



Helen Keller International
the international division of Helen Keller Worldwide

Micronutrient Initiative Project, Pilot Project—1
School-based Iron/Folate Supplementation for Girls
Manica Province

Report of Baseline Survey
9 May, 2002

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This work was carried out with the aid of a grant from Micronutrient Initiative, an international secretariat of the International Development Research Centre/MI, Ottawa Canada

Executive Summary

Introduction

A baseline survey was conducted in two rural districts in Manica Province to determine hemoglobin levels, knowledge and practices associated with healthy foods and anemia, and various factors related to socioeconomic status. The study objective is to determine if weekly school-based supplementation of iron/folate tablets to girls of reproductive age, concurrent with education, can positively affect anemia prevalence and micronutrient-related knowledge and practices among the target population.

The study took place in 12 schools in Guro and Macossa districts, May 28 - June 7, 2001. Schools were selected based on accessibility during the rainy season. All consenting girls between the ages of 10 and 18 were administered a questionnaire and their hemoglobin levels were determined, using the HemoCue™ portable hemoglobinometer. The sample size was 797 girls. Two teams performed the survey in local dialect, one team per district with the exception of Nhamassonge in Guro, which was collected by the Macossa team.

Results

Prevalence of anemia (Hb < 12.0 g/dl) was 45% overall, 40% in Macossa and 47% in Guro. Of this, 25% was mild, (Hb 11.0-11.9 g/dl), 19% moderate, (Hb 8.0- 10.9 g/dl), and 0.5% severe anemia (Hb < 8.0 g/dl). No significant demographic differences between respondents in the two districts existed, including age, menstruation status, morbidity and socioeconomic status.

Households of respondents in both districts are poor, although those in district capitals appear a little better off, likely due to better access and infrastructure. Animals, except chickens, are mostly used for income generation instead of consumption. Girls from households with chickens had lower anemia levels than households with animals other than chickens, or households with no animals. Few girls (7%) had heard of anemia, and 20% report they have begun menstruating. Consumption of healthy foods is not related to knowledge, but more likely to economic factors and access. Some misconceptions exist about types of healthy foods. Most girls (77%) had experienced malaria during the last year.

Conclusions

It was concluded that a high rate of anemia exists among adolescent school-girls in the two districts surveyed, probably complicated by malaria and other illnesses, less than optimal diets and economic limitations, though no significant differences were found. Supplementation of iron/folate to adolescent girls in schools could help improve iron stores before pregnancy, complementing the supplementation of pregnant women at health facilities. This supplementation should begin in early grades before girls leave school, and include a strong nutrition education component of both boys and girls and teachers/parents, and should encourage involvement of the entire community. Education should stress the importance of girls' education and prolonging parity. Teachers should be well trained and supervised to ensure distribution and compliance, and the distribution/surveillance system should be easy to understand and use.

Report of Baseline Survey for School-Based Iron/Folate Supplementation Project for Adolescent Girls

Background

The districts of Guro and Macossa lie at the northern end of Manica Province in west-central Mozambique. Although great improvements have been made since the end of the civil war in 1992, these regions still suffer from extreme poverty, malnutrition, and general food insecurity. Manica Province continues with some of the lowest health indicators in Mozambique, in part related to increasing HIV/AIDS prevalence and related complications (including nutritional consequences).

The main source of food for consumption is subsistence agriculture with little crop variety. The primary crops in Macossa consist of maize, sorghum, and millet. In Guro crop production is more varied, consisting of sorghum, maize, millet, groundnuts, and beans. In both areas, the lean season is from October/November to April/May. Vegetables are usually more available from January to June, while wild game meat is more available after the yearly burnings between August and November. As in most other rural regions in the country, the most common causes of food insecurity in these regions are pests, unfertile land, high prices for basic food items which are not locally produced, unemployment and lack of other off-farm income sources. Most years family agriculture provides poorer inhabitants of Guro and Macossa with food between 6-8 months per year. The rest of the year food must be acquired through other means, either employment, small family industries such as the sale of coal or traditional drinks and food, *ganho-ganho*¹, donations, or trade, and is often accompanied by reduced food intake and greater consumption of wild plants. Most men look for temporary employment to buy foodstuffs during the lean season, (1)

Gender shapes food security and nutrition in these areas. While women are usually in charge of all aspects of food preparation from harvesting to cooking, men generally control available monetary resources within families. The social and economic advancement of women is stymied by early marriage and pregnancy, accompanied by characteristically low school attendance and high dropout rates for girls. Of pupils 15 to 18 years old in rural Manica Province, only 26% are girls, or three times as many boys as girls are enrolled, indicative of the low priority placed on girl's education in these regions.(2) The "value" of girls' education is further complicated by cultural practices such as "lebola", the valued bride-price families receive from marriage of their daughters, whose education often becomes secondary to her position in her new family. Manica Province's overall poor nutritional status exemplifies findings of many studies in the developing and industrialized world, adding evidence to the association between mother's education level and health of the populations in which they live. In Mozambique, long-term nutritional status of children was found to be better when

¹ Ganho-Ganho is a short-term coping strategy used by families during periods of urgent need. Work can be for cash or payment in kind.

mothers are literate, with stronger correlations if the mother completed primary education (class 1-7). This positive association is especially strong in rural areas.(3)

There has been growing interest in and knowledge of micronutrient malnutrition among the world's nutrition community in recent years. To assess iron deficiency in Manica Province, the Ministry of Health, Mozambique and Helen Keller International carried out the first assessment of anemia in the provinces of Manica, Cabo Delgado, Gaza, and Maputo in 1998. Results showed an anemia prevalence of 45% among woman of reproductive age in Manica, not unexpected given that Manica Province has the 4th highest prevalence of malnutrition in Mozambique². Women with anemia have a higher risk of hemorrhaging during birth, having low birth-weight babies³, suffering from post-partum infection, and ultimately, dying from complications related to childbirth⁴. Anemia during pregnancy can also result in impaired physical and cognitive development of the fetus, with long-term negative and irreversible effects on major organ systems including the immune system, and decreasing post-partum growth, strength, educability and productivity.

Early pregnancy in these regions compounds problems associated with anemia. Adolescent girls are not yet fully-grown and developed when they become pregnant, which puts them at higher risk during pregnancy as increased nutrient demands for growth of the fetus competes with their own bodies' needs. Additionally, high prevalences of malaria, intestinal worms and other illnesses in the region complicate matters, increasing risk for women whose iron-stores are already compromised by repeated and regular infections. Factors such as these make tackling iron-deficiency anemia all the more urgent.

Current policy in Mozambique is supplementation of iron/folate tablets to all pregnant women through the national health service, distributed at the health facility level.(7) Nonetheless, problems such as low coverage due to supply shortages and poor compliance, among other reasons, continue within the health facility supplementation program. Supplements are not currently made available to girls/women of reproductive age unless they are pregnant. However, studies have shown that the risks, (maternal and fetal), associated with anemia for pregnant women is much greater when a woman *enters pregnancy* with depleted iron stores.(8-11) In the U.S. and other developed countries, expert panels recommend supplementation of non-pregnant woman if found to be anemic, with special attention to high-risk groups such as adolescents and multi-parous women.(12) Mozambique's culture of early parity means risk continues to be high even if girls begin taking supplements during pregnancy. In light of this, HKI, in conjunction with Provincial Health and Education Directorates (Direcção Provincial da Saúde: DPS and Direcção Provincial da Educação: DPE) of Manica Province, will carry out a school-based iron/folate supplementation pilot study targeted to pre-adolescent and adolescent girls.

² "Malnutrition" defined as < -2 S.D. below median reference weight-for-age. (4)

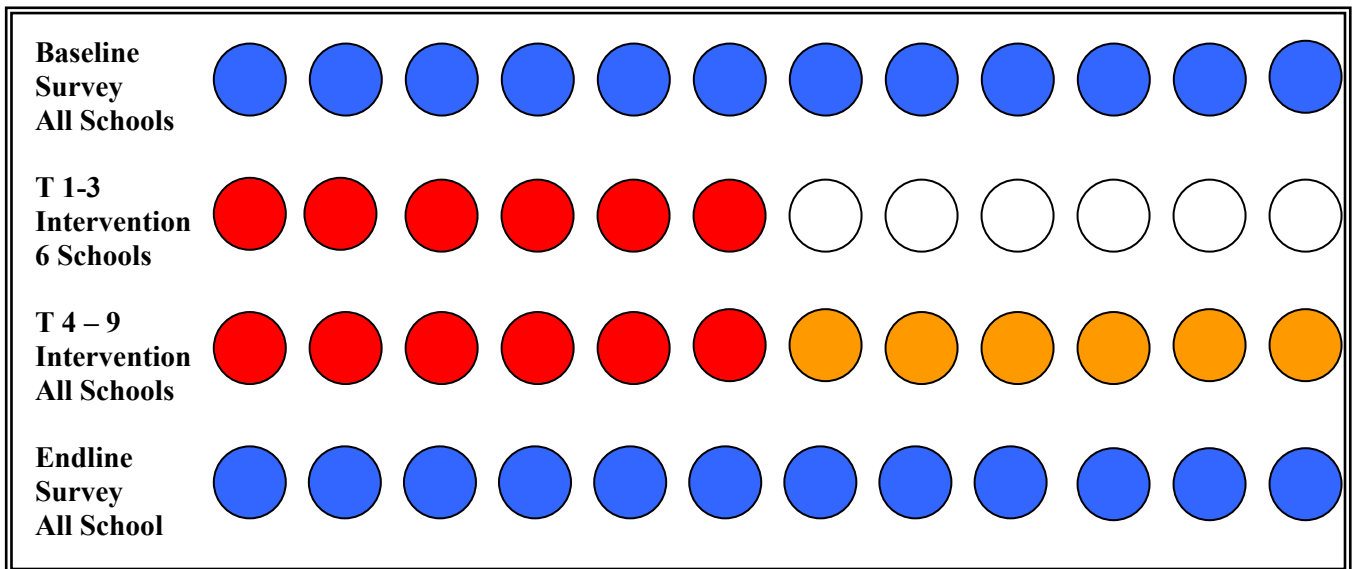
³ Anemic women have normal weight babies 30-40% less frequently than non-anemic women. (5)

⁴ Maternal Mortality Ratio in Mozambique is 1100/100,000 live births, ranking among the top 5 in the world according to available data. (6)

Schools are structured so as to offer good opportunity to introduce health programs, and distribution of weekly or daily tablets in the school setting has been shown to be extremely efficacious.(13) It is hoped that study results will reveal the efficacy of school-based weekly supplementation of reproductive age girls, and similar programs could follow in other schools in Manica Province and Mozambique, reinforcing the current health center-based system for pregnant women.

During the supplementation phase, girls in six schools will receive weekly supplementation with 60 mg iron/400 µg folic acid for nine months, and girls in the remaining six schools will receive six months. The first six schools will begin receiving iron supplementation at the beginning of the 2002 school year in February 2002. The schools, chosen randomly to participate during the first phase of the study, are as follows: Macossa Sede, Mussangadze, Dunda, Tseretse Khama, Mungari, and Mandie. The remaining six schools will begin supplementation after three-months, in May 2002. All 12 schools will then continue with supplementation until the end of the 2002 school year in November 2002.

Study Design: School-Based Iron-Supplementation Pilot Project



Along with lowering anemia, the study aims to improve knowledge and practices related to dietary iron, iron supplements and other micro-nutrients, by providing education to and involving the broader community. This includes teachers/school officials, students (both girls and boys), and families. The ultimate goal of course, is improvement of poor pregnancy outcomes related to anemia, although any assumption of this goes beyond the scope of this study.

Methods

The baseline study was carried out from May 28th to June 7th, 2001 in the Guro and Macossa districts of Manica Province, which are considered two of the poorest districts in the province. Using the help of district education officials, six schools were chosen in each district, using accessibility during the rainy season as primary criteria for school selection. Both primary schools (EP1 and EP2) and one secondary school were chosen to participate in the study. EP1 schools include classes up to grade five, where EP2 schools include EP1 plus grades six and/or seven. Secondary schools are those with classes beyond seventh grade (see below).

The twelve schools chosen for participation in the baseline study are as follows:

Macossa

School	Level
Nhamagua	EP1
Dunda	EP1
Catique Nzaia	EP1
Malimanão	EP1
Mussangadze	EP1
Macossa Sede	EP2, grade 6

Guro

School	Level
Guro Sede	Secondary, grades 6-10
Mungari	EP2, grades 6-7
Mandie	EP2, grades 6-7
Nhammasonge	EP1
Chivuli	EP1
Tseretse Khama	EP1

All girls between 10 and 18 years old at each school were administered a questionnaire concerning knowledge of anemia and related issues such as illness, menstruation, knowledge of foods, primary foods consumed at the household level, and questions relating to socioeconomic status and living conditions. A total of 797 girls were interviewed in the two districts, 197 in Macossa and 600 in Guro. With 13, 969 inhabitants, the total population of Macossa is much smaller than Guro, which has a population of 45,680. (2)

Additionally, hemoglobin levels in g/dl were determined for all girls, unless they refused to participate, using a simple finger prick and the HemoCueTM measuring instrument⁵. Mean hemoglobin levels were then calculated for each school, as well as the percentage

⁵ The HemoCueTM B-Hemoglobin system consists of disposable microcuvettes with reagent in a dry form and a single-purpose designed photometer. The HemoCueTM is portable and battery powered, and is convenient for field use. Only one drop of capillary blood is needed, collected through a finger prick.

of anemic girls, using < 12.0 g/dl as the cut-off point for those with anemia. All data analysis was completed using the SPSS 10.0 statistical package.

In the initial proposal, parents and teachers were also to be interviewed, but this was not done due to time constraints and lack of staff.

Data collection efforts consisted of two teams of interviewers (both men and women) with capability in local dialect, supervisors, HKI representatives and support staff. A representative of DPS/Manica also participated in the field study. Each group collected data in one district exclusively, with the exception of one Guro site, which was collected by the Macossa team.

As with every study, weaknesses and problems arise during the process of data collection and design which potentially affect the integrity of the data and resultant findings. Study findings should be considered in light of these mentioned weaknesses. They are as follows:

- Data was collected by two separate teams – one team per district – and may have resulted in interviewer bias. This might explain some different values between the two districts.
- It was discovered late in the survey that one interviewer did not have dialect skills as stated. These questionnaires were disregarded in analysis.
- Questionnaires did not ask if girls were pregnant, but were assumed not if they were still in school. Pregnancy could result in lower hemoglobin/higher anemia prevalences on average.
- For various reasons, the timing of the baseline survey phase to supplementation phase was delayed so that supplementation will begin a full 8 months after the baseline prevalence study. This could affect:
 - 1) actual prevalence of anemia at the beginning of the supplementation phase and at follow-up
 - 2) momentum and enthusiasm (and increased need for contact during the interim months and special attention to re-training and involving teachers and school administrators)
- Baseline and follow-up surveys will be carried out at different times of the year, and seasonality should be kept in mind in the interpretation of results.

Many factors can affect hemoglobin levels, including age, menstruation, pregnancy status, malaria/worms incidence, seasonality, and/or other ecologic factors which affect knowledge or practice. Therefore, care should be taken in comparison and interpretation of before/after anemia percentages.

Results

I. Age and Anemia Prevalence

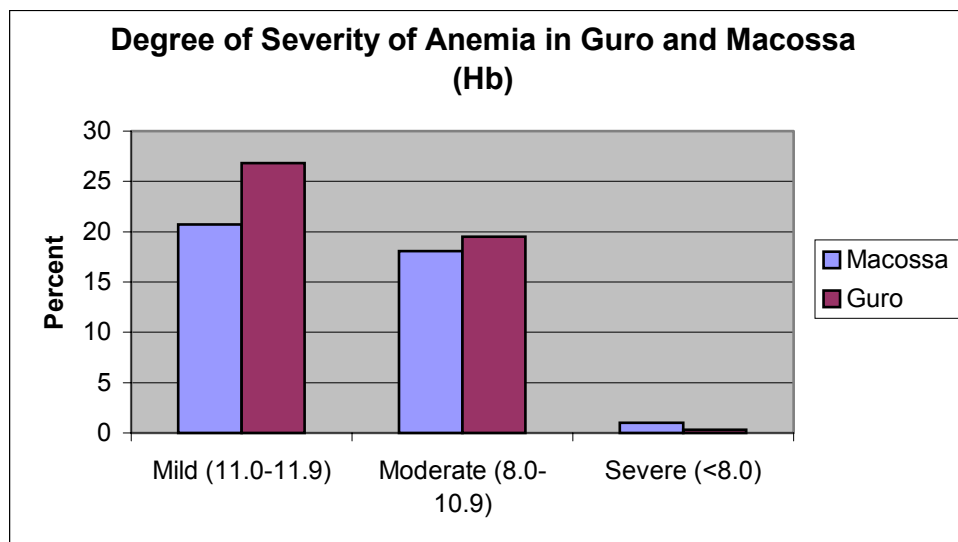
The mean age of girls in Macossa was 11.66 and 11.95 in Guro. However, one in three girls were only 10-years-old and only 11.4% of girls were 15 or older (Table A, Annex),

exemplifying the early age at which girls leave school in Mozambique. Sixteen girls did not know their ages and are not included in age-related data. Most of the girls interviewed were in either third or fourth grade, with lower numbers of girls in school after fourth grade (Table A1, Annex). Demographic data by school and district are shown in Table B (annex).

As would be expected from previous prevalence studies, the overall percentage of anemia for the two districts was 45%, with 40% in Macossa and 47% in Guro respectively, (using Hb < 12.0 g/dl as the cutoff, $p > .05$). The school with the highest percentage of anemia was Nhamassonge in Guro (67%). The lowest percentage was in Chivuli (22%), also in Guro (Table C, Annex). This is surprising because both schools are very close to each other geographically. In general, the percentage of girls with anemia (mild, moderate or severe) shows an increasing trend with age, however differences are not significant. Of girls ages 10-11, 42.0 % were anemic, ages 12-14, 48,0%, and of those 15 years or older, 50,0% were anemic, ($p > .05$). (Table D, Annex).

When grouped according to degree of severity, 25.3% of all girls assessed were mildly anemic, (Hb 11.0-11.9) and 19.1% were moderately anemic, (Hb 8.0-10.9). Very few girls, only 0.5%, experienced severe anemia, (Hb <8.0). Guro district had a mild anemia prevalence six percentage points greater than Macossa. However, both districts had approximately the same prevalence of moderate anemia, 18.1% and 19.5% respectively (Figure 1).

Figure 1.



II. Menstruation and Knowledge of Anemia

Overall, 20% of girls had begun menstruation or stated that they had (Table E, Annex). It is safe to assume that a larger percentage of girls had begun to menstruate since discussion of such topics is considered taboo in rural Mozambique. Additionally, some girls may have been hesitant to answer correctly even when encouraged by the

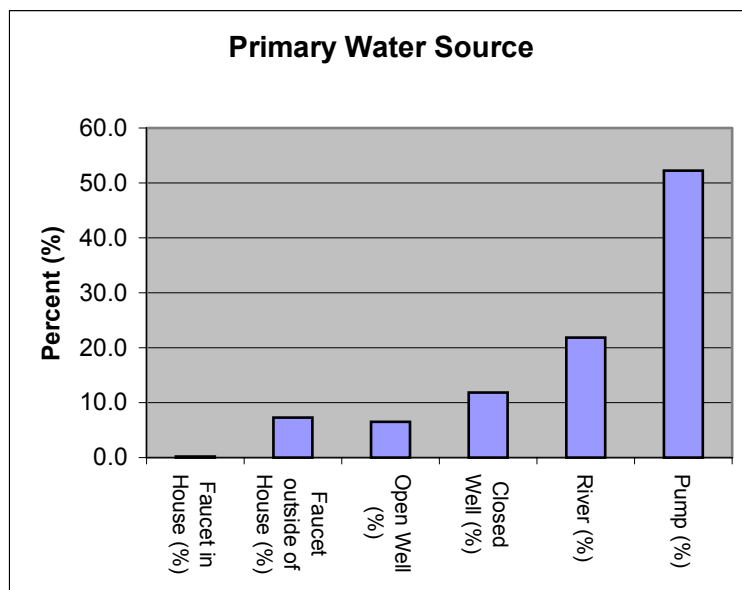
interviewer, especially if male. Unsurprisingly, there was an overall direct relationship between anemia and menstruation - of menstruating girls, 47.8% were anemic compared to 44% of non-menstruating girls. However, this relationship was generally weak, (likely due in part to small sample sizes of older age groups and some schools), and statistically insignificant. The difference is mentioned to highlight that menstruation - while itself not a singular and primary cause of anemia, amplifies growing girls’ risk for iron deficiency anemia.

Only 6.9% of girls had heard of anemia, or the local term “falta de sangue” (lack of blood), with only 3.1% in Macossa and 8.0% in Guro. In Macossa, only girls in two schools reported they had heard of anemia. In the smaller schools in the more remote areas, none of the girls had heard of “falta de sangue.” The schools with the highest percentage of knowledge about anemia were in Guro Sede (18%) and Tseretse Khama (9.7%). These schools benefit from the most accessibility and infrastructure in the entire region, facilitating access to health services and dissemination of information.

III. Socioeconomic Background

To determine hygiene practices and socioeconomic status, girls were asked where they collected water and if they had latrines. Most girls collected water from a pump, followed by rivers, (Figure 2). In some schools in Macossa however, it was much more common for girls to fetch water from a river. In Guro, the use of wells - either open or protected, and pumps were more common than in Macossa (Table F, Annex). In Tseretse Khama and Guro Sede schools, 17.7% and 23.3% of girls reported fetching water from a well. Out of the two districts, these areas are the most densely populated and are somewhat more developed, which may explain the greater prevalence of wells. Forty-five percent of girls in Macossa stated they had a latrine in comparison to 64% in Guro. However, the majority of these latrines were simply enclosures made of sticks to give privacy, with no actual latrine inside.

Figure 2.



Only 17.7% of latrines in both districts were constructed of cement (Table F, Annex). When grouped by type of latrine (cement vs. other), differences emerged in the prevalence of anemia. Although not statistically significant, there is nearly 5% PP difference overall in percentage of anemia when a girl reported having a cement versus any other type of latrine (Table G, Annex). These are mentioned because poor hygiene contributes to the web of factors associated with poorer health through increased intestinal illnesses, especially parasites, which are also associated with anemia.

Chickens were the most common animals owned by families of respondents, (76%). Only 11% in Macossa and 12% in Guro stated that they did not have any animals at all. After chickens, goats were the next most prevalent animals, (64%). Few of the families of girls surveyed owned cows—only 1% in Macossa and 16% in Guro. However, in Mandie, at the northern corner of Guro District, 43% of girls reported their families owned cattle (Table H, Annex). Many girls also said their families owned pigs, especially in Nhamagua at the southern edge of Macossa.

In analysis, households were compared for differences in anemia by animal ownership. Girls in households ‘with chickens’ had the lowest anemia prevalence, followed by households with ‘any animals including chickens’ and households with ‘any animals except chickens’. Girls in households without animals had highest anemia prevalence. ($p > .05$) (Table I, Annex). This potentially indicates that chickens are eaten more often than other animals, which are normally sold. Indeed, chickens are ubiquitous and often purchased as well as consumed at the household level, and probably provide a large proportion of a family’s regular heme iron intake.

The primary source of income for respondents in both Guro and Macossa was employment (32%) followed by the sale of animals (25%) (Table J, Annex). Because 25% of people depend on the sale of animals to generate cash, this means that a large number of families are forfeiting the opportunity to consume iron-rich red meat like goats and cows in favor of income generation.

All girls answered that they worked at home. Fetching water was the most common household task, with 95% of respondents overall stating that they helped to fetch water (Table K, Annex). Working on the family plot of land or “machamba” and cooking were the next most common household tasks reported. Both fetching water and working on the machamba are highly labor intensive, which must be kept in mind when considering the effects of anemia, as a heavy workload will take an even larger toll on an already weak girl, and a weak girl will be unable to do these tasks as well. Other common chores were cleaning house, looking for wood, pounding maize into flour, caring for siblings and washing clothes.

When grouped by mean number of tasks performed and by district, number of tasks reported appears to have a linear (although insignificant), relationship with anemia prevalence (Table L, Annex). There is nearly 10% difference in anemia prevalence between doing the fewest number of tasks and the greatest number. Additionally, girls in

Guro District report doing on average 1.4 more tasks per day than in Macossa, and have 7% higher prevalence of anemia.

On average, the most common household good was a radio (63% in Macossa and 74% in Guro), reflecting the importance of information to rural Mozambicans (Table M, Annex). Chairs, tables and bicycles were other common household goods. Few families reported ownership of sofas, TV's and/or cars. In general, households in Guro own more household goods than those in Macossa. This may be in part due to irregularities in data collection. It is also likely due in part to the relative isolation and fewer income opportunities in Macossa district. Anemia prevalence appeared unassociated upon cross-tabulation with an index of household goods⁶.

Type of cooking fire appeared to reflect level of development and infrastructure, which could be linked to socioeconomic status. Most respondents stated that their families usually cooked with wood at home (93.3% overall) (Table N, Annex). However, fewer families cooked with wood in the more accessible "Sedes," or district capitals, because they used more expensive, efficient charcoal. For example, approximately 10% less respondents cooked with wood in Guro Sede, Tseretse Khama, and Macossa Sede because they used charcoal as an alternative.

In conclusion, the areas surveyed were generally poor by Mozambican standards. Schools such as Tseretse Khama and Guro Sede are more accessible and have more developed infrastructures, which are reflected by socioeconomic indicators. Girls in these schools have more latrines and household goods than schools in more rural areas, where most families only have a radio and benches/chairs in their homes. In addition, girls in more urban areas more often cooked with charcoal rather than wood.

IV Malaria Experience and Iron Supplementation

To determine whether girls had ever taken iron tablets, interviewers showed each respondent a sample iron sulfate/folate tablet and asked if they had ever taken such pills to correct anemia. Twenty percent of respondents in Macossa and 24% in Guro reported they had taken tablets at some point in the past. These prevalences, however, are probably higher than the true number, since the tablets could be easily confused with aspirin. Given the frequent use of aspirin in conjunction with chloroquin to treat malaria, it is reasonable to assume the actual number of girls who have ever taken tablets is lower.

Girls were also questioned about symptoms of malaria and/or previous health problems in order to determine whether they might be currently experiencing health problems associated with anemia or if low hemoglobin levels could be attributed to malaria. The most frequently cited health problem in both districts was a headache, 43% and 24% in Guro and Macossa respectively. The next most common problem was fever, at 16% overall. In all, only 50% of girls responded that they had not suffered any problems with their health during the last two weeks (Table O, Annex).

⁶ An index was created both summing reported numbers of household goods, and by categorizing 0-1, 2-3 or 4+ goods per family, as a potential indication of wealth.

In Guro, 77% of girls reported experiencing symptoms of malaria during the past year; in Macossa, this was 79% (Table 1)⁷. The overall average number of times malaria symptoms were reported was 3.11 during the previous year, with Macossa (3.83) notably higher than Guro (2.88) ($p > .05$). Of the respondents, 13 stated that they did not know how many times they had experienced symptoms of malaria during the past year. In addition, 10 girls responded that they did not know if they had experienced malaria (Table P, Annex).

Table 1. Percent with symptoms of malaria during last year and mean number of times with symptoms of malaria

	Guro	Macossa	Total	n
% with symptoms of malaria in last year	77	79	77	772
Mean # times with symptoms of malaria	2.88	3.83	3.11	603
Prevalence of anemia	47	40	45	776

($p > .05$)

Among respondents, the prevalence of anemia showed no notable relationship with having had symptoms of malaria in the last 12 months, nor with the mean # of times with symptoms of malaria (Table 1). This variable is difficult to assess, however, given the large number of illnesses exhibiting symptoms similar to malaria, and the potential for interviewer and/or recall error, and other confounding factors.

V. Dietary Practices

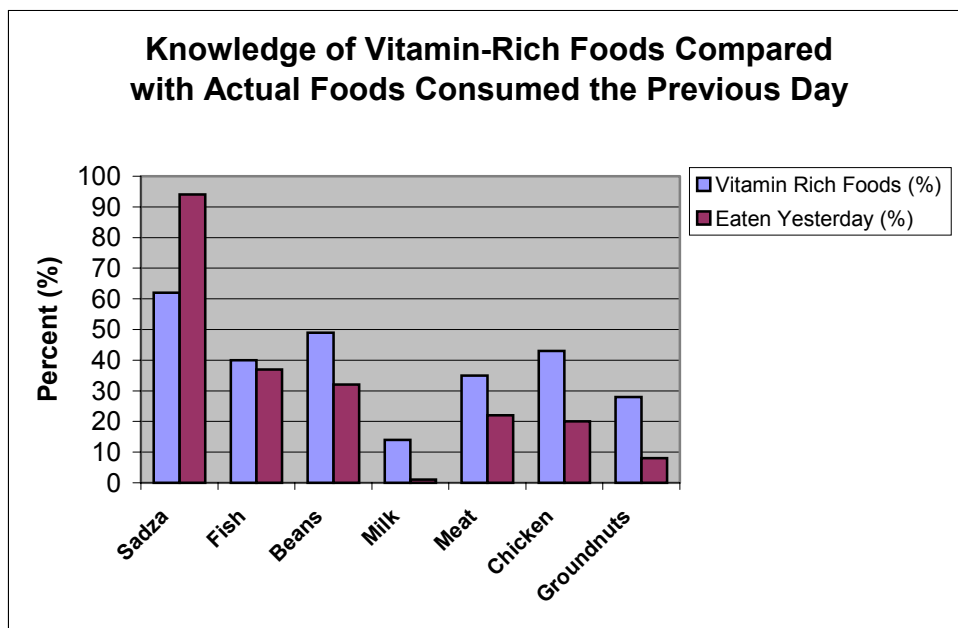
To determine dietary practices in the districts of interest, respondents were asked to recall foods consumed the previous day, to name the three most frequently consumed foods in their households, and to identify foods they had eaten in the previous week from a selection of iron-rich foods. Data for iron-rich foods eaten the previous week was not used because of misunderstandings and misinterpretations related to the questionnaire, and inconsistent translation of the question into local dialects by the interviewers.

By far, the most common food eaten the previous day was maize meal or “sadza” (87% in Macossa and 96% in Guro) (Table Q, Annex). The next most common food eaten in Macossa was chicken (22%) followed closely by fish and meat (16%). “Meat”, which includes all red meat excluding chicken, (goats, pigs, cows, and wild game such as kudu, gazelles, and monkeys), is eaten quite frequently in Macossa. In Guro, dried fish (44%) was the most frequently eaten food after sadza. Folhas de abobora, (a popular leafy green and a source of iron), which is often fried and eaten with sadza, was named by 35% of respondents in Guro.

⁷ Malaria symptoms and previous health problems were self-reported.

It is quite revealing to compare dietary recall with foods the girls thought were vitamin-rich.⁸ The foods most commonly named as rich in vitamins were sadza, beans, chicken, and fish (Table Q, Annex). These are all fairly good sources of iron with the exception of sadza. Usually, consumption the previous day did not reflect knowledge, most likely due economic constraints. For example, 35% of respondents named meat as a vitamin-rich food, but only 22% actually ate meat the previous day. Twenty-eight percent named groundnuts as vitamin-rich, but only 8% ate them the previous day (Figure 3). On the other hand, 62% of respondents named sadza as a vitamin-rich, healthy food which nearly all girls, 94%, reported having eaten the day before. Of all foods mentioned, it is one of the poorest sources of micronutrients.

Figure 3.



When asked to name the three foods most frequently found in their households, results followed a similar pattern as dietary recall of foods eaten the previous day. Sadza was named by 93.8% of respondents, followed by greens, 43.8% and fish, 35.7% (Table 2, following page).

⁸ Respondents were asked to name vitamin-rich foods rather than iron-rich foods because the word “iron” could not be easily translated into the local dialects.

Table 2. Results when respondents asked to name three foods most frequently found in their households.

Food	Percent
Maize meal (sadza)	93.8
Greens or leaves	43.8
Dried Fish	35.7
Beans	29.0
Meat	22.9
Chicken	22.4
Rice	15.9
Okra	13.4
Sweet Potato	5.6
Eggs	3.7
<i>Other</i>	11.2

Most girls in both districts stated they normally ate three meals a day. However, 21% of girls in Macossa and 16.6% in Guro only ate two meals a day. A very small number, under 2% in both districts, reported eating either one or more than three meals per day (Table 3). The number of portions an adolescent girls receives per day is very important because, although she may be eating iron-rich foods, if she is only eating two meals per day, she is most likely not consuming enough to avoid anemia. Anemia prevalence was not significantly different by number of meals consumed.

Table 3. Number of meals normally eaten per day by adolescent girls in Guro and Macossa

Number of Meals/Day	Macossa (%)	Guro (%)	Total (%)
One	0.0	1.5	1.1
Two	21.6	16.6	17.8
Three	77.3	80.2	79.5
More than Three	1.0	1.7	1.5

Discussion

It is concluded that a high rate of anemia exists among adolescent school-aged girls in the districts of Guro and Macossa. It is likely that a combination of factors contribute to this situation, including malaria and/or other illnesses, less than optimal diets and economic limitations. It is the interest of this project to address iron intake in adolescent girls, in an attempt to improve hemoglobin levels/iron stores and knowledge/practices related to anemia in this vulnerable group, and to ultimately improve gestational/maternal health

and pregnancy outcomes. Ideally, a combined strategy including improved diet, education, fortification and supplementation of vulnerable groups should be used to combat iron-deficiency effectively for the long term.

Several factors related to diet and living conditions inhibit healthy diets in Guro and Macossa districts:

First, the climate in these regions is alternately wet and dry, and it is difficult to maintain a healthy diet during the dry season. Seasonality affects diets of people everywhere. For some however, better incomes and access to a market, which provides food/nutritional variety year round, help cushion seasonal nutritional fluctuations. The very poor, such as are represented in this study, have no such cushion and suffer the ill effects in repeated cycles throughout their lifetime. Additionally, Macossa district has an overall less diversified crop production, and must rely year round on “import” of foods from other areas. This is perhaps important, especially if foods purchased are less-healthy or iron-poor foods.

Next, the people in these regions have better access to iron-rich foods, such as goats and pigs, than might be expected in areas with high anemia prevalence. However, rather than consuming the animals, many families sell their animals in order to generate cash to buy necessities such as soap, clothing, school supplies, etc. Such a practice is not easily changed unless the parents of the girls in these areas are afforded other ways to generate income. When these animals are eaten, they are also consumed in very small quantities, often as a side dish to accompany maize meal, or special occasions. It was mentioned by a teacher from Guro that goats are only eaten when they (goats) are sick, indicating that goats are not considered a common food source for families.

Third, local culture dictates that cash and family resource use is determined by the male household head. This common cultural practice has been shown to have less positive effects on family health than cultures where women control household resources. It was noted by teachers during a training session that many families *do* have money to buy healthy foods, but that men will often buy “nipa,” a locally brewed alcoholic beverage, rather than food or other needed items. Low status of women and early marriage and pregnancy ensures the longevity of this situation, which repeats itself, one young mother after another⁹. A continuing under-valuation of education for women ensures lack of autonomy for women in these societies as men continue to control all aspects of family life.

General lack of education of women also directly translates into poor health practices as mothers are the primary caregivers of children. Many social taboos and superstitions inhibit good health practices, such as the belief that eating eggs results in a bald baby, or that iron/folate tablets are actually contraceptives because only women take them. Over half of the girls surveyed believed that sadza is rich in vitamins. Sadza was the most frequently named “healthy” food, a logical finding considering sadza is the basic staple most consumed by Mozambicans. Although sadza is an important source of energy and

⁹ Of rural females in Moçambique 15-24 yrs of age, appx. 26% of primary school drop-outs were due to pregnancy or marriage. (14)

protein for this population, more emphasis should be placed on combining low-nutrient sadza with other vitamin-rich foods. Oils and sweets like sodas and cake are also thought to be healthy foods. This is likely because they provide calories and quickly fill the stomach. While oils do provide an important and necessary source of fat, education is needed to help people differentiate between foods rich in calories and those rich in nutrients. As in every society, beliefs dictate behaviors. Therefore, beliefs must be changed in order for behavior to change. These are issues which can only be addressed through time and commitment to education, and with sensitivity.

Next, food preparation and local customs prohibit maximum consumption and absorption of bio-available micronutrients such as iron. For example, many people believe that leafy green vegetables, including lettuce, should be cooked in oil rather than eaten raw. One teacher explained that people in her area did not eat lettuce because it took much oil to cook it. Cooking vegetables can destroy nutrients, especially vitamin C, which helps the body to absorb iron, thus decreasing the bio-availability of dietary iron. On the other hand, oil and fat facilitate the absorption of Vitamin A. It is important therefore to cook foods the least amount possible in order to preserve nutrients. Tea is often consumed with meals, and people are unaware that tannins found in tea and coffee inhibit absorption of iron.

For families who have resources and are willing change dietary habits, education and access to nutrient-rich foods are the key links to decreasing anemia prevalence. However, the high-risk of anemia among adolescent girls combined with the social and economic context of Manica Province, it is unlikely that dietary change alone would even be sufficient to prevent adverse effects associated with iron deficiency. For the many whose meager resources already barely cover basic needs, the problem is complicated and requires supplementation of iron/folate in combination with proper malaria and parasite treatment, at the very least.

The current health system addresses iron-deficiency among pregnant women but does not at this time serve non-pregnant women, a very high-risk group. The school-based approach, as proposed in this project, holds potential for meeting the needs of this population by delivering iron supplements and nutrition education to reproductive age girls in a controlled setting, reinforcing current health-center based services. If shown to be efficacious and feasible to deliver, a broader school-based iron supplementation and education program could be scaled up to other areas. It should be noted that children from relatively better off families attend school and therefore community based distribution channels should also be considered to reach girls/women of reproductive age who do not attend school.

Specific recommendations for management of school-based supplementation program:

- A clear and easy-to-use distribution (and surveillance) system should be created to facilitate teacher distribution of the tablets. Teachers should distribute tablets AND ensure that girls take them in the manner prescribed by protocol. Regular supervision and tight control by way of contacts and visits are needed to address problems as they arise.

- Teachers must explain to the girls and their parents the importance of the study, and carefully explain the reasons the girls are receiving the tablets in order to dispel any myths or fears that might be propagated. Along the same lines, teachers and girls should be forewarned about possible side-effects of the tablets.
- Because few girls are found in fifth grade and beyond, it is important that health and nutrition education start before these grade levels, before girls leave school. HKI must also collaborate with the government-appointed “gender coordinators” in each district to encourage girls to stay in school, and encourage parents to participate in the education of their children.
- Education efforts should seek understanding of the long-term repercussions of anemia and other micronutrients on health and growth, educability and economic well-being for the entire community. It should focus on the important role girls/women play as the bearers of children whose own health determines the health and well-being of generations that follow.
- Girls and boys should be taught not only which foods are rich in iron, but about all nutritious foods, as well as preparation methods and about accompanying foods and beverages. Locally available if not widely consumed healthy foods should be encouraged, (i.e., goat’s milk, fruit of the baobab tree, goats/pigs), to encourage improved diets without great behavior changes or introduction of new foods. Ideally the school-based education should be complimented with community-based education efforts to reinforce what children are learning.
- Economic factors, such that encourage the sale rather than consumption of iron-rich foods such as pigs and goats, should be discussed at the community level, as well as involving parents directly. However, without viable economic alternatives these practices will not change.

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Annex of Tables

Table A. Age frequency among respondents in Guro and Macossa

Age	Frequency	Percent
10	262	32.8
11	125	15.7
12	134	16.8
13	91	11.4
14	82	10.3
15	63	7.9
16	20	2.5
17	4	0.5
18	2	0.3
<i>Unknown</i>	15	1.8
Total	798	100

Table A1 . Percentage of respondents in each grade

Grade	Guro (%)	Macossa (%)	Total (%)
1	12.9	4.2	6.3
2	23.2	14.6	16.7
3	30.9	29.2	29.7
4	18.0	20.7	20.0
5	8.8	15.3	13.7
6	3.1	15.0	12.0
7	3.1	1.0	1.5

Table B. Demographic Data by School and District

DISTRICT	School Name	Number of Girls	Mean Age
Macossa	Macossa Sede	85	12.09
	Nhamagua	28	11.46
	Dunda	29	11.21
	Catique Nzaia	16	10.71
	Malimanau	23	10.45
	Mussangadze	16	12.81
	Total/Mean	197	11.36
	Guro	Guro Sede	231
Seretse Khama		103	10.84
Mungari		65	11.98
Nhamassonge		49	11.76
Chivuli		54	11.08
Mandie		98	12.21
Total/Mean		600	11.79
Grand Total/Mean		797	11.88

Table C. Prevalences of anemia and mean hemoglobin levels in schools in Guro and Macossa

DISTRICT	School Name	Mean Hb (g/dl)	% Anemic (<12 Hb)	n
Macossa	Macossa Sede	12.18	42	85
	Nhamagua	12.26	36	28
	Dunda	12.65	27	26
	Catique Nzaia	12.19	25	16
	Malimanão	11.12	57	23
	Mussangadze	12.08	47	15
	Mean	12.12	40	193
Guro	Guro Sede	12.08	48	231
	Tseretse Khama	12.20	40	103
	Mungari	11.89	48	64
	Nhamassonge	11.20	67	46
	Chivuli	12.78	22	54
	Mandie	11.86	53	98
	Mean	12.04	47	596
Grand Mean		12.06	45	789

(p>.05)

Table D. Prevalences of anemia and mean hemoglobin levels by age group

Age group	Mean Hb (g/dl)	% Anemic (<12 Hb)	n
10 - 11 years	12.11	42.0	384
12 - 14 years	12.00	48.0	304
15 year and more	12.02	50.0	88
Grand Mean	12.06	45.0	776

(p >.05)

Table E. Menstruation and Knowledge/Percent of Anemia by District

DISTRICT	Begun Menstruation (n=782)	Heard of Anemia (n=782)	Percent with Anemia	
			Menstruating (n=159)	Not Menstruating (n=628)
Macossa	21.2	3.1	35.0	40.0
Guro	20.1	8.1	52.1	45.2
Grand Mean	20.4	6.9	47.8	44.0

(p>.05)

Table F. Water source and latrine status among respondents

Water Source	Macossa (%)	Guro (%)
Faucet in House	1.0	0.2
Faucet Outside of House	11.7	7.3
Open Well	3.6	6.5
Closed Well	2.0	11.8
River	37.2	21.8
Pump	43.9	52.2
Sanitation		
Latrine	45.0	64.0
Cement Latrine	17.6	17.7

Table G. Overall Anemia by Type of Latrine used in Household

Latrine Type	Percent Anemia
Cement	40.2
Other	45.5

(p>.05)

Table H. Percentages of respondents reporting that their families owned certain animals

DISTRICT	School Name	Chickens (%)	Cows (%)	Goats (%)	Ducks (%)	No animals (%)	Others (%)
Macossa	Macossa Sede	77	0	43	29	18	13
	Nhamagua	100	3.5	68	32	0	57
	Dunda	89	0	64	18	7.1	50
	Catique Nzaia	75	0	63	0	19	0
	Malimanão	96	0	39	39	4.4	26
	Mussangadze	100	0	87	44	0	19
	Mean		86	1	54	28	11
Guro	Guro Sede	63	8.7	53	31	21	13
	Tseretse Khama	63	15	56	37	17	4.9
	Mungari	94	4.6	85	35	7.7	15
	Nhamassonge	88	24	82	35	4.1	53
	Chivuli	89	1.9	83	24	0	46
	Mandie	79	43	87	48	3.1	12
	Mean		73	16	67	35	12
Grand Mean		76	12	64	33	12	20

Table I. Prevalence of Anemia by Ownership of Animals

Animal Type	Anemia
Owens Chickens Only (n=95)	35%
Owens Chickens plus other animals (n=515)	44%
Owens Other Animals/No Chickens (n=91)	46%
Owens No Animals (n=95)	51%

(p>.05)

Table J. Primary sources of income in household of respondents

DISTRICT	School Name	Have Machamba (%)	Small Household Industry (%)	Selling Animals (%)	Selling Charcoal (%)	Business (%)	Ganho-Ganho ¹ (%)	Employment (%)
Macossa	Macossa Sede	94	7	12	3.5	3.5	12	61
	Nhamagua	100	0	18	0	0	29	21
	Dunda	96	0	39	0	0	36	21
	Catique Nzaia	100	0	44	0	0	44	13
	Malimanão	100	4.4	35	13	0	43	4.4
	Mussangadze	100				0	56	0
	Mean		97	3.6	23	3	1.5	28
Guro	Guro Sede	98	12	8.7	10	8.2	15	42
	Tseretse Khama	100	14	14	8.7	12	8.7	40
	Mungari	100	18	35	3.1	7.4	3.1	26
	Nhamassonge	96	4.1	39	16	2	24	10
	Chivuli	98	15	33	5.6	9.3	5.6	24
	Mandie	96	4.1	61	0	7.1	25	13
	Mean		98	11	26	7.7	8.2	13
Grand Mean		98	9.3	25	6.5	6.53	16	32

¹ Ganho-Ganho is a short-term coping strategy used by families during periods of urgent need. Payment can be for cash or in-kind.

Table K. Common household chores named by respondents

DISTRICT	Name of School	Fetch Water (%)	Care for Siblings (%)	Clean House (%)	Cook (%)	Wash Clothes (%)	Work on Farm (%)	Others (%)	# Tasks per Girl
Macossa	Macossa Sede	93	27	46	76	36	53	39	3.7
	Nhamagua	100	57	50	68	25	71	39	3.8
	Dunda	82	29	39	46	14	68	54	3.2
	Catique Nzaia	81	19	31	87	13	94	25	3.5
	Malimanão	95	18	32	41	9	59	27	2.7
	Mussangadze	100	0	75	94	38	81	50	4.4
	Mean	92	28	45	69	27	64	39	3.6
Guro	Guro Sede	98	46	84	80	82	78	18	5.1
	Tseretse Khama	97	45	92	65	78	78	9	4.9
	Mungari	98	34	91	86	84	82	20	5.1
	Nhamassonge	86	45	18	69	12	86	31	3.5
	Chivuli	100	55	73	78	65	84	35	5.0
	Mandie	96	69	90	91	88	90	28	5.6
	Mean	97	49	79	79	74	82	21	5.0
	Grand Mean	95	43	70	76	60	77	27	4.5

Table L. Percent Anemia by Number of Reported Household Chores per Girl

Number of Tasks/Girl	Anemia (%)
1-2 Tasks	39
3-5 Tasks	44
6+ Tasks	48

(p > .05)

Table M. Percentage of households that own certain domestic goods

DISTRICT	School Name	Radio (%)	Sofa (%)	Bicycle (%)	Chairs (%)	Table (%)	Television (%)	Car (%)
Macossa	Macossa Sede	71	2.4	27	45	43	1.2	1.2
	Nhamagua	75	0	18	25	18	0	0
	Dunda	46	0	25	50	32	0	0
	Catique Nzaia	69	0	6.3	13	13	0	0
	Malimanão	30	0	22	17	0	0	0
	Mussangadze	69	0	19	19	19	0	0
	Mean Percent	63	1	23	35	28	0.5	0.5
Guro	Guro Sede	72	7.4	46	87	74	1.7	4.8
	Tseretse Khama	83	3.9	67	91	74	0.9	2.9
	Mungari	78	0	43	72	51	0	0
	Nhamassonge	63	0	41	35	29	0	0
	Chivuli	65	0	48	57	44	0	0
	Mandie	78	1.0	53	73	53	0	0
	Mean Percent	74	3.7	50	77	62	0.8	2.3
	Grand Mean	71	3.0	43	67	53	0.8	1.9

Table N. Type of cooking fire by school and district

DISTRICT	School Name	Wood (%)	Charcoal (%)
Macossa	Macossa Sede	90.5	9.5
	Nhamagua	100	0
	Dunda	100	0
	Catique Nzaia	100	0
	Malimanao	91.3	8.7
	Mussangadze	93.8	6.3
Guro	Guro Sede	88.3	11.7
	Tseretse Khama	87.4	12.6
	Mungari	98.5	1.5
	Nhammasonge	100	0
	Chivuli	100	0
	Mandie	99	1
	Grand Mean	93.3	6.7

Table O. Reported Health Problems in Last Two Weeks by District

Health Problem	Guro (%)	Macossa (%)	Total (%)
Diarrhea	11	3	9
Vomiting	1	0	1
Headache	43	24	38
Fever	19	5	16
Cough	3	2	2
Weight Loss	1	1	1
Fatigue	2	0	1
Nausea	0	1	0
No Problems	44	66	50
Other Problems	4	4	4

Table P. Malaria Frequency During Last Year

No. Times During Last Year	Frequency (%)
1	23.5
2	28.7
3	20.6
4	6.0
5	7.8
6	0.7
7	0.2
8	0.3
9 or more	10.0
Don't Know	2.1

Table Q. Respondents Knowledge of Vitamin-Rich Foods Compared with Actual Consumption Practices

Food	Foods Containing Iron (%)			Foods Eaten Yesterday (%)		
	Guro	Macossa	Total	Guro	Macossa	Total
Fish	44	30	40	44	16	37
Oil	2	2	2	N/A	N/A	N/A
Rice	42	13	35	23	12	20
Beans	51	45	49	37	19	32
Milk	17	5	14	2	N/A	1
Meat	38	27	35	24	16	22
Chicken	44	38	43	20	22	20
Cabbage (repolho)	12	0.5	9	14	2	11
Vegetables	12	7	11	2	N/A	1
Liver	0.7	5	2	N/A	N/A	N/A
Groundnuts	31	18	28	10	2	8
Sadza	58	54	62	95	87	94
Fruits	7	10	9	N/A	N/A	N/A
Potatoes	N/A	N/A	N/A	28	2	22
Coffee	N/A	N/A	N/A	1	N/A	1
Tea	N/A	N/A	N/A	22	1	16
Leafy Vegetables (folhas de abobora)	N/A	N/A	N/A	35	22	30
Other	15	15	15	20	8	17