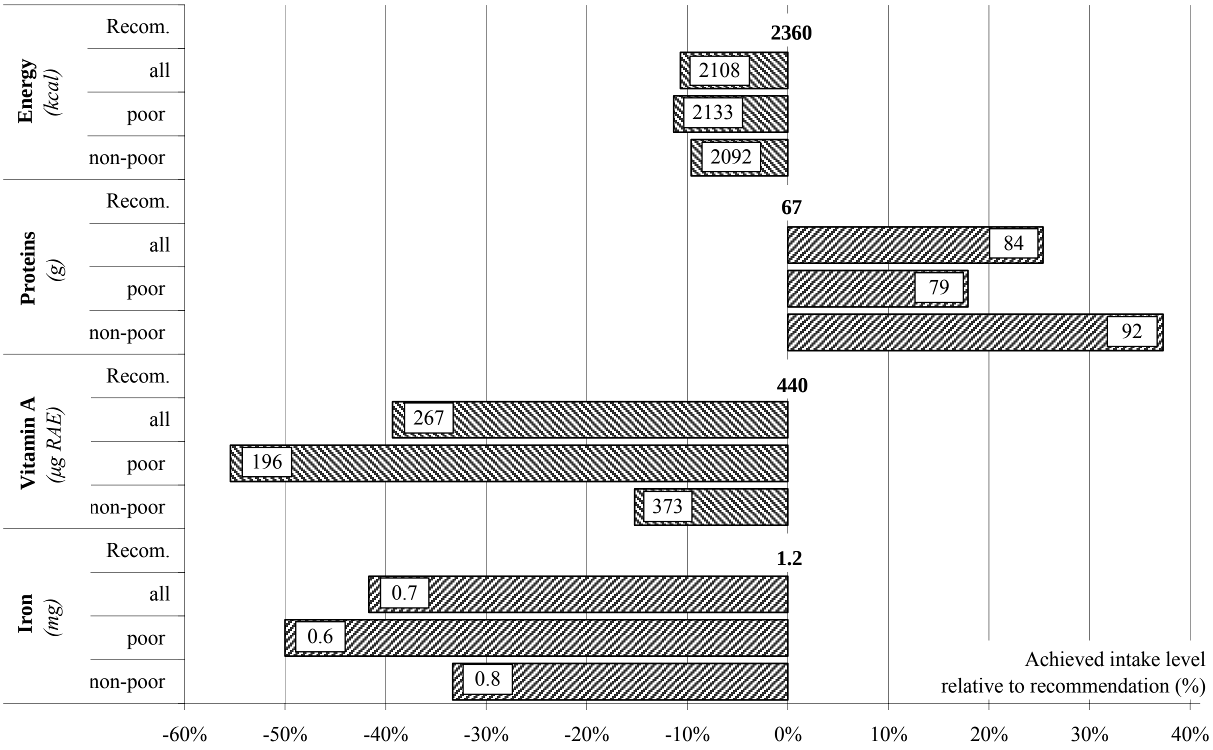
[9] Oversupply with protein is often found when calculating aggregate protein intake based on household consumption data. This result should be interpreted with caution, however, because protein quality is not considered. In spite of average protein oversupply, there might still be deficiencies in individual essential amino-acids.

among the deficient non-poor. These findings confirm that energy undersupply in Philippine peri-urban areas is closely related to poverty.

Figure 1: Macro- and micronutrient supply of households expressed per AE



Note: Intake recommendations are based on FNRI (2002) and FAO/WHO (2001), as explained in sub-section 2.3.

According to FNRI (2001) the average Filipino diet reaches less than 90% of the recommended intake for energy but exceeds the recommended protein intake by 6%. This confirms the pattern found in our analysis. Although hunger and undernutrition have diminished in the Philippines over the last decade, they are still prevalent and continue to be severe problems among the poor, especially among highly vulnerable groups. FNRI (2004) estimates that one-fourth of the preschool children are underweight, and 12% of adults are chronically energy deficient.

Micronutrient malnutrition, however, seems to be even more pronounced. Figure 1 shows that the undersupply of vitamin A and iron is sizeable for the average of all sample households, although there are important differences between income groups, as one would expect. In total, 91% of the sample households are vitamin A deficient; 93% of the poor and 87% of the non-poor. The deficient poor can satisfy only 34% of the recommended intake, while non-poor deficient households satisfy 42% on average. FNRI (2001) reported a higher level of vitamin A intake for the Philippines reaching 88% of the RDA. This contradiction can partly be explained by our non-representative sample design. However, it is probably also a consequence of the detailed food group specific conversion factors for provitamin A employed by us, which provide more reliable estimates than the standard rates used by FNRI.

According to our calculations, most households (92%) are unable to satisfy their daily iron requirements. The prevalence as well as the severity of iron deficiency seems to be strongly associated with poverty again. Iron deficiency affects 61% of the poor and 39% of the non-poor households. The average shortfall of the deficient poor amounts to 55% as compared to 49% among the deficient non-poor. Apart from low iron intakes, the high prevalence of deficiency and the low NAR among deficient people of 0.47 is caused by the low bioavailability of iron in the meals. The estimated mean amount of bioavailable iron is only 7% of total iron intake after adjusting for the absorption enhancers and inhibitors. Among the deficient poor, the bioavailable iron intake amounts to a daily 0.54 mg per AE, and among the non-poor to 0.61 mg per AE. This is far below the recommended intake. FNRI (2001) estimates that the average Filipino reaches 65% of the recommended iron intake. However, the FNRI study assumed normal iron stores and did not consider enhancing and inhibiting effects of food ingredients; instead iron bioavailability was fixed at 10%.

3.2 Dietary composition and key nutrient sources

In this sub-section, we investigate the contribution of certain food groups to total nutrient intakes. Thereby we provide evidence of the prevalence and severity of deficiencies for the whole sample population and differentiated for the two income groups. Due to differences in nutrient contents, certain food groups are of different relevance in providing energy, protein, vitamin A, and iron. The same food item might be of minor importance for energy and protein supply but of major importance as micronutrient source, even if consumed in relatively small quantities. Special attention is drawn to the contribution of vegetables, especially indigenous vegetables, versus meat products to vitamin A and iron intakes.

A detailed dietary analysis for poor and non-poor households is presented in Tables A1 and A2 in the annex.[10] Dietary composition is given in absolute and relative terms; the figures

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[10] Ascorbic acid is not specifically considered in our analysis due to its minor relevance in the context of nutrient deficiencies but included in Tables A1 and A2 because of its major role as enhancing factor in iron absorption.

shown are averages over all households in each income group expressed per AE. A summary of relative nutrient intakes is given for the main food groups in Table 1.

Table 1: Nutritional composition of the diet in poor and non-poor households (per AE)

	Energy		**Protein**		**Vitamin A**		**Iron**	
	poor	***non-poor***	***poor***	***non-poor***	***poor***	***non-poor***	***poor***	***non-poor***
Cereals	69%	63%	39%	31%	0%	0%	40%	33%
Pulses	0%	1%	1%	1%	1%	1%	2%	2%
Vegetables	2%	3%	1%	2%	23%	14%	9%	10%
Indigenous	*2%*	*2%*	*1%*	*2%*	*18%*	*13%*	*8%*	*9%*
Exotic	*0%*	*1%*	*0%*	*0%*	*5%*	*1%*	*1%*	*1%*
Meat, fish & poultry	13%	19%	52%	61%	63%	77%	29%	36%
Eggs & milk products	1%	1%	3%	2%	7%	3%	5%	4%
Fruits	1%	1%	0%	0%	3%	1%	3%	3%
Others	13%	12%	4%	3%	3%	4%	12%	12%
Total	100%	100%	100%	100%	100%	100%	100%	100%

The total number of different food items covered in the survey was 142, with an average of 12 food items recorded per household. In general, dietary diversity, which can be defined as the number of different food items consumed over a given period, has been recognized as a key indicator of nutritionally balanced diets (e.g. Hatloy et al. 1998, Onyango et al. 1998, Ruel 2002, Torheim et al. 2004). High numbers of different food items consumed per meal usually result from adding non-staple food items with higher contents of essential micronutrients. Cutoff points for ‘optimal’ diversity vary between countries and regions; determination of meaningful cutoffs is a demanding task. In our analysis, we cannot confirm the linkage between dietary diversity and nutrient intakes. Our data neither reveal significant differences in the number of food items consumed between poor and non-poor households nor between deficient and non-deficient households in terms of vitamin A and iron.

Diets in the sample households consist to a great extent of rice as staple food, which is usually combined with fish and vegetables in a meal. In poor households, larger amounts of cereals, mainly rice, are consumed. Table 1 indicates that cereals and meat products are the main sources of energy and protein. Other food groups are of lesser relevance in this regard. Obviously, rice as the staple food provides more than 60% of households’ calorie intake. Meat, fish, and poultry as well as rice contribute most to protein supply. More than half of the proteins consumed emanate from meat products with a considerably higher share among the non-poor households. Fish, the main provider of proteins in the household diets, makes up one-third of total protein intake. The share of proteins from fish is similar for poor and non-poor households implying that high amounts of fish proteins can be afforded by most households. For meat this does not hold. With increasing incomes the relevance of meat as energy and protein source increases at the expense of rice. Poor households get 66% of their energy and 37% of protein from rice and 13% and 51% from meat products, respectively. In the diets of non-poor households, rice makes up for 61% of the energy and for 29% of the proteins, while meat products amount to 19% of the energy and 61% of proteins. The gap in protein intake between poor and non-poor households illustrated in Figure 1 is hence caused by the differences in the consumption of meat products to a major extent.

A close examination of the consumed quantities of the main micronutrient-rich food items in Philippine diets, mainly meat products and vegetables, may provide evidence on the nutritional intake. Meat products and vegetables are largely substitutes with respect to vitamin A and iron intakes, although meat products are more valuable sources because of higher bioavailability rates. Poor households eat on average 170 g of meat products per AE and day, which is less than three-quarters of the amount eaten in non-poor households (238 g). Vegetables are consumed in smaller amounts than meat products in both household groups. The daily diet of poor households contains 96 g vegetable products per AE on average, of which 90% are considered as indigenous. The average amount in the non-poor group accounts for almost a quarter more (126 g). Again, 90% are indigenous vegetables. Overall, vegetable intakes are far below the daily per capita intake of 200 g recommended by FAO (1999). In addition to low vegetable consumption, the consumption of fruits, another important source of micronutrients, is very limited. Only 10% of the households surveyed ate fruits on the survey day.

Table 2 presents the frequency of indigenous vegetable, fish, and meat consumption among the poor and non-poor. Indigenous vegetables are components of every day's meal in more than 40% of the households analyzed, with slightly higher percentages among the poor. For fish and meet, the opposite can be observed. While fish is still consumed relatively often among the poor, the consumption frequency is somewhat higher among the non-poor. For meat, the differences are more pronounced: 55% of the non-poor consume meat several times per weak, compared to only one-third of the poor.

Table 2: Frequency of indigenous vegetable, fish, and meat consumption in poor and non-poor households

	Indigenous vegetables		Fish		Meat	
	poor	*non-poor*	*poor*	*non-poor*	*poor*	*non-poor*
Less than once a month	0%	0%	0%	1%	13%	6%
1-3 times per month	3%	6%	5%	3%	34%	16%
Once a week	6%	9%	7%	1%	19%	23%
2-4 times per week	43%	45%	45%	51%	30%	45%
5-7 times per week	48%	40%	43%	44%	4%	10%

For vitamin A supply, meat products and vegetables play the main role. Meat and fish are the most important source for all households, although the relative importance is greater among the non-poor. Accordingly, the contribution of vegetables to total vitamin A intake is relatively higher among the poor. This is not surprising, given that meat products are relatively expensive foodstuffs. Table 1 demonstrates that poor households extract 63% of their vitamin A from meat products of which two-thirds stem from fish sources. Non-poor households even obtain 77% of vitamin A from meat products of which fish makes up for only 38%.[11] The contribution of vegetables to total vitamin A intake amounts to only about one-third of the contribution of meat products among the poor and to less than one-fifth among the non-poor. In total, 23% of the vitamin A intake in poor households and 14% in non-poor households are from vegetable sources. Thus, poor households partly substitute the lower amounts of retinol with provitamin A. Among the vegetables, most of the intake stems from leafy vegetables, which are almost exclusively indigenous in the Philippines. Specifically cassava, horseradish, and sweet potato leaves play a relatively important role in the diets. Indigenous vegetables provide 80% of vitamin A intake from plant-based foods in poor households and almost 90% in non-poor households.

Several studies (e.g. Grivetti and Ogle 2000, Engle and Altoveros 2000) emphasize the importance of leafy indigenous vegetables in the diet of poor people because of their high vitamin A and mineral contents and their permanent availability at low costs. However, the amount of vitamin A from plant sources effectively available to the human body is significantly lower than vitamin A from animal products. First, crucial losses occur during the cooking process. Additionally, the vitamin A bioavailability of plant-based foods and of green

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[11] The high vitamin A value of 'other meat products' in Table A2 is mainly caused by the consumption of entrails. 'Other meat products' were consumed in only seven households and also include horse and snack meat. The main share of vitamin A intake through 'other meat products' is caused by the consumption of high quantities of liver in one household. Given the small group size, overinterpretation should be avoided.

leafy vegetables is considerably lower than the bioavailability of meat products. This is of disadvantage for the vitamin A intake of poor people in particular. Beside the lower consumption of vitamin A-rich foods, this fact explains the large difference in the vitamin A intake between poor and non-poor households, as illustrated in Figure 1. In order to consume sufficient vitamin A in a pure vegetarian diet, significantly higher amounts of vegetables would be required. Consequently, meat and fish are more efficient vitamin A suppliers per quantity unit and in total. Particularly the role of fish for vitamin A supply has to be emphasized because fish is a rich and inexpensive source of vitamin A. Our data suggest that both non-poor households and most of the poor households can afford a regular consumption of fish.

Leafy vegetables and other vegetables (as classified in Tables A1 and A2) as well as fruits are also of vital importance in iron absorption. They are rich in ascorbic acid, a main enhancer of iron absorption. Leafy vegetables account for 16% of ascorbic acid intake in poor households and for 23% in non-poor households. Fruits make up 28% of ascorbic acid intake in the poor group and half in the non-poor group. Indigenous vegetables are thus the main provider of ascorbic acid overall.

Iron is mainly supplied as non-heme iron found in plant-based foods as well as in meat products. For iron intake, vegetables play a secondary role. Strikingly, cereals, especially rice, are the main source of iron for the poor, while meat and fish are more important among the non-poor. The partial substitution of rice by meat, found for consumed food quantities and confirmed for protein, is reflected in iron intake. In the diet of poor households 40% of iron intake is from rice and 30% from meat products. The respective figures for non-poor households amount to 33% and 37%. The shift from higher rice shares towards higher meat shares is also associated with an absolute higher iron intake. Furthermore, the iron absorbed by the human body increases over-proportionately due to higher bioavailability of heme-iron versus non-heme iron and the enhancing effect of heme-iron on the non-heme iron absorption from non-meat/fish meal components. It should be mentioned that the slight reduction of phytate intakes from reduced rice intake has only a negligible effect. Analogous to vitamin A intake, the absolute higher intake as well as the higher absorption due to meat consumption explains the gap in iron intake between poor and non-poor households. The gap for iron intake does not diverge as much as for vitamin A, however, since the consumption of rice can partly compensate for the lower amount of meat in the poor group.

For our sample, we therefore conclude that vitamin A and iron deficiencies are rather the result of a quantitatively low consumption of micronutrient-rich foods than of low dietary diversity. Our analysis further suggests that poor households are at higher risks of severe vitamin A and iron deficiencies since the consumed quantities of meat products are absolutely lower and the difference is not compensated with a higher vegetable consumption.

4. Determinants of vitamin A and iron intakes

In the previous section, we have analyzed the micronutrient intakes of poor and non-poor households. Here, we employ an econometric model, in order to identify socioeconomic factors influencing vitamin A and iron intakes of Filipino households. The regression model is introduced first, and results of the estimation are presented and discussed subsequently.

4.1 The model

In line with previous studies (e.g. Bouis and Novernario-Reese 1997, Weinberger 2001), micronutrient consumption is assumed to be a function of household income and other socioeconomic household characteristics. For empirical estimation, the functional form needs to be specified. We employed the MacKinnon-Davidson test, in order to test linear versus logarithmic specifications. The test results suggest choosing a simple linear form for both the vitamin A and iron models at a 0.05 significance level. Using ordinary least squares (OLS) procedures, the regression models are estimated separately for vitamin A and bioavailable iron intakes with the following specification:

$$N = \alpha + \beta_x X + \beta_y Y + \beta_z Z + \varepsilon$$

with the variables:

N = vitamin A/bioavailable iron intake of households measured per AE and day
X = daily food expenditure per capita
Y = vector of variables characterizing the household
Z = vector of variables characterizing the meal planner of the household.

Daily per capita food expenditure (X) calculated from the 24-hour food consumption recall is used as proxy for income. It is well known from the literature that in household surveys consumption data measured by expenditure are usually a better approximation of permanent income and living standard than current income recorded during the survey, especially in developing countries (cf. Deaton 1997). Income is generally more difficult to record and tends to vary more over time than actual living standard. In our survey, only a rough estimation of monthly income was available, which also showed not to be significant for the models specified. Furthermore, income and weekly food expenditure, which was additionally surveyed, do not capture the value of self-produced food items or gifts. We therefore calculated daily food expenditure from the 24-hour food consumption recall by including the reported prices paid for the consumed food items. Self-produced food items or gifts are valued at average local market prices. Food expenditure (*X*) enters the model on a per capita basis.[12]

Vector *Y* includes characteristics of the household, namely location and size. Location is captured in dummy variable form identifying the districts Tranca and Paciano, while Massaya is taken as the reference district. We included location to capture effects like infrastructural endowment, market integration, and local agro-ecological conditions on household nutrient intake. Household size is incorporated to account for possible economies of scale in household consumption, which are widely reported in the literature (Bouis and Novernario-Reese 1997). Vector *Z* captures attributes of the meal planner of the household. It incorporates a sex dummy, in order to consider possible gender-related effects on the nutritional status of household members. Generally, women take better care of nutritional quality than men (cf. e.g. Behrman and Wolfe 1984, World Bank 2006). We additionally integrated a variable capturing the age of the meal planner. The role of education and knowledge of women for a healthy nutrition has been emphasized repeatedly (e.g. Behrman and Wolfe 1984, Bouis and Novernario-Reese 1997, Bouis et al. 1999, World Bank 2006). In our model, we used the meal planner's number of schooling years as a proxy for education and a dummy variable capturing the participation in nutrition training as a proxy for knowledge on nutritional aspects. ε is a random error term. All variables included in our model are summarized in Table 3.

Table 3: Definition and summary statistics of variables

Variable	**Definition**	Mean	SD
Vitamin A intake	Daily vitamin A intake in µg RAE per AE	267.191	663.246
Iron intake	Daily bioavailable iron intake in mg per AE	0.644	0.430
Food expenditure	Daily per capita food expenditure in PhP	27.987	14.786
Tranca*	Household is located in Tranca district**	0.186	0.390
Paciano*	Household is located in Paciano Rizal district**	0.389	0.489
Household size	Number of persons per household	5.895	1.980
Female*	Meal planner is female	0.872	0.335
Age	Age of the meal planner in years	37.779	10.911
Education	Number of schooling years of meal planner	7.895	3.112
Knowledge*	Household participated in a training course on nutrition	0.256	0.438

* Dummy variable.
** The reference variable represents the district Masaya.

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[12] The surveyed food expenditure amounts to 76% of the surveyed income on average.

4.2 Results

Results of the regression analysis for household vitamin A and iron intakes are presented in Table 4. Our regression model explains about 9% of the variation in vitamin A and 22% of the variation in iron intakes. The F-test shows that the models for vitamin A and iron intakes are significant at the 0.05 and 0.01 level, respectively. However, only two coefficients in both regressions are significant, which are food expenditure indicating the Engel-relation and a dummy variable capturing the location. The significance of the location dummies is of low interpretation potential since no clear pattern is given simultaneously for vitamin A and iron intakes. Results clearly suggest that more factors determine vitamin A and iron intakes of households than those included in our model. Overall, the low significance level of most socioeconomic variables may partly be attributed to the relatively low data variability within the sample: differences in household size, level of education, and age may be too small to display significant effects on vitamin A and iron intakes.

Table 4: Determinants of the vitamin A and iron intake

	Vitamin A status			**Iron status**		
Variable	Coefficient		t-statistic	Coefficient		t-statisitc
Intercept	32.98		0.09	0.409		1.87
Food expenditure	7.38	**	2.10	0.013	***	5.97
Tranca	295.93	**	2.21	-0.010		-0.01
Paciano	-35.11		-0.32	-0.119	*	-1.79
Household size	-25.23		-0.96	0.023		1.43
Female	30.00		0.20	-0.071		-0.79
Age	-0.15		-0.03	-0.004		-1.24
Education	8.30		0.48	0.002		0.19
Knowledge	192.65		1.65	-0.077		-1.09
F-value	2.00 **			5.63 ***		
R-square	0.09			0.22		
Number of observations	172			172		

*,**,*** Coefficients are significantly different from zero at the 0.1, 0.05, and 0.01 level, respectively.

Though insignificant, education is positively related with both vitamin A and iron intake, which is in line with results of other studies. Behrman and Wolfe (1984) reported a highly significant impact of women's schooling on vitamin A and iron intake for Nicaraguan households. Abdulai and Aubert (2004) found a significant, positive coefficient for women schooling in vitamin A and iron demand in Tanzania. Our model further suggests that vitamin A and iron intakes are negatively related to the age of the meal planner, but again the effect is not statistically significant.

Household size, gender, and nutritional knowledge do not show consistent effects on vitamin A and iron intakes in our sample. In accordance with other studies, the number of household members is negatively correlated with vitamin A intake. Abdulai and Aubert (2004) and Behrman and Wolfe (1984) ascertained a negative, significant relation for both vitamin A and iron intakes. Using data of Bangladeshi households, Bouis and Novernario-Reese (1997) found a negative, non-significant effect for vitamin A intake and a positive, non-significant effect for iron intake. As expected, the dummy variables representing gender and nutritional knowledge possess positive effects on vitamin A intake in our regression.

Given the mostly insignificant results, over-interpretation should be avoided. However, the micronutrient-income (proxied by food expenditure) relationship is positive and significant in both models, confirming that micronutrient malnutrition is strongly associated with poverty.

5. Summary and conclusion

This paper aimed at contributing to the discussion on patterns and determinants of micronutrient malnutrition in developing countries. Attention has been given to the question whether dietary patterns considerably differ between poor and non-poor households, resulting in significant differences in nutrient intakes. We analyzed the consumption of vitamin A and iron in addition to calories and protein. Special emphasis was put on the role of vegetables, indigenous vegetables in particular, versus the contribution of animal source foods. Vegetables and animal products are usually the main sources of vitamins and minerals in household diets. We used a stratified sample survey consisting of 172 resource-poor households located in peri-urban areas of Laguna Province in the Philippines. We differentiated the dataset into groups of poor and non-poor households to point out differences in dietary patterns. A 24-hour food consumption recall allowed for a detailed, meal-specific examination of households' diets.

24-hour food recalls are useful tools in nutrition economics to identify dietary patterns in populations in a disaggregated manner at limited costs. However, they provide only a snapshot of households' diets on one particular day, so that the results should be interpreted with some caution. Furthermore, with respect to micronutrient intakes, issues of bioavailability need to be accounted for. Our analysis considered food group-specific conversion factors for calculating vitamin A intakes from plant-sourced foods. For iron absorption, we employed a meal-specific algorithm that includes enhancing and inhibiting effects from meal components and takes into account that most households in the sample had low body iron stores. Our calculative adjustments for micronutrient bioavailability constitute a novel approach in nutritional economics. Furthermore, we compared effective household intakes of energy, protein, vitamin A, and iron with intake recommendations for a healthy diet, in order to analyze the prevalence and severity of nutritional deficiencies in peri-urban areas of the Philippines.

We found that the average peri-urban household is undersupplied with energy, vitamin A, and iron but oversupplied with protein. For energy, the discrepancy in supply of poor versus non-poor households is small. Calorie undernutrition is still relatively widespread in peri-urban areas of the Philippines. Likewise, the prevalence of vitamin A and iron deficiencies is high among vulnerable groups. Both micronutrient deficiencies are strongly associated with poverty, which is also confirmed in econometric analyses. The gaps in intakes of protein, vitamin A, and iron between poor and non-poor households show a clear pattern, which is determined by the food types consumed. Furthermore, our data suggest that micronutrient deficiencies are rather caused by low quantities of micronutrient-rich foods than by a low diversification in the meals. Dietary diversity measured in the number of different food items consumed does not differ significantly between poor and non-poor nor between micronutrient-deficient and non-deficient households.

Household diets generally consist of rice as the major staple food, which is mostly combined with fish and vegetables. Rice amounts to about two-thirds of the total food quantity consumed. Main sources of protein, vitamin A, and iron are meat products. Since non-poor households consume higher quantities of these products, their micronutrient status is somewhat better than that of the poor. Fish plays a vital role in the supply of vitamin A and iron. We found no significant differences in the consumed quantity and consumption frequency between poor and non-poor households suggesting that large shares of the peri-urban population have access to fish. In contrast, notable differences between poor and non-poor households exist for the quantity and frequency of meat consumption. We observed the tendency that, with increasing income, rice is partly substituted by meat. This substitution is reflected in the intakes of protein, vitamin A, and iron. Due to higher micronutrient concentrations in meat products, severe deficiencies are more likely among the poor.

Most people fall short in the daily per capita intake of 200 g vegetables recommended by FAO, even in non-poor households. Nonetheless, the non-poor consume higher amounts of vegetables on average, resulting in higher intakes of vitamin A and iron again. Due to the higher consumption of meat products and thus heme-iron, the bioavailability of non-heme iron is also higher among the non-poor. The vast majority of vegetables are indigenous in the Philippines. The consumption of indigenous vegetables appears to be widely independent of income.

Our dietary analysis clearly indicates the importance of animal foods, especially fish, for vitamin A and iron intakes. In order to improve the micronutrient supply in peri-urban areas, especially among the poor, the promotion of regular fish consumption is advisable. Small-scale aquaculture projects might be a promising strategy to improve availability and accessibility of vitamin A and iron-rich foods throughout the year. Compared to vegetables, animal foods are more valuable sources of these micronutrients. However, since vegetables are relatively cheaper, they also play a crucial role for micronutrient supplies. Vegetables account for almost one-quarter of vitamin A supplies among the poor. Although their direct contribution to iron supplies is lower, vegetables and fruits are still important for the overall iron status, as they contain high amounts of ascorbic acid, which enhances the bioavailability of non-heme iron contained in various food stuffs. Indigenous vegetables are therefore crucial for multiple vitamin and mineral supplies among vulnerable population groups. For achieving a sufficiently balanced diet in peri-urban areas of the Philippines, the consumption and production of indigenous vegetables should be encouraged. Most types of vegetables seem to be favored by the majority of the population, which facilitates implementation of related strategies. To increase availability and accessibility for the poor, home garden projects might be a good opportunity. Of course, overall poverty reduction will also help to reduce the problem of micronutrient malnutrition. But, since this is a longer-term strategy, more targeted interventions are required in the interim.

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Annex

Table A1: Nutrient composition of the diet in poor households per AE (n=103)

	Quantity		Energy		Protein		Vitamin A		Ascorbic acid		Iron	
	g	%	kcal	%	g	%	µg RAE	%	mg	%	mg	%
Cereals	412	48	1450	69	31	39	0	0	0.0	0	3.9	40
Rice	390	45	1386	66	29	37	0	0	0.0	0	3.9	40
Others	22	3	64	3	2	2	0	0	0.0	0	0.0	0
Pulses	11	1	10	0	1	1	2	1	3.2	7	0.1	2
Indigenous	11	1	10	0	1	1	2	1	3.2	7	0.1	2
Exotic	0	0	0	0	0	0	0	0	0.0	0	0.0	0
Leafy vegetables	33	4	10	0	0	1	28	14	7.6	16	0.4	4
Indigenous	26	3	9	0	0	1	28	14	6.5	14	0.4	4
Exotic	7	1	1	0	0	0	0	0	1.1	2	0.0	0
Root vegetables	19	2	14	1	0	0	9	5	2.1	4	0.1	1
Indigenous	16	2	12	1	0	0	0	0	1.6	3	0.1	1
Exotic	3	0	2	0	0	0	9	5	0.5	1	0.0	0
Other vegetables	44	5	12	1	0	1	8	4	7.1	15	0.3	3
Indigenous	44	5	12	1	0	1	8	4	7.1	15	0.3	3
Exotic	0	0	0	0	0	0	0	0	0.0	0	0.0	0
Animal foods	188	22	296	14	43	54	137	70	0.5	1	3.4	35
Fish	118	14	151	7	28	35	82	42	0.0	0	1.7	17
Poultry	17	2	37	2	7	8	2	1	0.0	0	0.5	5
Pork	24	3	62	3	4	5	6	3	0.3	1	0.3	3
Red meat	5	1	10	0	1	2	6	3	0.0	0	0.2	2
Other meat products	6	1	10	0	1	2	28	14	0.1	0	0.2	2
Eggs	14	2	24	1	2	3	13	6	0.0	0	0.5	5
Milk products	4	0	2	0	0	0	1	1	0.1	0	0.0	0
Fruits	36	4	29	1	0	0	5	3	13.6	28	0.3	3
Edible oils	16	2	144	7	0	0	0	0	0.0	0	0.0	0
Spices	27	3	59	3	1	1	1	0	0.2	0	0.4	5
Other foods	22	2	37	2	1	2	4	2	0.5	1	0.4	4
Beverages	54	6	30	1	1	1	1	1	13.0	27	0.3	3
Coffee and tea	1	0	4	0	0	0	0	0	0.0	0	0.0	0
Others	53	6	26	1	0	0	1	1	13.0	27	0.3	3
TOTAL	862	100	2092	100	79	100	196	100	47.8	100	9.8	100

Table A2: Nutrient composition of the diet in non-poor households per AE (n=69)

	Quantity		Energy		Protein		Vitamin A		Ascorbic acid		Iron	
	g	*%*	kcal	*%*	g	*%*	µg RAE	*%*	mg	*%*	mg	*%*
Cereals	381	*40*	1350	*63*	29	*31*	0	*0*	0.0	*0*	3.6	*33*
Rice	364	*38*	1295	*61*	27	*29*	0	*0*	0.0	*0*	3.6	*33*
Others	17	*2*	55	*3*	2	*2*	0	*0*	0.0	*0*	0.0	*0*
Pulses	14	*2*	12	*1*	1	*1*	2	*1*	4.0	*7*	0.2	*2*
Indigenous	14	*1*	12	*1*	1	*1*	2	*1*	3.9	*7*	0.2	*2*
Exotic	1	*0*	1	*0*	0	*0*	0	*0*	0.1	*0*	0.0	*0*
Leafy vegetables	43	*5*	13	*1*	1	*1*	41	*11*	13.3	*23*	0.6	*5*
Indigenous	33	*3*	11	*1*	1	*1*	40	*11*	11.6	*20*	0.5	*5*
Exotic	11	*1*	2	*0*	0	*0*	0	*0*	1.6	*3*	0.0	*0*
Root vegetables	33	*3*	30	*1*	0	*0*	5	*1*	6.6	*11*	0.2	*1*
Indigenous	32	*3*	29	*1*	0	*0*	0	*0*	6.4	*11*	0.1	*1*
Exotic	1	*0*	1	*0*	0	*0*	5	*1*	0.2	*0*	0.0	*0*
Other vegetables	50	*5*	13	*1*	0	*1*	7	*2*	9.0	*16*	0.3	*3*
Indigenous	49	*5*	13	*1*	0	*1*	6	*2*	8.9	*16*	0.3	*3*
Exotic	1	*0*	0	*0*	0	*0*	0	*0*	0.1	*0*	0.0	*0*
Animal foods	254	*27*	432	*20*	58	*63*	300	*80*	1.2	*2*	4.5	*41*
Fish	141	*15*	179	*8*	32	*34*	109	*29*	0.0	*0*	1.8	*17*
Poultry	29	*3*	66	*3*	12	*13*	3	*1*	0.0	*0*	0.8	*8*
Pork	46	*5*	126	*6*	7	*8*	7	*2*	0.6	*1*	0.5	*5*
Red meat	10	*1*	18	*1*	3	*3*	16	*4*	0.0	*0*	0.4	*4*
Other meat products	12	*1*	17	*1*	2	*2*	152	*41*	0.5	*1*	0.4	*3*
Eggs	14	*1*	23	*1*	2	*2*	12	*3*	0.0	*0*	0.5	*4*
Milk products	3	*0*	3	*0*	0	*0*	1	*0*	0.1	*0*	0.0	*0*
Fruits	29	*3*	19	*1*	0	*0*	3	*1*	8.0	*14*	0.3	*3*
Edible oils	14	*1*	126	*6*	0	*0*	0	*0*	0.0	*0*	0.0	*0*
Spices	29	*3*	54	*3*	1	*1*	3	*1*	0.4	*1*	0.4	*4*
Other foods	25	*3*	39	*2*	1	*2*	9	*3*	0.7	*1*	0.3	*3*
Beverages	85	*9*	44	*2*	1	*1*	2	*1*	14.3	*25*	0.6	*5*
Coffee and tea	1	*0*	2	*0*	0	*0*	0	*0*	0.0	*0*	0.0	*0*
Others	84	*9*	42	*2*	0	*0*	2	*1*	14.3	*25*	0.6	*5*
TOTAL	958	*100*	2133	*100*	92	*100*	373	*100*	57.6	*100*	11.0	*100*

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