Impact of the Ghana School Feeding Programme in 4 districts in Central Region, Ghana
Impact of the Ghana School Feeding Programme in 4 districts in Central Region, Ghana

Tineke Martens
Registration number 840126546090
Email: tineke.martens@wur.nl
Course number: HNE-80936

Supervision
Wageningen University
Dr. Ir. I.D. Brouwer, Assistant Professor Division of Human Nutrition

Noguchi Memorial Institute for Medical Research
Dr. M. Armar Klemesu, Head of Nutrition Department

Examiner
Prof. Dr. Ir. F.J. Kok

This report was prepared as a partial fulfilment of the MSc degree. It is not an official publication of the Division of Human Nutrition of Wageningen University.
Acknowledgements

This study was written in the period of October 2006 until January 2008. This time was a time of continuous learning. Learning about how to conduct research for my future work as a nutritionist and learning about myself. I gained a lot of knowledge and experience through the versatility and the different aspects of this study, I had a lot of fun in Ghana and I have never worked as hard as I did in the past year to make this succeed!

I would like to thank the members of the SIGN foundation and Sabine Lucassen especially for providing us with the necessary funds to be able to do this research.

I would never have completed my thesis without the dedicated supervision of Inge. Thanks for your time and patience, your straightforward, clear commenting and your coaching all the way through! I very much appreciated it, and I think no other supervisor could have guided me to this end result the way you did. I will never forget Ghana and the way we were supported by Maggie, ('still alive') Harry and doctor Kojo from Noguchi Institute. I could never have learned so much about fieldwork as I did under your supervision. Thank you! I remember my stay in Ghana (as 'obruni'!) as a time of hard work in hot temperatures and making long hours, the getting used to the African pace of working, the always friendly invitations in the villages we selected for the study, the helpful teachers and above all: the early morning, cool rides to the communities through the beautiful green Ghanaian landscape! Iris, thank you for the fun we had in Ghana and the good scientific discussions, which always ended at finding the perfect solution we needed for the problems and challenges we were presented with during the field work. I am grateful I had the opportunity to spend my time in Ghana with you. Because I was so fortunate not to get as ill as you during our stay, I have finished now, but I offer you all the help you need to finish your thesis as well.

Many thanks to my family and friends and Cornelis for being so patient and sympathetic with me and for the willingness to read my work. Cornelis, also thanks for being my 'sparring partner'!

Tineke Martens, January 2008
Summary

Introduction: The Ghana School Feeding Programme aims at (1) reducing hunger and malnutrition in primary school children, (2) increasing school enrolment, attendance and retention in primary schools, and (3) boosting domestic food production. The aim of this study was to determine the nutrient intake from school meals and the out-school food consumption of primary school children and to determine the impact on the demand for locally produced foods.

Methods: Data were collected in 4 primary schools in 4 different districts in Central Region in Ghana in the period of February to April 2007. The study population consisted of 129 3rd grade children aged 7 to 16 years. Anthropometric measurements were taken to determine nutritional status. Data collection on nutrient intake from school meals was done using 1-day weighed dietary records and weighing the portion sizes of the selected 3rd grade children. The primary caretakers of the 3rd grade children were interviewed by trained translators using 24hr recalls to determine the out-school food consumption. The demand for locally produced foods per district was determined via the production figures of staple foods gathered from the district Agricultural Extension Service and the information from the weighed dietary records. Food composition data were derived from 3 tables, of which the leading table was: 'Table de composition d’aliments du Mali’ (Barikmo, 2004) (supplements: 'Foods commonly used in Ghana’ (Eyeson, 1975) and the 'NEVO table’ (NEVO 2006)). The statistical is comprised of descriptive analyses on all data, ANOVA followed by a Tukey test for normally distributed variables, Kruskal-Wallis followed by a Dunnett test for skewed variables, a Spearman correlation test, a independent sample T-test and a paired sample T-test.

Results: The total food consumption had a DDS of 6.4 (±1.0), which is on average 1 (±0.8) food group higher than the home food consumption (sig. 0.001). Only 22.6% of the children still received a home lunch. The nutrient intake recommendations for energy (30-45% of RDA) and protein (60-70% of RDA), formulated by the Ghana SFP National Secretariat have been met (31.9% and 67.6% respectively). The iron intake (6.1±5.8) is low compared to the weighted DRI of this age group of 22.9 mg/day (bioavailability of 5%). The demand for locally produced staples is on average 0.07% of the total production of staples in the district. This may potentially increase to 1,11% in the year 2010.

Discussion and conclusions: The Ghana SFP succeeded in increasing the dietary diversity of the diet of the school children in the selected schools. This may reflect in the nutritional adequacy and nutritional status of the primary school children, but no internationally agreed upon cut-off points are available to use as a reference. The Ghana SFP meets their own recommendations for energy intake and protein intake. Vitamin A intake is probably sufficient, but the iron intake remains low, which raises concern. The impact of the Ghana SFP on the local demand for staple foods at district level seems limited.
# Table of contents

Acknowledgements ........................................................................................................ 3
Summary ....................................................................................................................... 4
Table of contents ........................................................................................................... 5
Index of tables ............................................................................................................. 6
Abbreviations ............................................................................................................... 7

## Introduction

Ghana School Feeding Programme ............................................................................ 8
School Feeding as a nutritional intervention strategy .................................................. 9
Rationale ..................................................................................................................... 10

## Methodology

Study design .................................................................................................................. 13
Study population and sampling ................................................................................. 13
  District ...................................................................................................................... 13
  School ..................................................................................................................... 13
  Children .................................................................................................................. 14
Data Collection ............................................................................................................. 14
  Child level data ................................................................................................. 14
  School level data ............................................................................................... 15
  District level data ............................................................................................... 15
Data analysis ................................................................................................................ 15
  Nutrition status and morbidity ........................................................................... 15
  Nutrient intake ................................................................................................... 16
  Dietary diversity Scores ....................................................................................... 17
  Farmer Focus Group Discussions ........................................................................ 17
  Impact on local food production ......................................................................... 17
Statistical analysis ....................................................................................................... 17

## Results

School description ....................................................................................................... 19
Description of the study population ......................................................................... 19
Description of school lunches .................................................................................... 21
Portion Size .................................................................................................................. 22
Characteristics of home consumption ....................................................................... 22
Nutrient intake ............................................................................................................ 23
Dietary diversity .......................................................................................................... 24
Impact on local food production ............................................................................... 24
Farmer Focus Group Discussions ............................................................................. 27

## Discussion

Conclusions and recommendations .............................................................................. 29

References ................................................................................................................... 34
Table of contents continued

Appendices..................................................................................................................................38
Appendix 1: Ghana ..........................................................................................................................39
Appendix 2: Current School Feeding Programmes in Ghana .........................................................40
Appendix 3: Programme design of Ghana School Feeding Programme ........................................42
Appendix 4: Placing and use of the weighing scales ...................................................................43
Appendix 5: Focus Group Guide for Farmers ..............................................................................44
Appendix 6: Food Composition Table ..........................................................................................45
Appendix 7: Cooked-to-dry ratio’s ...............................................................................................46
Appendix 8: Calculation of variables of the demand for locally produced staple foods .............47

Index of tables

Table 1: Overview of the used scales .............................................................................................15
Table 2: School characteristics .....................................................................................................19
Table 3: Study population description: Nutritional status and disease symptoms .......................20
Table 4: Z-scores per age-category ...............................................................................................20
Table 5: Composition of school lunches ....................................................................................21
Table 6: Portion size school lunch, (mean, SD) ...........................................................................22
Table 7: Characteristics of the home consumption .......................................................................23
Table 8: Nutrient intake school lunches (mean, SD) ...................................................................23
Table 9: Dietary Diversity Score (mean, SD) .............................................................................24
Table 10: Origin of foods used in meal preparation .....................................................................25
Table 11: Demand for staple foods ...............................................................................................26
Table 12: Group description Focus Group Discussions .................................................................27
Table 13: Programme design of Ghana School Feeding Programme ..........................................42
Table 14: Food composition table impact assessment study Ghana SFP ....................................45
Table 15: Ratio cooked product to dry product ..........................................................................46
Table 16: Calculation of variables of the demand for locally produced staple foods ...............47
Abbreviations

AAK  Abura Asebu Kwamankese district
ADRA  Adventist Development and Relief Agency
AES  Agricultural Extension Service
AOP  Annual Operating Plan
AU  African Union
BMI  Body Mass Index
BMIAZ  Body Mass Index-for-age Z-score
CAADP  Comprehensive Africa Agricultural Development Programme
CHO  carbohydrates
CRS  Catholic Relief Service
DA  District Assembly
DCE  District Chief Executive
DDS  Dietary Diversity Score
DIC  District Implementation Committee
DRI  Dietary Recommended Intake
EU  European Union
FCT  Food Composition Table
FFE  Food For Education
FFS  Food For School
FGD  Focus Group Discussion
FVS  Food Variety Score
GES  Ghana Education Service
GHS  Ghana Health Service
GSPER  Gross Primary School Enrolment Ratio
HAZ  Height-for-age Z-score
HDI  Human Development Index
MAR  Mean Adequacy Ratio
MDGs  Millennium Development Goals
NAR  Nutrient Adequacy Ratio
NEPAD  New Economic Partnership on African Development
NMIMR  Noguchi Memorial Institute for Medical Research
NPSER  Net Primary School Enrolment Ratio
NS  National Secretariat
SD  standard deviation
SFP  School Feeding Programme
SIC  School Implementation Committee
SMC  School Management Committee
UN  United Nations
UNHTF  United Nations Hunger Task Force
WAZ  Weight-for-age Z-score
WFP  World Food Programme
WHO  World Health Organization
Introduction

The ambition of all nations in the United Nations (UN) to address the challenges resulting from advancing globalization, resulted in the formulation of the Millennium Development Goals (MDGs) in the year 2000. In the formulation of the MDGs attention has been paid to hunger and poverty as stated in MDG number 1: Eradicate extreme hunger and poverty. The sub goal formulated hereby is: by the year 2015 the proportion of people who suffer from hunger is halved as compared to 1990 (UN 2005b). School Feeding Programmes (SFP’s) are said to contribute to achieving this first Millennium Development Goal (Ghana 2006a).

The United Nations Hunger Task Force (UNHTF) has made 7 recommendations on how to achieve the first MDG. These are stated in their report “Halving Hunger, it can be done” (2004). One of the strategies identified by the UNHTF to achieve this goal is the implementation of school feeding programmes (SFPs) with locally produced foods rather than imported food (aid). The UNHTF considers school feeding programmes as a good combination of education and agriculture. Their point of view is that SFPs could increase school attendance, especially of girls and, furthermore, the Task Force expects that the implementation of SFPs can stimulate the market demand for locally produced foods. The UNHTF especially recommends comprehensive community- and school-based feeding programs that include not only school feeding, but also systematic de-worming, micronutrient supplementation, take-home rations, safe cooking facilities, clean drinking water, and improved sanitation. Also education on HIV/AIDS, health, nutrition, and hygiene should be included. All these ingredients taken together provide a good platform for improving schools, keeping children healthy and engaging the community (UN 2005a).

The New Partnership on Africa’s Development (NEPAD) adopted the approach of the UNHTF and also focuses on the combination of school feeding programmes and agriculture. The NEPAD is a part of the African Union (AU), the sister of the European Union (EU), and was founded in 2002. The NEPAD Secretariat has formulated the Comprehensive Africa Agricultural Development Programme (CAADP), which functions as a framework for the restoration of agriculture, growth, food security, and rural development in Africa. In this framework, pillar 3 has a specific focus on increasing food supply and reducing hunger and includes the following objectives: (1) to reduce malnutrition in school going children through diet supplementation via a complete and adequate meal (in terms of calorie and micronutrient content), and (2) to expand local demand for food products and to stimulate production by smallholder farms. NEPAD has formulated an indicator of improvement: the provision of basic school lunches that are balanced in terms of caloric en micronutrient content to 1.000.000 children in poor and vulnerable areas throughout the NEPAD member states (NEPAD 2005a).
**Ghana School Feeding Programme**

Ghana (see appendix 1) is the first of 10 countries in Sub-Saharan Africa implementing an SFP modelled to the guidelines of the NEPAD as described in the CAADP. In Ghana several school feeding programmes were already implemented, of which an overview can be found in appendix 2. The formulation of the Ghana SFP started in the year 2004 and the programme will run from January 2006 until December 2010. It was preceded by a pilot programme, which was carried out from September to December 2005. (NEPAD 2005b). In the year 2010 the programme intends to serve about 1.04 million children in all 138 districts of Ghana. (Ghana 2006a; Ghana 2005; Ghana 2006c)

The long-term objective of the Ghana SFP is to contribute to poverty reduction and food security and to increase school enrolment, attendance and retention. The SFP is based on locally grown food products, which should promote domestic food production and improve market access for resource-poor farmers. The government wants to achieve this objective through an increase in employment and income level of farmers at community and national level. In addition, greater availability, access and utilization of food crops and products at community level are assumed to enhance food security.

By the end of the programme, it is expected that there will be: a real increase of 8% in income at national and community levels, an 8% increased employment at community level and a greater availability, access, utilization and stability of food crops at community level. This strategy complements the development strategies of the government of Ghana (Ghana 2006a).

The immediate objectives as formulated in the Annual Operating Plan (AOP) to reach these goals are:

1. To reduce hunger and malnutrition
2. To increase school enrolment, attendance and retention
3. To boost domestic food production

The corresponding outputs and indicators of achievement formulated in the AOP of the Ghana SFP for the years 2007 to 2010 are listed in Appendix 3.

Figure 1 illustrates the possible impacts formulated by the Ghana SFP National Secretariat (NS) of the Ghana SFP as nutritional intervention using locally produced foods as ingredients. In figure 1, the 3 main outcomes of the Ghana SFP are increased demand for locally produced foods, increased school enrolment and increased nutrient intake.
School Feeding as a nutritional intervention strategy
SFPs are said to have 3 major impacts (Bennett 2003; Hall 2007). The 1st impact is the improvement of the nutritional status of school-going children and the reduction of malnutrition rates. The 2nd includes the improvement of school enrolment, school attendance and cognitive performance, also reducing the gender gap herein. The 3rd impact is the effect of school feeding on the demand for locally produced foods.

Since many of the nutritional and growth problems occur in the first 2 years of life, it is appropriate to mention that a life cycle approach is needed to improve nutritional status. Improving nutritional status is thought to require a range of interventions, varying from supplementary feeding for mothers and young children to school feeding and other food based strategies (Bennett 2003; Allen 2001; Hall 2007). This may indicate that school feeding programmes on their own may not be sufficient to improve nutritional status of primary school children.

Some studies however indicate an improvement of Body Mass Index (BMI) in primary school children participating in breakfast supplementation programmes of 0.62 (Ahmed 2004) and 0.23 and 0.28 in undernourished children and adequately nourished children respectively (Powell 1998). An evaluation of an SFP in Vietnam by Hall et al. (2007) showed that children in the SFP schools gained significantly more weight (0.24 kg, p=0.001) and height (0.27 cm, p=0.008) than children in the control group, but these increases could also be attributable to seasonal variation in food consumption and occasional de-worming and not only the food supplements. Whether the improvement of nutritional status is due to improved nutrient intake through SFPs has not been studied in much detail. A study by Meme et al. (1998) indicated a higher lunch time caloric intake in children participating in an SFP compared to the control group, but no significant difference in stunting percentages could be determined.
Different studies have shown an increase in both Gross Primary School Enrolment Rates (GSPER) and Net Primary School Enrolment Rates (NSPER)\(^1\), an increase in school attendance rates and a reduction of drop-out rates compared to control schools (Ahmed 2004; Bennett 2003; Del Rosso 1996; Powell 1998). The fact that poorly nourished children benefit cognitively from SFPs has also been demonstrated in several studies (Allen 2001; Grantham-McGregor 1998; Levitsky 2005; Powell 1998). In all these studies a significant increase was detected in school test-performance between under-nourished children receiving breakfast or lunch and children in the control group not receiving breakfast or lunch at school.

Another aspect of SFPs is the reduction of the gap between boys and girls in education and nutritional status. Reducing the gender gap requires a greater increase in primary school enrolment of girls than boys and the difference between gross enrolment for boys and girls tends to be smaller in SFP-schools (Allen 2001). In Food For Education (FFE) schools in Bangladesh where take home rations were provided to children, a 44% increase in enrolment for girls and a 28% increase in boy enrolment was found (Ahmed 2004). Also the World Food Programme (WFP) found a 7% increase in net enrolment rate in Bolivian girls, when providing take home rations to girls showing a 90% attendance over a given time span (WFP 2006a). Powell et al. indicated a greater improvement in height, weight and BMI was in girls than boys (Powell 1998), which suggests that if girls are enrolled in schools, their benefit from an SFP is greater compared to boys.

The last aspect of SFPs is that of boosting local food production. The evaluation of the pilot schools of the Ghana SFP by Berkeley University of California in 2006 indicated that the participation of the local farmers is limited and most food is procured at large town markets in stead of in surrounding villages and farms, and therefore they conclude that the connection between local agriculture and the Ghana SFP was weak. In the review report of the World Food Programme (2006) it was suggested, that the use of locally grown food is expected to create additional demands of 2.0 million metric tonnes of maize for school feeding, 5.4 million metric tonnes for Food For School (FFS) take-home rations only, and 7.4 million metric tonnes for FFE (that is school feeding plus FFS take-home rations) for the entire Sub-Saharan Africa (WFP 2006). The Catholic Relief Services also implements SFPs and recommends in its best practices the use of locally available vitamin and mineral rich foods, but does not give an indication of the extent of the use of these foods, nor of the consequences for the demand for these foods in the local community (Janke 2001). At this moment, few empirical evidence is available that show the ability to help local farmers by using locally produced foods for SFPs, according to Ahmed Akhter (IFPRI 2004).

---

\(^1\) The gross enrolment ratio is the number of children enrolled in primary school expressed as a percentage of the total of children of primary school age as where the net school enrolment only counts in the children who belong to the relevant age-group in calculating the percentage of enrolled children. This explains the higher GSPER compared to the NSPER. Unicef. 2006. Unicef Multiple Indicator Cluster Survey, Vol. 2006, pp. www.childinfo.org.
**Rationale**

In the review of the pilot of the Ghana SFP of 2006, an improvement of health status and nutritional status of children in SFP schools was suggested, although based on anecdotal evidence rather than objective and quantitative data (Ghana 2006c). A small effect of SFPs on the nutritional status of school children has been demonstrated in a few studies. However it is not yet clear if the effect on nutritional status can be attributed to the implementation of an SFP.

In the Ghana SFP pilot review an increase in school enrolment in the schools involved in the SFP was indicated, but no data are available on the effect on school enrolment rates in the districts. The capability of SFPs to increase school enrolment is in research the most clear consequence of the implementation of SFPs. To reduce the gender gap between boys ad girls, it could be that supplementing measures, like take home rations, are needed to attract girls to school.

The pilot review did not address the impact on the demand for locally produced foods and in literature the link between SFPs and the demand for locally produced foods is not widely addressed.

Therefore the overall objective of this study is: to determine the mid-term impact of the Ghana SFP on nutritional and health status of the primary school children, on school enrolment and attendance ratios and on the demand for locally produced foods, and to monitor the implementation of the programme. The specific objectives are formulated at 3 levels:

- at child level: to determine the impact on health status, nutritional status, nutrient intake from school meals and out school consumption;
- at school level: to determine the impact on school enrolment, school attendance and drop-out, the demand for locally produced foods and to assess the practical implementation of the Ghana SFP in the schools;
- at district level: to determine the impact on school enrolment rates, the demand for locally produced foods and the practical implementation and management of the Ghana SFP on district level.

The realization of this study was a joint operation of two Msc Students Nutrition and Health of Wageningen University. This report especially focuses on the nutrient intake from the school lunch of the primary school children and on the impact on the demand for locally produced foods. The objective for the part of the study is reported in this thesis is therefore: to determine the mid-term impact of the Ghana SFP on the nutrient intake of primary school children and the demand for locally produced foods.
Methodology

Study design
The study focused on children attending primary schools enrolled in the Ghana School Feeding Programme (Ghana SFP schools). The study took place in 4 districts of Central Region in Ghana, which was selected because of proximity to the Greater Accra region, facilitating supervision from Noguchi Memorial Institute for Medical Research in Legon. The data collection took place from February to April 2007 and was conducted at 3 levels: the level of the child, the school and the district. At child level, data on the nutrient intake from school meals and the out-school consumption were collected. At school level, data were collected on the school menu, origin of ingredients and composition of school meals. At district level data collection focused on the impact on the demand for locally produced staple food.

Study population and sampling

District
Central Region consists of 12 districts and 1 municipality. According to the Annual Operating Plan 2006 of the SFP (Ghana, 2006b), 500 schools participated in the Ghana SFP by the end of June 2006, corresponding to 3 to 4 schools per district. Assin North (non-coastal district) was included in the pilot study of the Ghana SFP in 2005 and is therefore also included in this study. The 3 other districts were randomly selected from the remaining 11 districts, and are in alphabetical order: Abura Asebu Kwamankese (AAK), Gomoa and Mfantseman. Stratified random sampling has been used to select 1 more non-coastal district (AAK) and 2 coastal districts (Mfantseman and Gomoa district). Cape Coast Municipal Area was excluded from the selection of districts, because this district was an urban area. In the districts, cooperation was asked from the District Implementation Committees (DICs), Ghana Health Services (GHS), Ghana Education Services (GES) and Agricultural departments in the selected districts.

School
The GES in the 4 districts were asked for the names and locations of the schools in the district enrolled in the Ghana SFP. This information was used to select 1 Ghana SFP school in every district. Schools were only selected if they were enrolled in the programme for at least 6 months, if 30 or more pupils were enrolled in 3rd grade and if the schools were willing to cooperate. Nduaso DA Primary school, the pilot school in Assin North district was purposely enrolled in the study; in the other districts, the 1st school enrolled in the Ghana SFP was selected. In total, 4 teams of cooks, 4 head teachers and 4 3rd grade teachers of the primary schools participated in the study, and 4 representatives of School Implementation Committees (SMCs).
Children

The school lists, comprising the names of all children enrolled in the 3rd grade of the participating schools, were collected at every school. The children of 3rd grade of the selected school were randomly allocated to 1 of the 5 schooldays, resulting in 5 groups of pupils (n=129). In the allocation of the children to the days, an even distribution of girls amongst the school days was ensured.

Data Collection

Child level data

Anthropometric measurements of all selected children were taken during the morning break in school on the day they were allocated to. They only wore a school uniform and no shoes. Weight and height of each 3rd grade pupil were determined according to standardized methods (UN, 1986), using a calibrated weighing scale with a precision of 0.5 kg and a stadiometer with a precision of 0.1 cm. The Seca 150 weighing scale used for measuring the children has been calibrated with a 25 kg water-filled jerry-can every day in the first week and once in the second school. No further calibration was performed, because the calibration tool broke down. The date of birth was in the first place collected via the school registers. If the dates were not present, the primary caretakers were asked to bring the birth certificate or weighing card of the child, and if that was not available, the last option of parent recall was used (16 children).

The nutrient intake from the school meals of the children enrolled in Ghana SFP schools was determined using one-day weighed dietary records. All dishes, their ingredients, the origin of the ingredients, and their cleaned, ready-to-use weight were recorded. The total weight of the prepared dishes in the pans was determined before serving. To be able to weigh the pans on the Seca 150kg scale that were too big or had a round bottom, a 140g stand was used. The weight of the prepared dish was not corrected due to the already low precision of 0.5 kg of the scale and due the fact that the effect of a 140g weighing error in the total dish is negligible at the individual child level.

The individual intake was determined on the day the child had been allocated to by weighing the plate and the quantity of each different dish on the plate before dishing out. After eating, the plate containing the leftovers was weighed for each separate dish of the leftover, via consecutively scraping off the dishes from the plate and weighing in between. Every day, the total portion size of 10 other, randomly selected, 3rd grade pupils, was also weighed to determine whether the portion size of the allocated children was significantly different.

Table 1 (next page) shows the scales that were used for the study. The table includes the weight interval and the precision of the scales. Appendix 4 shows the placing and use of the scales during field work.
The children were asked to bring their primary caretaker to school the day after they were measured. The primary caretakers, preferably the parents, were presented with a health status questionnaire and a 24hr recall via a translator after giving a verbal informed consent. If the primary caretakers were not able to come to the school, they were visited in their homes.

**School level data**

An interview with the headmaster of the school was conducted concerning the menu for the Ghana SFP, origin of ingredients, the number, training and payment of the cooks and the water supply.

**District level data**

To assess the demand for locally produced foods (foods produced inside the community of the Ghana SFP or in the directly neighbouring communities), data were collected from the agricultural department on the total production of the crops with the largest cultivated area in the selected districts in the agricultural season of 2005/2006.

In Assin North and Gomoa district the headmasters of the SFP schools or the chiefs of the communities where the Ghana SFP schools were located, were asked to call together a male and a female farmer focus group. The choice for both a male and female Focus Group Discussion (FGD) is made based on their different farming activities and based on the fact that they both must be able to speak freely and not feel restricted to talk due to the presence of the opposite sex. Each farmer focus group consisted of 6 to 9 farmers from the local community (Varkevisser 2003). The discussions were carried out according to a focus group guide (see Appendix 5). A translator was present and the discussions were recorded on tape. Detailed minutes were taken during all focus group discussions and on-site summaries were written immediately after the session.

**Data analysis**

**Nutritional status and morbidity**

The stadiometer had a deviation, which led to an overestimation of the height by 2 millimetre for all children taller than 134.6cm. This has been corrected for. The Z-scores for height-for-age (HAZ), weight-for-age (WAZ) and BMI-for-age (BMIAZ) and the prevalence...
of stunting (height-for-age > -2SD) and underweight (weight-for-age > -2SD) were calculated using the NCHS/CDC reference population (CDC, 2000). 2 children with outlying z-scores (<-5.0 and >+3.0 for height-for-age and <-5.0 and >+5.0 for weight-for-age) were excluded from analysis. The Z-scores per age-category were determined for the following age-categories: 7-8 years of age, 9-10 years of age, 11-12 years of age and 13-16 years of age. The frequency of occurrence of the disease symptoms was determined and the percentage of children suffering from the 3 most frequent symptoms was calculated.

Nutrient intake
A description of the composition of all school lunches per day per school was made. Per child, the portion sizes of the main dish, the 1st and 2nd side dish, the fruit, the total portion and the leftover were calculated. The percentage of children consuming the whole portion was determined. The percentages of children consuming food before coming to school, consuming lunch after coming home from school, consuming dinner, consuming snacks and the percentage of primary caretakers using iodated salt in meal preparation were calculated. Also, the number of meals exclusive and inclusive of snacks was determined.

The individual nutrient intake of the children from the school lunch was determined, using the VBS Bas Software version 4.0. This covered the intake of energy (kilo-calories), protein (g), carbohydrates (g), fat (energy %), vitamin A (RAE) and iron (mg). The weighted Dietary Reference Intake (DRI) was calculated for energy, protein, fat and carbohydrates, (UNU 2004) and for iron (WHO/FAO 2004). The Nutrient Adequacy Ratio (NAR) for vitamin A (Food and Nutrition Board 2004) and iron (WHO/FAO 2004) and the Mean Adequacy Ratio (MAR) were calculated as described by Hatloy (1998). The iron recommendation was calculated for an iron bioavailability of 5%, because iron deficiency anaemia is widespread among children below 5 years of age in Central Region (76.4%)(DHS 2006) and secondly, the Ghana SFP lunch does not contain any meat, which is an indication for low iron bio-availability (WHO/FAO 2004). Topnut (VBS Bas Software 4.0) is used to determine which foods are responsible for 90% of the intake of vitamin A and iron.

Food composition data (see appendix 6) were taken from the ‘Table de composition d’aliments du Mali’ (Barikmo, 2004), supplemented with data from ‘Foods commonly used in Ghana’ (Eyeson, 1975) and the ‘NEVO table’ (NEVO 2006) for data on foods and nutrients not available in Barikmo (2004). An evaluation study of the Barikmo table by Doets (2007) has assessed this FCT to be a reliable source.

The dishes composed of multiple ingredients (e.g. stew) were recorded as a standard recipe in the VBS-Bas Programme and the nutrient intake of the individual child was calculated using the consumed portion in grams as part of the total dish. To determine the raw weight of some of the meal-ingredients, cooked-to-raw ratio’s were determined (see appendix 7). With the help of this ratio, the weight of the prepared dish on the plate of the child (e.g.
beans) was converted into the original raw weight of the ingredient, needed for the calculation of the nutrient intake.

**Dietary diversity Scores**

The consumed foods were allocated to the following food groups, composed by the FAO/DHS: (1) Cereals and grain products; (2) Vitamin A rich vegetables and tubers; (3) White tubers and roots; (4) dark green leafy vegetables; (5) other vegetables; (6) vitamin A rich fruits; (7) other fruits; (8) organ meat (iron rich); (9) flesh meats; (10) eggs; (11) fish; (12) legumes, nuts and seeds; (13) milk and milk products; (14) oils and fats. The food groups of sweets and coffee/tea were left out, since they are not relevant for this research. The food groups are composed especially to investigate the consumption of vitamin A and iron-rich food products (FAO/DHS 2007). Food products with a vitamin A level exceeding 130 mcg RE are considered vitamin A rich foods (Kennedy 2006).

The dietary diversity scores (DDS) for the school lunch, the home consumption and the combination of the school and home consumption were calculated per child by summing the number of different consumed food groups.

**Farmer Focus Group Discussions**

In the analysis of the answers of the FGD the following categories of answers are used: (I) Group description, (II) Food production, (III) Awareness about the Ghana SFP, (IV) General benefits and perceived problems, (V) Nutritional and health benefits and (VI) School attendance. Similarities and discrepancies of the answers between males and females and between districts were analysed.

**Impact on local food production**

The 22 food products used for the lunch preparation are categorized in 3 categories of origin: local (bought in the community of the Ghana SFP school), district (bought outside the community, but inside the district) and regional (bought outside the district, but within regional boundaries). The number of food products per category is expressed as percentage of the total number of used food products in the district.

Based on the list of production figures of the 10 food products with the highest amount of cultivated land and the weighed dietary records the demand for staples per week per school, demand for staples per year per school, demand for staples per year per district and the demand by the year 2010 are calculated (for detailed information on the calculation of these variables see appendix 8).

**Statistical analysis**

All statistical analysis is performed using the Statistical Package for the Social Sciences for Windows (SPSS Inc. version 15.0). All tests were carried out with a significance level of 0.05 and a two-sided confidence interval of 95%.
Descriptive analyses were performed on all variables to assess the mean and standard deviation (SD), to determine proportions and to test for skewness.

If the variables showed a normal distribution, an ANOVA test was done to check if differences between districts existed. This was done for the variables of nutritional status, disease symptoms, portion sizes, the percentages of breakfast, lunch, dinner and snacks, the energy-, fat and carbohydrate-intake and DDS figures. If the ANOVA test showed significantly different population means, a Tukey HSD test is performed to determine which district or districts differ.

If the variables showed a skewed distribution, the Kruskal-Wallis test was performed to check if differences between the districts were present, followed by a Dunnett test (equal variances not assumed) to see which districts differ. This was the case for the figures of protein-, vitamin A and iron-intake.

A Spearman correlation test was done to check for linear correlation between age and HAZ, WAZ and BMI-AZ. To check for differences between total portion sizes of the selected pupils for 1 day, compared to the other randomly chosen pupils, independent sample t-tests were performed.

The difference between the DDS SH (DDS score of the school lunch and the home consumption combined) and the DDS H (DDS of the home consumption) was tested using a paired sample t-test.
Results

School description
Table 2 shows that the school size varied from 161 in Gomoa district to 278 in AAK district, with an average enrolment of 201 pupils per school. Enrolment in 3rd grade was on average 34. Most schools had 4 cooks paid by the Ghana SFP National Secretariat (NS) but not trained, except for the cooks in Assin North. The payment was delayed for several months in all districts. In Assin North district, a matron, who stayed for 1 month at the school carried out a training on cooking practices.

In all schools a menu was available, but the compliance differed per school and the availability of ingredients was liable to seasonal variation. When an ingredient included in the menu was unavailable due to seasonal shortages, it was either replaced by another ingredient or left out. The menu in Assin North district was the only menu formulated by the district nutrition officer, the other menus were formulated by the cooks themselves.

In none of the districts an SIC was installed to facilitate the implementation of the Ghana SFP, due to the fact that an SMC was already in place in 3 of the districts. In Mfantseman district, the head teacher of the primary school coordinated the implementation of the SFP. The water supply varied per school, being a borehole in Assin North, supplemented with filtered water in AAK and river water in Gomoa. In Mfantseman, only filtered water was used. The SFP poly tanks were installed in all districts, but only used in Mfantseman district.

Table 2: School characteristics

<table>
<thead>
<tr>
<th>District</th>
<th>Assin North</th>
<th>AAK</th>
<th>Mfantseman</th>
<th>Gomoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolment school (06-07)</td>
<td>190</td>
<td>278</td>
<td>175</td>
<td>161</td>
</tr>
<tr>
<td>Enrolment class 3</td>
<td>33</td>
<td>38</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td># cooks / school</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td># paid cooks / school</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Cooks trained (yes/no)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Menu available (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SIC</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>SMC</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Water supply</td>
<td>Bore hole</td>
<td>Bore hole and filtered water(^2)(^,)(^3)</td>
<td>Filtered water(^2)</td>
<td>Bore hole / river water(^4)</td>
</tr>
</tbody>
</table>

1: SMC = School Management Committee; 
2: The filtered water comes out of the Ghana SFP polytank; 
3: The main water supply is from the community borehole; 
4: According to the cooks: the water from the bore hole tastes salty. The children do not like the salty water and 50% of the children brings water from the river in stead of water from the borehole.

Description of the study population

According to table 3, 129 children were enrolled in the study, of which 57.4% were boys. Lower numbers in enrolment in the study compared to the official class 3 enrolment
showed in table 1, are due to dropouts from school. The mean age was 10.4 (±1.7) years, with significantly younger children in Assin North (9.9 years ±1.4) and older children in Mfantseman (11.0 ±1.7). The HAZ, WAZ and BMIAZ are respectively -1.37 (±1.31), -1.08 (±0.76) and -0.69 (±0.60) and did not significantly differ between the districts. The stunting percentages varied between 13.3% in Assin North district and 30.0% AAK district, and 3.2% in Mfantseman district and the underweight percentages varied between 9.4% in Gomoa district. Most frequently occurring symptoms of disease were cough and skin disease (e.g. eczema, rashes), both on average 15.5%. High body temperature occurred in 13.2% of the children.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Total</th>
<th>Assin North</th>
<th>AAK</th>
<th>Mfantseman</th>
<th>Gomoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of children</td>
<td>129</td>
<td>30</td>
<td>31</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>boys (%)</td>
<td>57.4</td>
<td>60.0</td>
<td>54.8</td>
<td>67.7</td>
<td>46.9</td>
</tr>
<tr>
<td>Age (mean, SD)</td>
<td>10.4 (1.7)</td>
<td>9.9 (1.4)a</td>
<td>10.9 (1.5)a</td>
<td>11.0 (1.7)b</td>
<td>9.8 (1.7)a</td>
</tr>
<tr>
<td>HAZ score (mean, SD)</td>
<td>-1.37 (1.31)</td>
<td>-1.54 (0.71)a</td>
<td>-1.60 (1.06)a</td>
<td>-1.27 (1.08)a</td>
<td>-1.06 (1.99)a</td>
</tr>
<tr>
<td>WAZ score (mean, SD)</td>
<td>-1.08 (0.76)</td>
<td>-1.17 (0.42)a</td>
<td>-1.17 (0.59)a</td>
<td>-1.12 (0.65)a</td>
<td>-0.88 (1.17)a</td>
</tr>
<tr>
<td>BMIAZ score (mean, SD)</td>
<td>-0.69 (0.60)</td>
<td>-0.71 (0.37)a</td>
<td>-0.67 (0.37)a</td>
<td>-0.71 (0.69)a</td>
<td>0.65 (0.68)a</td>
</tr>
<tr>
<td>Stunted (%)</td>
<td>20.9</td>
<td>13.3a</td>
<td>30.0</td>
<td>16.1a</td>
<td>28.1a</td>
</tr>
<tr>
<td>Underweight (%)</td>
<td>5.4</td>
<td>3.3a</td>
<td>6.5</td>
<td>3.2a</td>
<td>9.4a</td>
</tr>
<tr>
<td>Cough (%)</td>
<td>15.5</td>
<td>26.7a</td>
<td>6.5a</td>
<td>6.5a</td>
<td>15.6a</td>
</tr>
<tr>
<td>Skin disease (%)</td>
<td>15.5</td>
<td>20.0a</td>
<td>25.8a</td>
<td>12.9b</td>
<td>6.3c</td>
</tr>
<tr>
<td>High body temperature (%)</td>
<td>13.2</td>
<td>10.0a</td>
<td>22.6b</td>
<td>16.1a</td>
<td>6.3c</td>
</tr>
</tbody>
</table>

*a The districts in a row sharing codes are not significantly different.

<table>
<thead>
<tr>
<th>Age category</th>
<th>HA Z-score (mean, SD)</th>
<th>WA Z-score (mean, SD)</th>
<th>BMIAZ score (mean, SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-8 years of age (n=12)</td>
<td>-0.22 (1.14)a</td>
<td>-0.18 (0.98)a</td>
<td>-0.39 (0.53)</td>
</tr>
<tr>
<td>9-10 years of age (n=55)</td>
<td>-1.19 (1.00)b</td>
<td>-1.00 (0.71)b</td>
<td>-0.66 (0.67)</td>
</tr>
<tr>
<td>11-12 years of age (n=44)</td>
<td>-1.53 (1.08)b,c</td>
<td>-1.28 (0.57)b,c</td>
<td>-0.80 (0.54)</td>
</tr>
<tr>
<td>13-16 years of age (n=12)</td>
<td>-2.77 (1.19)c</td>
<td>-1.64 (0.58)c</td>
<td>-0.70 (0.53)</td>
</tr>
</tbody>
</table>

*b The districts in a column sharing codes are not significantly different.
Description of school lunches

Table 5 shows an overview of the weekly meals consumed in the schools in the 4 districts. The main dish consisted of the staple foods rice (9 out of 20 meals), beans or gari (3 out of 20 meals), yam or banku (twice of the 20 meals), and/or plantain (once alone, and once combined with beans). The main dish is accompanied by a stew as 1st side dish in 19 of the 20 meals observed and fish as a 2nd side dish in 14 of the 20 meals observed. Fruit was only served as a dessert 3 times in Mfantseman district and meat was never included in the preparation of the school lunches. All stews, except for the groundnut soup, are made on the basis of oil (vegetable oil or palm oil), onion and tomatoes (fresh and/or tinned). When the stew is named e.g. garden egg-stew, this means a 4th ingredient has been added, namely garden eggs.

Table 5: Composition of school lunches

<table>
<thead>
<tr>
<th>District</th>
<th>Day</th>
<th>Main dish</th>
<th>Side dish</th>
<th>Side dish</th>
<th>Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assin north</td>
<td>Mon</td>
<td>Rice</td>
<td>Tomato-stew</td>
<td>Fish (herring)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>Plantain</td>
<td>Beans-stew</td>
<td>Gari powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>Yam</td>
<td>Garden egg-stew</td>
<td>Fish (herring)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>Jollov rice</td>
<td></td>
<td>Fish (herring)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>Banku</td>
<td>Tomato-stew</td>
<td>Fish (herring)</td>
<td></td>
</tr>
<tr>
<td>AAK</td>
<td>Mon</td>
<td>Rice</td>
<td>Tomato-stew</td>
<td>Fish (salmon)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>Gari balls</td>
<td>Tomato-stew</td>
<td>Fish (salmon)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>Rice</td>
<td>Beans-stew</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>Beans</td>
<td>Tomato-stew</td>
<td>Gari powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>Rice</td>
<td>Egg-stew</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mfantseman</td>
<td>Mon</td>
<td>Rice</td>
<td>Cabbage-stew</td>
<td>Fish (salmon)</td>
<td>Pineapple</td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>Gari balls</td>
<td>Egg-stew</td>
<td>Fish (tuna, salmon)</td>
<td>Banana</td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>Rice balls</td>
<td>Groundnut soup</td>
<td>Fish (tuna, salmon)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>Yam</td>
<td>Palaver-sauce</td>
<td>Fish (tuna, herring)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>Beans/plantain</td>
<td>Tomato stew</td>
<td>Gari-powder</td>
<td>Pineapple</td>
</tr>
<tr>
<td>Gomoa</td>
<td>Mon</td>
<td>Rice</td>
<td>Beans-stew</td>
<td>Fish (tuna)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>Beans</td>
<td>Stew</td>
<td>Gari-powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>Gari balls</td>
<td>Tomato-stew</td>
<td>Fish (tuna)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>Rice</td>
<td>Beans-stew</td>
<td>Fish (tuna)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>Banku</td>
<td>Garden egg-stew</td>
<td>Fish (tuna)</td>
<td></td>
</tr>
</tbody>
</table>

1: garden eggs are the egg-shaped fruits of the egg-plant with a whitish / greenish colour;
2: jollov rice is rice cooked in tomato sauce (tomatoes (fresh/canned), grinded onion and palmoil);
3: banku is a cooked mixture of fermented maize- and/or cassava-dough;
4: gari is dried and granulated cassava;
5: egg-stew including cabbage and gardeneggs;
6: groundnut soup containing garden-eggs;
7: palaver-sauce is a stew containing nkontomire leaves (dark-green leaves of the coco-yam);
8: garden egg-stew containing okro (green pod-like fruits);
9: The fish is mixed through the stew.
**Portion Size**

Table 6 shows that 6 out of the 129 pupils (4.7%) did not consume a school meal, because they were not present in school in the week of data collection. Of the 123 pupils consuming a school lunch, 118 consumed 1 side dish (95.9%) and among them 62 consumed a 2nd side dish (50.4%). The portion size of the main dish in Mfantseman district (400.7±52.9) and the total portion (613.0±69.3) were significantly bigger compared to the other 3 districts. On average, 75.6% of the pupils finished the whole portion of the school meal and among the pupils that did not finish their meals, the average leftover (31.9±70.8) was only 7% of the total portion.

A significant overestimation of on average 15g was found of the total portion size of the selected pupils, compared to the other randomly chosen pupils. No correction was performed for the significant overestimation of 15g (3.3% of the weight of the total dish), because it was difficult to determine which one of the 3 dishes (the main dish, 1st side dish or 2nd side dish) was accountable for the difference.

**Table 6: Portion size school lunch, (mean, SD) **

<table>
<thead>
<tr>
<th>Portion size</th>
<th>Total (n=123)</th>
<th>Assin North (n=30)</th>
<th>AAK (n=31)</th>
<th>Mfantseman (n=31)</th>
<th>Gomoa (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main dish (g)</td>
<td>322.9 (99.4)</td>
<td>265.5 (119.2) a</td>
<td>295.8 (35.8) a,b</td>
<td>400.7 (52.9) c</td>
<td>326.7 (108.2) b</td>
</tr>
<tr>
<td>Side dish 1 (g)</td>
<td>98.6 (62.0)</td>
<td>88.7 (95.1) b</td>
<td>63.4 (22.1) b</td>
<td>137.9 (51.9) c</td>
<td>98.6 (62.0) a,c</td>
</tr>
<tr>
<td>Side dish 2 (g)</td>
<td>55.6 (79.9)</td>
<td>65.4 (114.1) a</td>
<td>61.7 (12.9) a</td>
<td>43.4 (14.0) a</td>
<td>55.6 (79.9) a</td>
</tr>
<tr>
<td>Fruit (g)</td>
<td>11.5 (30.8)</td>
<td>0 0</td>
<td>0 0</td>
<td>47.7 (47.5)</td>
<td>0 0</td>
</tr>
<tr>
<td>Total portion (g)</td>
<td>450.7 (133.6)</td>
<td>377.1 (107.0) b,c</td>
<td>371.3 (36.6) a</td>
<td>613.0 (69.3) b</td>
<td>436.7 (125.8) c</td>
</tr>
<tr>
<td>Leftover (g)</td>
<td>31.9 (70.8)</td>
<td>84.6 (109.8) a</td>
<td>8.0 (25.6) a</td>
<td>9.1 (31.9) a</td>
<td>27.8 (56.0) a</td>
</tr>
</tbody>
</table>

| Children consuming whole portion (%) | 75.6 | 46.7 a | 83.9 b | 90.3 b | 78.1 b |

* The districts in a row sharing codes are not significantly different.

**Characteristics of home consumption**

As shown in table 7, the percentage of children consuming food before going to school varies from 58.1% in Assin North district to 96.8% in Mfantseman district and the percentage of children consuming lunch at home varies from 6.3% in Gomoa district to 53.3% AAK district. Most children consume dinner at home (99.2%), but only a small percentage (22.6% on average) of the primary caretakers in the communities used iodated salt to prepare the meals in the homes.

On average, the children consumed 3 (±0.5) meals a day, and when including snacks, the average number of meals increased to 3.5 (±0.7), corresponding to 1 snack per child per 2 days. In 59.7% of the cases the snack was an orange or a slice of pineapple. In the other cases it was a piece of bread, biscuits or a warm snack e.g. rice and stew. The number of meals exclusive of snacks, consumed by the pupils in Assin North district (2.7±0.7) is significantly lower compared to the other 3 districts and the number of meals including the snacks is significantly higher in AAK district (4.1±0.7).
Table 7: Characteristics of the home consumption *

<table>
<thead>
<tr>
<th></th>
<th>Total (n=123)</th>
<th>Assin North (n=30)</th>
<th>AAK (n=31)</th>
<th>Mfantseman (n=31)</th>
<th>Gomoa (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast consumed (%)</td>
<td>86.3</td>
<td>58.1(^a)</td>
<td>93.3(^b)</td>
<td>96.8(^b)</td>
<td>86.3(^b)</td>
</tr>
<tr>
<td>Lunch consumed (%)</td>
<td>22.6</td>
<td>25.8(^a)</td>
<td>53.3(^b)</td>
<td>6.5(^a)</td>
<td>6.3(^a)</td>
</tr>
<tr>
<td>Dinner consumed (%)</td>
<td>99.2</td>
<td>100(^a)</td>
<td>96.7(^a)</td>
<td>100(^a)</td>
<td>100(^a)</td>
</tr>
<tr>
<td>Snacks consumed (%)</td>
<td>41.1</td>
<td>51.6(^a,b)</td>
<td>66.7(^b)</td>
<td>29.0(^a,c)</td>
<td>18.8(^c)</td>
</tr>
<tr>
<td>Number of meals consumed excl. snacks (mean, SD)</td>
<td>3.0 (0.5)</td>
<td>2.7 (0.7)(^a)</td>
<td>3.3 (0.5)(^b)</td>
<td>3.0 (0.3)(^b)</td>
<td>3.0 (0.3)(^b)</td>
</tr>
<tr>
<td>Number of meals consumed incl. snacks (mean, SD)</td>
<td>3.5 (0.7)</td>
<td>3.4 (0.9)(^a)</td>
<td>4.1 (0.7)(^b)</td>
<td>3.3 (0.5)(^a)</td>
<td>3.5 (0.7)(^a)</td>
</tr>
<tr>
<td>Use of iodated salt in households (%)</td>
<td>22.6</td>
<td>41.9(^a)</td>
<td>10.0(^b)</td>
<td>32.3(^a,b)</td>
<td>6.3(^b)</td>
</tr>
</tbody>
</table>

* The districts in a row sharing codes are not significantly different.

**Nutrient intake**

The energy intake from the average school lunch in kilocalories (799.5±301.3) was 37.0% of the DRI for energy intake, which is 2158.0 kilocalories per day at moderate physical activity (table 8). The protein intake (24.5±17.9) from the school meal was 73.6% of the weighted average of the DRI for protein (33.3g/day) and the carbohydrate intake (111.4±32.8) was 85.7% of the DRI for carbohydrates (130g/day). The average NAR for vitamin A was calculated to be 1.32 (±1.32) and varied from 0.99 (±0.69) in AAK district to 1.62 (±1.38) in Mfantseman district. The average intake of iron (6.1±5.8) is 26.6% of the weighted DRI for iron of 22.9 mg/day and the average NAR for iron is 0.28 (±0.29). The MAR for vitamin A and iron is 0.45 (±0.27).

The vitamin A intake did not significantly differ between districts. The energy intake (1074.8±168.4) and protein intake (46.2±20.7) is significantly higher in Mfantseman district compared to the 3 other districts.

Table 8: Nutrient intake school lunches (mean, SD) *

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Total (n=123)</th>
<th>Assin North (n=30)</th>
<th>AAK (n=31)</th>
<th>Mfantseman (n=31)</th>
<th>Gomoa (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>799.5 (301.3)</td>
<td>844.0 (375.7)(^a)</td>
<td>592.8 (100.6)(^b)</td>
<td>1074.8 (168.4)(^c)</td>
<td>684.2 (236.2)(^a,b)</td>
</tr>
<tr>
<td>Protein (g)(^1)</td>
<td>24.5 (17.9)</td>
<td>20.5 (11.5)(^a)</td>
<td>12.3 (5.3)(^a)</td>
<td>46.2 (20.7)(^b)</td>
<td>18.8 (5.9)(^a)</td>
</tr>
<tr>
<td>Fat (Energy %)</td>
<td>27.6 (9.0)</td>
<td>32.1 (9.6)(^a)</td>
<td>25.5 (5.5)(^b)</td>
<td>27.9 (11.1)(^a,b)</td>
<td>25.1 (7.1)(^a,b)</td>
</tr>
<tr>
<td>CHO (g)</td>
<td>111.4 (32.8)</td>
<td>113.7 (42.7)(^a,b)</td>
<td>97.3 (15.6)(^b)</td>
<td>127.4 (20.5)(^a)</td>
<td>106.9 (37.7)(^a,b)</td>
</tr>
<tr>
<td>Vitamin A (RAE)(^1)</td>
<td>788.8 (805.0)</td>
<td>968.5 (1133.2)(^a)</td>
<td>598.6 (419.9)(^a)</td>
<td>1020.9 (879.3)(^a)</td>
<td>573.9 (517.7)(^a)</td>
</tr>
<tr>
<td>NAR Vitamin A</td>
<td>1.32 (1.32)</td>
<td>1.62 (1.88)(^a)</td>
<td>0.99 (0.69)(^a)</td>
<td>1.62 (1.38)(^a)</td>
<td>1.05 (0.95)(^a)</td>
</tr>
<tr>
<td>Iron (mg)(^1)</td>
<td>6.1 (5.8)</td>
<td>6.8 (6.7)(^a)</td>
<td>2.3 (1.5)(^b)</td>
<td>10.1 (4.9)(^a)</td>
<td>5.1 (6.0)(^a,b)</td>
</tr>
<tr>
<td>NAR Iron(^1)</td>
<td>0.28 (0.29)</td>
<td>0.34 (0.35)(^a)</td>
<td>0.10 (0.08)(^b)</td>
<td>0.43 (0.23)(^a)</td>
<td>0.25 (0.31)(^a,b)</td>
</tr>
<tr>
<td>MAR</td>
<td>0.45 (0.27)</td>
<td>0.47 (0.31)(^a)</td>
<td>0.40 (0.22)(^a)</td>
<td>0.52 (0.26)(^a)</td>
<td>0.44 (0.27)(^a)</td>
</tr>
</tbody>
</table>

* The districts in a row sharing codes are not significantly different.

\(^1\) The protein-, vitamin A-, iron- intake and the NAR for iron had a positively skewed distribution within districts, indicating a presence of high outliers.
The single food responsible for 92.6% of the intake of vitamin A is palm oil and the foods together responsible for 90% of the iron intake are smoked fish (27.6%), beans (25.6%), maize dough (23.1%), white rice (4.5%), yam (4.4%), tomato puree (4.2) and raw fish (1.9%).

**Dietary diversity**

The DDS of the school consumption was on average 4.5 (±0.6). The DDS of the school consumption is significantly higher in Mfantseman district (5.0±0.6) and significantly lower in AAK district (4.0±0.0) compared to the other districts. This difference in DDS is due to the more frequent use in the lunch preparation of beans (food group 12), nkotomire leaves (food group 4), eggs (food group 10), and tubers (food group 3) in Assin North, Mfantseman and Gomoa district compared to AAK district. Table 9 shows that the consumption of the school lunch on average adds 1.0 (±0.8) food group to the dietary diversity score (DDS) of the food consumption in the homes of the pupils. The DDS of the combined school and home food consumption (DDS SH) is on average 6.4 (±1.0) and no significant differences between districts were found.

**Table 9: Dietary Diversity Score (mean, SD) **

<table>
<thead>
<tr>
<th>DDS</th>
<th>Total (n=123)</th>
<th>Assin North (n=30)</th>
<th>AAK (n=31)</th>
<th>Mfantseman (n=31)</th>
<th>Gomoa (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDS S</td>
<td>4.5 (0.6)</td>
<td>4.4 (0.5)a</td>
<td>4.0 (0.0)b</td>
<td>5.0 (0.6)c</td>
<td>4.6 (0.5)a</td>
</tr>
<tr>
<td>DDS H</td>
<td>5.4 (1.1)</td>
<td>5.2 (1.3)b,b</td>
<td>5.9 (0.9)b</td>
<td>5.1 (0.9)a</td>
<td>5.3 (0.9)b,b</td>
</tr>
<tr>
<td>DDS SH</td>
<td>6.4 (1.0)</td>
<td>6.2 (1.0)a</td>
<td>6.4 (1.0)a</td>
<td>6.7 (1.0)a</td>
<td>6.2 (0.8)a</td>
</tr>
<tr>
<td>Difference</td>
<td>1.0 (0.8)</td>
<td>1.0 (0.8)aa</td>
<td>0.5 (0.7)aa</td>
<td>1.6 (0.7)aa</td>
<td>0.8 (0.5)aa</td>
</tr>
<tr>
<td>DDS SH-DDS H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The districts in a row sharing codes are not significantly different.
1: DDS S = Dietary Diversity Score of the school meal
2: DDS H = Dietary Diversity Score of the home consumption
3: DDS SH = DDS S = Dietary Diversity Score of the school lunch and home consumption combined

* difference between DDS SH and DDS H significant at 0.001 level

**Impact on local food production**

In total, on average 32% of the food products are bought inside the community, with a larger percentage bought locally in Assin North district (47%) compared to the other 3 districts (table 10 on page 25). Out of the 22 food items, used for the preparation of the school lunches in the districts studied, garden eggs were bought in the local community in all 4 districts and eggs in 3 out of the 4 districts. Of the remaining 30 items, 4 items (palm oil, pepper tomatoes and yam) were bought locally in 2 of the 4 districts and 5 items (fish, nkotomire leaves, oranges, plantain and maize) were bought locally in 1 of the 4 districts.
Table 10: Origin of foods used in meal preparation

<table>
<thead>
<tr>
<th>Food item</th>
<th>Assin North Local1</th>
<th>Region</th>
<th>AAK Local</th>
<th>District</th>
<th>Region</th>
<th>Mfantseman Local</th>
<th>District</th>
<th>Region</th>
<th>Gomoa Local</th>
<th>District</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agushii seeds</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Beans</td>
<td></td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cabbage</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cassava</td>
<td></td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Frytol</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Garden eggs</td>
<td></td>
<td>X1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Groundnuts</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Iodated salt</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maize</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nkontomire leaves</td>
<td></td>
<td>X1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onions</td>
<td></td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oranges</td>
<td></td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Palm oil</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Plantain</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pepper</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rice</td>
<td></td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tomatoes</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tomato puree</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yam</td>
<td></td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Percentages

- 1= Bought in the local community;
- 2= Product only used for meal preparation when in season;
- 3= number of food items bought inside the community divided by the total number of food items.
Table 11: Demand for staple foods*

<table>
<thead>
<tr>
<th></th>
<th>Demand per week per school¹ (kg)</th>
<th>Demand per year per school² (kg)</th>
<th>Demand in district per year³ (metric tonne)</th>
<th>Demand in district by the year 2010⁴ (metric tonne)</th>
<th>Total production in district⁵ (metric tonne)</th>
<th>% of total production (per district)</th>
<th>% of total production (per district, by the year 2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assin North</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cassava</td>
<td>17</td>
<td>535</td>
<td>1.1</td>
<td>21.5</td>
<td>140728</td>
<td>0.00</td>
<td>0.02</td>
</tr>
<tr>
<td>- Maize</td>
<td>50</td>
<td>1605</td>
<td>3.2</td>
<td>63.2</td>
<td>24951</td>
<td>0.01</td>
<td>0.25</td>
</tr>
<tr>
<td>- Plantain</td>
<td>19</td>
<td>620</td>
<td>1.2</td>
<td>24.0</td>
<td>16709</td>
<td>0.01</td>
<td>0.14</td>
</tr>
<tr>
<td>- Yam</td>
<td>63</td>
<td>2019</td>
<td>4.0</td>
<td>79.6</td>
<td>2369</td>
<td>0.17</td>
<td>3.36</td>
</tr>
<tr>
<td>- Rice</td>
<td>111</td>
<td>3539</td>
<td>7.1</td>
<td>140.2</td>
<td>2562</td>
<td>0.28</td>
<td>5.47</td>
</tr>
<tr>
<td><strong>AAK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cassava</td>
<td>45</td>
<td>1450</td>
<td>7.3</td>
<td>38.8</td>
<td>110232</td>
<td>0.00</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Mfantseman</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cassava</td>
<td>63</td>
<td>2005</td>
<td>12.0</td>
<td>86.4</td>
<td>29696</td>
<td>0.04</td>
<td>0.29</td>
</tr>
<tr>
<td>- Plantain</td>
<td>15</td>
<td>482</td>
<td>2.9</td>
<td>20.6</td>
<td>1892</td>
<td>0.15</td>
<td>1.09</td>
</tr>
<tr>
<td>- Yam</td>
<td>10</td>
<td>314</td>
<td>1.9</td>
<td>13.7</td>
<td>2167</td>
<td>0.09</td>
<td>0.63</td>
</tr>
<tr>
<td><strong>Gomoa</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cassava</td>
<td>28</td>
<td>896</td>
<td>2.7</td>
<td>41.7</td>
<td>8754</td>
<td>0.03</td>
<td>0.48</td>
</tr>
<tr>
<td>- Maize</td>
<td>10</td>
<td>335</td>
<td>1.0</td>
<td>14.9</td>
<td>3187</td>
<td>0.03</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.07</td>
<td>1.11</td>
</tr>
</tbody>
</table>

* For the calculation of the variables: see appendix 8
Table 11 shows (see page 26) that the highest percentage of the production of the selected staples in the district, needed for the preparation of the school lunches is, 0.28% of the total production at district level. This percentage has the potential to increase to a maximum of 5.47% for rice in Assin North district in the year 2010 when 7500 children per district are supposed to be enrolled in the Ghana SFP. The average percentage of the district production of staple foods in the situation in July 2007 is 0.07%. This percentage could increase to 1.11% in the year 2010.

**Farmer Focus Group Discussions**

The male and female farmers grow on average the same crops, but the female farmers grow more crops on average than the male farmers (table 12). Both male and female farmers were better educated in Assin North district compared to Gomoa district, but comparable in age.

<table>
<thead>
<tr>
<th>Table 12: Group description Focus Group Discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assin North (Nduaso)</strong></td>
</tr>
<tr>
<td><strong>Males</strong></td>
</tr>
<tr>
<td>Number of participants</td>
</tr>
<tr>
<td>Age-interval (years)</td>
</tr>
<tr>
<td>Percentage educated¹</td>
</tr>
<tr>
<td>Products grown</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

¹: the education level varies from 2nd grade primary school to university level (chief of Sampa-town), most common is primary school 4th grade as highest level of education.

The main part of the harvested agricultural produce listed in table 12, is sold directly after the harvest (70-90%) in both villages. Only palm oil, maize and rice (Nduaso) are partially stored to be sold in the lean season. The farmers prefer to sell their foods in the local village, but it is difficult, because too little buyers come to the villages. Because transport to the market places costs money, the farmers have to sell their produce to middlemen or retailers who come to their villages, for a price set by these middlemen. The farmers have no choice but to sell, because otherwise the foods will spoil. Because of these issues, farming is not profitable enough for the young men and they leave town (Gomoa district). The people in the community want the government to establish jobs in the area and/or to
improve the road to improve the popularity of the town and the town's marketplace in order to make farming more attractive and profitable.

With respect to the implementation of the Ghana SFP, responses indicated in all 4 focus groups, that the participants were aware the programme started in their villages and that the programme was about feeding children in school. The farmers also knew that their village was the 1st village in the district enrolled in the programme. In both villages the District Chief Executive (DCE) came to introduce the programme under the condition that the community members would build a kitchen, canteen and store. After the construction, the villages received kitchen utensils and plates. In both villages kindergarten was included after 6 months (Mfantseman district) and 1 year (Assin North district). The farmers indicated as a reason for enrolment in the programme that the children receive poor feeding, especially during lean season (female farmers) or that the community people deserved it because they are good Christians and/or nice to visitors (male farmers).

Responses indicated that the general, nutritional and health benefits from the programme are: (1) the children do not eat lunch anymore in the home, which saves the parents money and time; (2) the farmers in the Assin North school are able to sell some of their foods (palm oil, yams, fish) to the programme; (3) the children get more nutritious food due to the variation in the school meals; (4) the children are stronger, less sick and grow better; (5) they are enthusiastic to go to school and they perform better in class; (6) the children have more energy to play after school; (7) in both villages responses indicated a rise in enrolment and in school attendance due to the SFP.

The perceived problems indicated by the FGD participants are: (1) the delay in the finishing of the construction of the canteen by the DA in the Assin North school; (2) the (too) small influence on the local market, which does not lead to an impact on the local food production or price (according to the Assin North male farmers 70% of the foods is bought outside the village and the Gomoa-farmers told that all the ingredients are purchased outside the village); (3) the sustainability of the programme when the 5 years of government support are over.

In Nduaso the farmers came up with a set of possible solutions: (1) allocation of land to make a school garden. The farmers asked the AES to provide support; (2) a weekly offertory in church; (3) contribution of foods to the programme. (4) set-up of a women’s corporation to make it easier to get loans for fertilizer to produce more and therefore sell more and contribute the money to the programme.
Discussion

The aim of the study was to determine the impact of the Ghana School Feeding Programme on the nutrient intake from school meals in 3rd class primary school children and to determine the impact on the demand for locally produced foods. The results indicate that the Ghana SFP adds on average 1 food group to the home consumption of the pupils in the study and replaces the home lunch. The nutrient intake recommendations for energy (30-45% of RDA) and protein (60-70% of RDA), formulated by the Ghana SFP National Secretariat in the Programme Document 2007-2010, have been met (31.9% and 67.6% respectively). The iron intake (6.1±5.8) is low compared to the weighted DRI of this age group of 22.9 mg/day at a bioavailability of 5%. The percentage of food products, bought in the local community is on average 32% of the total number of food products used for the Ghana SFP. In the situation in July 2007, the demand for locally produced staples is on average 0.07% of the total production of staples in the district. This may potentially increase to 1.11% in the year 2010.

The study was carried out in 4 districts in Central Region in Ghana. The Ghana SFP schools in the sample are representative for other SFP schools in Central Region, because the sample is well-balanced in coastal and non-coastal districts, the communities of the selected schools in the study had comparable characteristics and the sample of 129 children was homogenous. All villages had no connection to the electricity network and no sanitary facilities and all communities had comparable sized market places and a main income from agricultural activities. The sample of 129 children was considered homogenous, because no significant differences between districts could be found in HAZ, WAZ and BMIAZ and stunting and wasting percentages. However, the low number of the sample size of on average 31 per school is too small to draw firm conclusions.

The schools in the sample are not representative for all schools in Ghana. Central Region on average ranks 4th (scores from good to bad) on the list of all 10 regions in terms of nutritional status (WAZ, HAZ and weight-for-height Z-scores) (DHS 2006). This means Central Region scores above average compared to other regions. Ghana also has 3 climate zones: a tropical and comparatively dry climate in the south-east; hot and humid in the south-west; and a hot and dry climate in the North (Library of Congress 1994). This results in different ways of agricultural production, the use of different crops and the use of different ingredients in school meals. Therefore, these primary schools are not comparable to other primary schools outside Central Region.

Two remarks should be made regarding the study population. The 1st remark is that the criteria for selection of the schools that were mentioned by the DCE might suggest other criteria for enrolment in the Ghana SFP than the schools being specifically located in hunger hotspots in the district. A 2nd remark is that in this study population the enrolment for boys (57.4%) is higher than the enrolment for girls. This was not expected, because the girl/boy ratio in primary schools in Central Region equalled 1.01 (DHS 2006) and secondly, 1
of the goals of the Ghana SFP is to decrease the gender gap in the schools, which means that equal enrolment percentages for boys and girls should be expected. Possible explanations could maybe be that the Ghana SFP at this stage attracts more boys than girls or that if the Ghana SFP would attract pupils from other primary schools, the attraction would be larger for boys than for girls. These explanations have not been further investigated in this study.

The stunting (20.9%) and underweight levels (5.4%) observed seem to be low in this study population. Data on nutritional status in primary school children are hardly available for Ghana. A study in Volta Region suggests higher stunting and underweight percentages in primary school children, of 40.3% and 32.9% in 8-9 year olds and 56.2% and 46.2% in 12-13 year olds respectively (anonymous 1998). In children below 5 years of age in Ghana, the stunting and underweight percentage are 30.0% and 22% respectively (DHS 2006). Due to the absence of studies to compare with, no explanation for the low stunting and underweight levels could be found.

Furthermore, the Z-scores of pupils in this study population are significantly higher for height and weight for age in the two eldest age-categories. Significant reverse correlations between age and HAZ and age and WAZ were also found in other studies (anonymous 1998; Meme M.M. 1998; Simondon 1998; Lwambo 2000). Simondon et al. (1998) indicated that a late onset of the growth spurt in Senegalese girls (at age 12) and boys (at age 16) could be a possible cause. This conclusion is supported by Lwambo in Tanzanian girls and boys. The increasing Z-scores with age suggest that the problem of undernutrition is larger in the age groups of 11-13 and 13-16 than it is in the 2 lowest age groups. Some studies indicated that within 1 school, inadequately nourished children are suggested to cognitively benefit more from SFPs than their more adequately nourished counterparts (Simeon 1998; Walker 1997; Lwambo 2000), so this might suggest the children in the 2 eldest age categories in this study population to benefit more from the Ghana SFP.

The total portion size of the school lunch of 613.0g (±69.3) in Mfantseman district is significantly larger than those in the other 3 districts. The fruit servings could account for some, but not all of this variation. This would suggest that the cooks in the school in Mfantseman districts on average give more food to the children compared to the cooks in the other districts. In the Ghana SFP Operation Manuals (2005 and 2007), no guidelines for the portion sizes are given. The portion size of the 3rd grade children therefore seems to depend on the amount of food available. Per child an amount of 3000 Cedis (0.30 Ghana Cedi) is available to buy ingredients for the school meals. Since the portion size in Mfantseman is significantly bigger compared to the other districts, it seems that in Mfantseman district the school was able to buy more ingredients for the same amount of money. It might be possible that the use of middle men in the food purchase in the other 3 districts might have increased the price of the ingredients and, as such decreased the amount of ingredients available per child.
It was observed that the children whose portions were weighed were placed in the front of the waiting line. In the sub sample of the 10 other randomly selected 3rd grade children, an average 15 g smaller portion size was determined. This difference was significant. The overestimation of the portion size in the selected children by 3.3%, could have lead to a small overestimation of the energy intake in this study.

A replacement of the home lunch seems to occur in this study population, because on average only 22% of the pupils consumed a home lunch after coming home from school compared to 86.3% consuming breakfast and 99.2% consuming dinner. The suggestion of home lunch replacement is supported by the responses from the FGDs, because these indicate that not having to prepare home lunches is a large advantage of the Ghana SFP. A replacement of home food consumption also occurred in other studies (Grantham-McGregor 1998; Grantham-McGregor 1992; Greenhalgh 2007). Other studies suggested the overall net energy-intake in school children was higher than without the school breakfast (Walker 1997) or without a school meal of noodles (Wijngaarden 2005). Another study found that pupils continued to receive about the same number of calories from home as the nonparticipants (Jacoby 1997). Studies by Hall (2006) and Powell (1998) also found no evidence for substitution.

Although evidence from literature is ambiguous on whether school breakfast or lunch partially substitutes home caloric intake, one might assume that the energy intake from the Ghana SFP school lunch could be higher than the energy intake from an usual home lunch, assuming that the lunch portion (450.7±133.6) in the observed schools is on average bigger than the usual lunch portion size children would have received at home. This assumption would mean that the Ghana SFP lunch might lead to a higher net caloric intake in the 3rd grade primary school children in this study population, but this has not been investigated in this study. This outcome would however be in line with the study by Walker (1997) and van Wijngaarden (2005).

The recommendations for energy (30-45% of RDA) and protein (60-70% of RDA), formulated by the Ghana SFP National Secretariat have been reached with values of 31.9% and 67.6% respectively. In other studies, the supplementary feeding was responsible for 20% of energy requirements and an adequate protein intake (Walker 1997) or only 5% of the energy requirements (Hall 2006). A study by Meme et al. (1998) only indicated that the SFP resulted in the intake of fewer calories and more protein than the Recommended Dietary Intakes.

The NAR for vitamin A of 1.3 (±1.3) is above the DRI for vitamin A, but the intake of 788.8 RAE (±805.0) does not exceed the tolerable upper intake level of 850 RAE for children aged 8 to 13 years (National Institute of Health). However, if the pupils would consume any foods containing vitamin A outside school, the tolerable upper intake level might easily be exceeded.
However, losses in nutrients due to cooking were not taken into account in this study. Experiments with red palm oil (which is the source of 96.4% of vitamin A intake in this study) have repeatedly shown that only a fraction of the α-carotene is retained when the oil is used for frying (Lietz 2001). Research has indicated that a 30 minute heating of palm oil on a temperature of 150°Celsius decreased the vitamin A content by more than 36% (Mudambi 1977) and a 50% decrease of the storage of vitamin A in the liver (Favaro 1992). In the preparation of the school lunches, the stew was heated for more than an hour, which will probably have had a considerable impact on the vitamin A content of the palm oil and therefore the vitamin A intake is most probably overestimated.

If a loss of 36% in vitamin A content in palm oil due to the cooking procedure, as suggested by Mudambi (1977), would be taken into account, the vitamin A intake would be around 500 µg RAE. This value would be 90% of the weighted DRI for vitamin A of 560.2 µg RAE. This would therefore suggest that the Ghana SFP could be responsible for at least 90% of the intake of vitamin A for this age group.

The iron intake from the Ghana SFP school lunch of 26.6% of the weighted DRI is low, but considering the high anaemia rates, which serve as an indicator for iron deficiency, a contribution of 26.6% is already high. A breakfast supplementation study by Walker (1997) indicated an even lower iron intake of 15% of RDA. This could be due to the fact that breakfast generally might have smaller portion sizes than lunch. A wide variation of foods contributed to the iron intake, of which smoked fish (27.6%), beans (25.6%), and maize dough (for banku) (23.1%) are the most important contributors. However, smoked fish and especially beans are foods that are not frequently eaten at home according to the 24hr recall. This would suggest that the Ghana SFP would contribute to an increased iron intake. Following the WHO recommendations against iron supplementation in malaria-endemic areas of Ghana (WHO 2001), it is available to consider inclusion of iron fortified foods in the Ghana SFP menu.

The DDS of the combined home and school consumption (6.4±1.0) is on average 1 food group higher than the DDS of the home consumption alone. We cannot conclude with certainty that the contribution of 1.0 (±0.8) food group to the DDS can be solely attributed to the Ghana SFP, because we did not include a control group of pupils from schools that did not implement a SFP. However, based on the 24hr recall, the food groups that are responsible for the increase of the combined DDS (beans, eggs, nkontomire leaves and tubers) are food products that are not frequently used in the preparation of the home meals. Therefore it is likely that the increase of the combined DDS compared to the DDS of the home consumption, is attributable to the provision of school lunches of the Ghana SFP.

Few data are available on the dietary variety of food consumption in Ghanaian primary school children, but 1 study found an DDS of 7.5 in Ghanaian primary school children (3 to 6 years of age) using 13 food groups (Ferguson 1993). In the present study 14 food groups based on the FAO/DHS food groups have been used to assess the DDS of the children’s food intake. Other studies used 7 (Arimond 2004), 8 (Hatløy A 1998), 9 (Hall 2007) or 10 food
groups (Torheim LE 2003; Torheim LE 2004) to assess DDS. The use of different food groups hampers the comparison of our results with the results of other studies. Also no internationally agreed upon cut-off points are available for DDS to indicate nutrient adequacy. Therefore we cannot determine whether a DDS of 6.4 (±1.0) reflects sufficient nutrient adequacy.

An increase in DDS might result in an increase in nutrient adequacy and/or nutritional status. Torheim et al. (2004) showed a positive correlation of 0.30 (p=0.001) between MAR and DDS in a sample of men and women with a mean age of 28 years. This was confirmed in children of 13 to 58 months by Hatloy (1998) and in adults by Torheim (2003). Arimond et al. suggests that an increase in DDS causes an increase in nutritional status in children below 2 years of age. Children in the highest DDS-tertile had a significantly higher HAZ (varying from an increase of 0.24 to 0.59), compared to children in the lowest DDS-tertile (Arimond 2004). Other studies also found a significant association between DDS and nutritional status (Hatloy A 2000) and DDS and HAZ and WAZ (Onyango 1998). In all these studies, different age groups have been used, which makes it difficult to conclude whether the results of these studies could be extrapolated to the primary school children in our study as well. However, since all studies indicate an improved nutrient adequacy with increasing DDS, we may assume that the increase in DDS found in this study may also reflect an improvement of nutrient adequacy of the diet of our school children.

On district level, the impact on the demand for staple foods seems small (0.07% of the district staple production in the agricultural season of 2006-2006). The impact on the community production could be higher, because 32% of all ingredients are bought inside the local community. This has not been investigated in this study, because community production figures were not available. Although the percentage has the potential to increase to 1.11% in the year 2010, it remains low. The projected additional demand for locally grown maize according to the WFP as a consequence of implementing SFPs throughout Sub-Saharan Africa is thought to be 2.0 million metric tonnes (WFP 2006a). This would equal 5.1% of the total maize production, based on the 2006 production figures for Sub-Saharan Africa (FAO 2006). Based on this study, the expectation for the demand for locally produced foods as suggested by the WFP should probably be reconsidered.

With regard to the situation of the Ghana SFP in June 2007, a few remarks should be made on the matter of demand for locally produced foods, that should be further looked into: (1) If the school lunch of the Ghana SFP substitutes the home lunch as consumed before the implementation of the programme, the demand for (staple) foods would not increase at all. (2) If all the ingredients that were formerly needed for the preparation of the home lunches were bought inside the community and now only 32% on average of the ingredients needed for the Ghana SFP lunches is bought locally, a shift away from the community market to the district market could have occurred. (3) The on average 0.07% increase in demand for a commodity (in this case staples) not automatically results in a proportional increase of 0.07% in net income for the local farmers (the goal of the Ghana SFP is to increase farmer
income by 8.0% in the year 2010 (Ghana 2006a). Other economic indicators, like price, supply and demand of staples, need to be taken into account in analysing the local agriculture market and farmer income (Koomen 2004). (4) The final comment is that the district implementation structure of the Ghana SFP is also an important determinant of the effect of the Ghana SFP on the demand for locally produced foods. In the current implementation structure 3 of the 4 schools (exclusive of Mfantseman district) get their supplies via a middleman or retailer. Because the middlemen require salary, not all the money intended for the purchase of ingredients can be allocated to the purchases.

Conclusions and recommendations
The following final conclusions can be drawn from this study:

- Through the Ghana SFP, the dietary diversity of the diet of the school children in the selected schools increased. This may reflect in an increased nutrient adequacy of the primary school children. Whether this is a sufficient nutrient adequacy can not be determined, as no internationally agreed cut-off points are available. More research should be carried out to define suitable cut-off points for DDS to indicate nutrient adequacy.

- The Ghana SFP meets their own formulated recommendations for energy- and protein-content of the school meals. Vitamin A content is probably sufficient, but the iron intake remains low. This raises concern and more emphasis on iron intake is needed. It is advisable to look into the possibilities of inclusion of flesh foods (including meat) or the inclusion of iron-fortified products in the school menu.

- The impact of the Ghana SFP on the local demand for staple foods at district level seems limited. More research is needed to determine whether the Ghana SFP is capable of increasing the demand for locally produced foods and net income of the local farmers.
References


Eyeson KK, Ankrah EK. 1975. Composition of foods commonly used in Ghana. Food Research Institute, Council for Scientific and Industrial Research Unit (UNDP/FAO).


Janke C. 2001. Food and Education: Background considerations for policy and programming. Education Development Centre Inc.

Kennedy G, Nantel G. 2006. Basic guidelines for validation of a simple dietary diversity score as an indicator of dietary nutrient adequacy for non-breastfeeding children 2-6 years. FAO.

Koome MHC, Peerlings JHM. 2004. Economics of Agribusiness. Wageningen


NEPAD Secretariat. 2005a. CAADP Summary for the Southern Africa Regional Implementation Planning meeting.

NEPAD School Feeding Programme. 2005b. NEPAD School Feeding Programme; Annual Operating Plan.

Nevo Foundation Bureau. 2006. NEVO table 2006, Dutch Food Composition Table.


United Nations. 2005a. UN Millennium Project. Halving Hunger: It can be done; Summary version of the report of the Task Force on Hunger.


Appendices

Appendix 1: Ghana
Appendix 2: Current school feeding programmes in Ghana
Appendix 3: Programme design of Ghana School Feeding Programme
Appendix 4: Placing and use of the weighing scales
Appendix 5: Focus Group Discussion guide
Appendix 5: Calculation of variables for the demand for locally produced staple foods
Appendix 6: Food Composition Table
Appendix 7: Cooked-to-dry ratio's
Appendix 1: Ghana

Country-introduction
The republic of Ghana is a country located on the west coast of Africa and is surrounded by Côte d’Ivoire on the western side, Burkina Faso on the northern side, on the eastern side by Togo and in the south by the natural border of the Gulf of Guinea. It is a former British colony, known as the Gold Coast, and was the first sub-Saharan African Country to achieve independence in 1957. The country is subdivided in ten regions and 138 districts (Ghana 2006b) and has a population of 22.1 million in the year 2005 with an annual growth rate of 2,0% (WHO 2006b). Based on a surface area of 238,533 square kilometres, the population density is calculated to be 88 persons per square kilometre (Ghana 2006b).

Per 1000 yearly born children, the country has an infant mortality rate of 68.0 and an under-5 mortality rate of 118.3 in rural areas and of 92.7 in urban areas. The life expectancy at birth for males and females is 56 and 58 years of age respectively. Overall, Ghana ranks 9th of all 46 African countries published in the WHO Statistics Database. The ranking goes from good to worse according to the indicators. An outlier on the ranking of indicators is the literacy rate of Ghanaian adults, which ranks 27th with a percentage of 54.1% in the year 2004 (WHO 2006a). In the years 1998 to 2003, the wasting prevalence amongst under fives decreased from 9.5 to 7.8, the stunting prevalence decreased from 27.5 to 23.9 and the underweight prevalence was 26,7 in the year 1998 and decreased to 18.6 in the year 2003. The World Food Programme investigated that the poverty incidence in Accra, capital of Ghana, is less than 2%, while in the Northern Regions it is 70% to 90%. According to the United Nations database of 2006, still 45% of the population of Ghana lives on less than 1 US$ a day.

The ranking on the United Nations Human Development Index (HDI) is 138 of 177 countries with a HDI value of 0.560. The number one, which is Norway, has a score of 0.963 (UNDP 2005). The daily energy supply per capita is 2723 kcal per day according to the Food Balance Sheets, which is above the FAO/WHO cut-off point of on average 2500 kcal per capita per day (UNU, 2004). This information could indicate a food distribution problem in Ghana (WFP 2006b).

---

2 The Human Development Index takes into account (i) longevity (measured by life expectancy), (ii) knowledge (measured by a combination of adult literacy (two-thirds weight) and mean years of schooling (one-third weight) and (iii) standard of living (measured by purchasing power, based on real GDP per capita adjusted for the local cost of living (purchasing power parity, or PPP) UNDP. 2005. Human Development Report 2005; International cooperation at crossroads: aid, trade and security in an unequal world.
Appendix 2: Current School Feeding Programmes in Ghana

Several organizations carry out supplementary feeding programmes in Ghana. They include the World Food Programme (WFP), the Catholic Relief Services (CRS), World Vision, Adventist Development and Relief Agency (ADRA), Netherlands Development Agency (SNV) and SEND. In this paragraph three major organisations are highlighted, which are the WFP, CRS and World Vision.

World Food Programme (WFP)
The WFP is operating in 25 districts in the three northern regions of Ghana, where hunger is most persistent according to WFP standards. The goal of the Ghana Country Programme (2006–2010) is to support the Government in its assistance to hungry poor households to meet their education, health and nutrition needs on a sustainable basis. With regard to support for basic education, WFP wants to implement a SFP, modelled to the NEPAD SFP, under which the national school feeding programme is to be linked to local food production.

The WFP supports the Community Health and Nutrition Education Centres, set up by the Ghana Health Service, with integrated supplementary feeding, health and nutrition education activities targeting malnourished pregnant/lactating women and children from 6 months to 5 years. The school feeding programmes are aimed at the provision of supplementary meals twice a day throughout the year. The menus vary according to season and the ability of parents to contribute. The WFP import from the USA corn soy blend, vegetable and palm oil, iodized salt and sugar. To give an incentive to girls from poor families, take home rations are provided to girls showing an attendance of at least 85% in a given month.

Some of the Nutrition Education Centres are charging canteen fees for rewarding cooks and attendants and as payment for ingredients. In some centres, mothers have organised themselves in associations aimed at income-generating activities. This contributes to the view of the WFP on its food aid programmes, which is to catalyse the community organisation and women’s empowerment. (Anderson 2005; Ghana 2006a; WFP 2005)

Catholic Relief Services (CRS)
CRS aims to improve food security and the quality of life of poor families in rural areas in Ghana. The focus shifted only recently to the rural areas, whereas prior urban and semi-urban areas were also part of the operations. To accomplish the improved food security and quality of life, CRS-Ghana supports programmes that promote the involvement of local communities and organizations in the design and execution of activities and tries to integrate food assistance with other interventions, such as water, education and school health. The CRS operates mostly in the three northern regions of Ghana: the Upper west region, the Upper East region and the Northern region. Their operations consist of serving
about one third of the schools in these regions with a hot lunch on schooldays during the lean season. Also take home rations are provided to girls having a 90% attendance rate.

The foods used as ingredients for school meals are shipped from the USA to Ghana and stored in warehouses, from which two to three deliveries are yearly distributed to the schools through contracted transporters. The CRS does not provide assistance with local production and storage and controls in the storage and distribution facilities. However, the distribution and storage is now controlled by the community in most places.

The primary donor of the CRS is the United States Agency for International Development (USAID). However, USAID wants the CRS to cut back their SFP-activities with 75% by the end of the year 2008 (Anderson 2005) (CRS 2006) (Ghana 2006a)

**World Vision**

The operations of World Vision started in the year 2006 and are restricted to two districts only. In the lean season primary school children are served with school lunch. The ingredients for these lunches are purchased at the local market and sent to the schools. The schools themselves are responsible for the construction of the kitchen and storage room and each kid has to bring his/her own bowl. The parents of the children contribute to the operational costs of the programme via canteen fees of 2000 cedis per month. (Ghana 2006a)
### Appendix 3: Programme design of Ghana School Feeding Programme

**Table 13: Programme design of Ghana School Feeding Programme (Ghana 2006a)**

<table>
<thead>
<tr>
<th>1. reduce hunger and malnutrition</th>
<th>Outputs</th>
<th>Indicators of achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) All primary school children &amp; kindergarten children receive one nutritionally adequate meal per school day</td>
<td>i) the rate of growth in height and weight for age is more than the national average</td>
</tr>
<tr>
<td></td>
<td>b) Baseline data produced</td>
<td>ii) the height, weight and upper arm circumference of under fives in the Ghana SFP should be greater than the national average</td>
</tr>
<tr>
<td></td>
<td>c) 1.04 million children fed each school day by 2010</td>
<td>iii) Meals produced and consumed by children on school days</td>
</tr>
<tr>
<td></td>
<td>d) Higher growth rate of height and weight for age than national average.</td>
<td>(iv) (BMI) of target group raise to standard level (19-25)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. increase school enrolment, attendance and retention</th>
<th>Outputs:</th>
<th>Indicators of achievement:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Enrolment in GSFP schools increased</td>
<td>i) Increase enrolment in Ghana SFP schools above the national baseline of 83.3%</td>
</tr>
<tr>
<td></td>
<td>b) Attendance in GSFP schools improved and dropout rates reduced</td>
<td>ii) Improve attendance in GSFP schools by 20% by the end of the programme</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) Reduce drop out rate by 20% in GSFP schools</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. boost domestic food production</th>
<th>Outputs:</th>
<th>Indicators of achievement:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Income of local farmers increased</td>
<td>i) production of farmers (linked to the Ghana SFP or supplying to the Ghana SFP) increased</td>
</tr>
<tr>
<td></td>
<td>b) Production of local farmers increased using environmentally sustainable methods</td>
<td>ii) income of farmers supplying to the Ghana SFP increased</td>
</tr>
<tr>
<td></td>
<td>c) Farms started in schools participating in Ghana SFP</td>
<td>iii) 40% of the Ghana SFP beneficiary schools have school farms.</td>
</tr>
</tbody>
</table>
Appendix 4: Placing and use of the weighing scales
Appendix 5: Focus Group Guide for Farmers

A) Food production
First I will like to know something about the farming activities in this area that you are engaged in.
Probes: What do you cultivate/grow?
   What proportion of this do you sell for a living?
   Who are your main customers?
   Do you sometimes have problems selling your farm produce?

B) Awareness about School Feeding Programme
Are you aware of the free meals programme to schools?
Probes Can you tell me what you know about it?
   How did you hear about it?

C) General Benefits and perceived problems
What do you perceive as the benefits of the programme if any?
   Has the programme in any way influenced:-
   i) Your volume or quantity of food you produce?
   ii) Sources for marketing your farm produce?
   iii) Prices of the food you produce?
   iv) Your net income from crop production?
   Why or why not?
   What do you consider to be problems if any?

D) Nutritional and health benefits
I would like us to talk about its influence on well being of school children. In your view has the programme brought any health benefits to school children?
Why or why not?

E) School attendance
In your view has the introduction of the scheme influenced children’s attendance to school?
Probes Why or why not

F) Closing
In your opinion do the arrangements for the programme require changes?
Probes Why or why not
   Are there any suggestions or comments about the programme?
<table>
<thead>
<tr>
<th>Code</th>
<th>Source table</th>
<th>Source code</th>
<th>Name ingredient</th>
<th>Energy</th>
<th>Energy</th>
<th>Moisture</th>
<th>Protein</th>
<th>Fat</th>
<th>CHO</th>
<th>Vit A RAE</th>
<th>Iron mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ghana</td>
<td>99</td>
<td>agushie, shelled</td>
<td>2372</td>
<td>561</td>
<td>6.0</td>
<td>27.1</td>
<td>48.8</td>
<td>14.4</td>
<td>0</td>
<td>5.5</td>
</tr>
<tr>
<td>2</td>
<td>Mali</td>
<td>153</td>
<td>banana, raw</td>
<td>369</td>
<td>88</td>
<td>77.0</td>
<td>1.5</td>
<td>0.1</td>
<td>20.0</td>
<td>8</td>
<td>0.3</td>
</tr>
<tr>
<td>3</td>
<td>Mali</td>
<td>384</td>
<td>beans, white, dried</td>
<td>1215</td>
<td>289</td>
<td>8.9</td>
<td>22.1</td>
<td>1.5</td>
<td>46.1</td>
<td>15</td>
<td>5.7</td>
</tr>
<tr>
<td>4</td>
<td>Mali</td>
<td>155</td>
<td>cabbage, raw</td>
<td>116</td>
<td>28</td>
<td>90.0</td>
<td>1.4</td>
<td>0.1</td>
<td>5.2</td>
<td>6</td>
<td>0.3</td>
</tr>
<tr>
<td>5</td>
<td>Ghana</td>
<td>42</td>
<td>cassava dough</td>
<td>828</td>
<td>198</td>
<td>50.8</td>
<td>0.8</td>
<td>0.5</td>
<td>47.5</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mali</td>
<td>46</td>
<td>cassava, sweet, dried</td>
<td>1482</td>
<td>353</td>
<td>8.7</td>
<td>1.3</td>
<td>0.5</td>
<td>84.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ghana</td>
<td>4</td>
<td>corn dough</td>
<td>879</td>
<td>210</td>
<td>47.0</td>
<td>5.1</td>
<td>1.4</td>
<td>45.8</td>
<td>2</td>
<td>9.9</td>
</tr>
<tr>
<td>8</td>
<td>Ghana</td>
<td>308</td>
<td>coconut oil</td>
<td>3699</td>
<td>884</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mali</td>
<td>137</td>
<td>egg, hen raw</td>
<td>591</td>
<td>141</td>
<td>75.0</td>
<td>12.1</td>
<td>1.0</td>
<td>1.0</td>
<td>175</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Mali</td>
<td>108</td>
<td>fish, smoked</td>
<td>1587</td>
<td>378</td>
<td>5.8</td>
<td>76.0</td>
<td>8.0</td>
<td>0.0</td>
<td>35.0</td>
<td>16.7</td>
</tr>
<tr>
<td>11</td>
<td>Mali</td>
<td>106</td>
<td>fish, raw, fat</td>
<td>598</td>
<td>143</td>
<td>73.5</td>
<td>15.8</td>
<td>8.9</td>
<td>0.0</td>
<td>5</td>
<td>1.5</td>
</tr>
<tr>
<td>12</td>
<td>Ghana</td>
<td>227</td>
<td>stink fish</td>
<td>561</td>
<td>134</td>
<td>57.6</td>
<td>26.2</td>
<td>2.4</td>
<td>0.0</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Ghana</td>
<td>272</td>
<td>tuna, hot, smoked</td>
<td>661</td>
<td>158</td>
<td>62.6</td>
<td>34.5</td>
<td>1.2</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mali</td>
<td>149</td>
<td>Garden eggs</td>
<td>133</td>
<td>32</td>
<td>90.0</td>
<td>1.0</td>
<td>0.2</td>
<td>6.4</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Mali</td>
<td>147</td>
<td>garlic</td>
<td>568</td>
<td>135</td>
<td>64.0</td>
<td>7.9</td>
<td>0.6</td>
<td>24.2</td>
<td>0.0</td>
<td>1.9</td>
</tr>
<tr>
<td>16</td>
<td>Mali</td>
<td>78</td>
<td>groundnut paste</td>
<td>2452</td>
<td>584</td>
<td>7.2</td>
<td>25.0</td>
<td>47.2</td>
<td>16.5</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Mali</td>
<td>262</td>
<td>cube maggi</td>
<td>716</td>
<td>170</td>
<td>3.3</td>
<td>17.3</td>
<td>4.0</td>
<td>16.1</td>
<td>15.0</td>
<td>2.2</td>
</tr>
<tr>
<td>18</td>
<td>Mali</td>
<td>143</td>
<td>goat, moderately fat, raw</td>
<td>713</td>
<td>170</td>
<td>68.0</td>
<td>18.0</td>
<td>11.0</td>
<td>0.0</td>
<td>0.0</td>
<td>2.3</td>
</tr>
<tr>
<td>19</td>
<td>Mali</td>
<td>227</td>
<td>leaves, dark green, raw</td>
<td>258</td>
<td>61</td>
<td>80.0</td>
<td>4.5</td>
<td>0.3</td>
<td>10.0</td>
<td>275.0</td>
<td>7.2</td>
</tr>
<tr>
<td>20</td>
<td>Mali</td>
<td>170</td>
<td>okro, pods, raw</td>
<td>162</td>
<td>39</td>
<td>89.0</td>
<td>2.1</td>
<td>0.2</td>
<td>7.0</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Mali</td>
<td>183</td>
<td>onion, shallot, mature bulbs, raw</td>
<td>170</td>
<td>41</td>
<td>88.0</td>
<td>1.2</td>
<td>0.1</td>
<td>8.6</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Mali</td>
<td>252</td>
<td>palmoil, fresh</td>
<td>2590</td>
<td>617</td>
<td>10.2</td>
<td>4169</td>
<td>70.0</td>
<td>140.0</td>
<td>38.5</td>
<td>88</td>
</tr>
<tr>
<td>23</td>
<td>Mali</td>
<td>193</td>
<td>pepper, dried</td>
<td>1407</td>
<td>335</td>
<td>10.2</td>
<td>13.8</td>
<td>14.0</td>
<td>38.5</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Mali</td>
<td>148</td>
<td>pineapple, fresh</td>
<td>223</td>
<td>53</td>
<td>87.0</td>
<td>0.4</td>
<td>0.1</td>
<td>12.5</td>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>25</td>
<td>Mali</td>
<td>152</td>
<td>plantain, ripe, raw</td>
<td>576</td>
<td>137</td>
<td>65.0</td>
<td>1.2</td>
<td>0.3</td>
<td>32</td>
<td>33</td>
<td>0.6</td>
</tr>
<tr>
<td>26</td>
<td>Mali</td>
<td>372</td>
<td>rice, white, polished</td>
<td>1450</td>
<td>345</td>
<td>11.0</td>
<td>6.1</td>
<td>0.5</td>
<td>78.2</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Mali</td>
<td>279</td>
<td>tomato concentrate</td>
<td>405</td>
<td>96</td>
<td>72.0</td>
<td>4.5</td>
<td>0.2</td>
<td>18.9</td>
<td>105</td>
<td>3.5</td>
</tr>
<tr>
<td>28</td>
<td>Mali</td>
<td>201</td>
<td>tomatoes, fresh</td>
<td>92</td>
<td>22</td>
<td>94.0</td>
<td>1.0</td>
<td>0.2</td>
<td>4.0</td>
<td>32.0</td>
<td>0.6</td>
</tr>
<tr>
<td>29</td>
<td>NEVO</td>
<td>413</td>
<td>tomatosuccere</td>
<td>54</td>
<td>13</td>
<td>10.2</td>
<td>0.9</td>
<td>0.9</td>
<td>2.3</td>
<td>22</td>
<td>0.3</td>
</tr>
<tr>
<td>30</td>
<td>Mali</td>
<td>375</td>
<td>vegetable oil</td>
<td>3700</td>
<td>900</td>
<td>0.0</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Unilever</td>
<td>frytol</td>
<td>frytol</td>
<td>3700</td>
<td>900</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Mali</td>
<td>264</td>
<td>water</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>Mali</td>
<td>375</td>
<td>wheatflour, white</td>
<td>1437</td>
<td>342</td>
<td>11.6</td>
<td>10.3</td>
<td>1.5</td>
<td>71</td>
<td>0</td>
<td>4.5</td>
</tr>
<tr>
<td>34</td>
<td>Mali</td>
<td>44</td>
<td>yam, tuber, fresh</td>
<td>499</td>
<td>119</td>
<td>69.0</td>
<td>1.9</td>
<td>0.2</td>
<td>27</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Appendix 7: Cooked-to-dry ratio's

Table 15: Ratio cooked product to dry product

<table>
<thead>
<tr>
<th>Product</th>
<th>Dry</th>
<th>Cooked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banku</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Beans</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Gari</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Plantain</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Rice</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Yam</td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>
### Appendix 8: Calculation of variables of the demand for locally produced staple foods

**Table 16: Calculation of variables of the demand for locally produced staple foods**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Calculation</th>
<th>Assumption(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand per week per school (kg)</td>
<td>the staple foods were filtered from the AES-list of 10 food products with the highest amount of cultivated area in the district; the mean staple intake of a 3rd grade pupil was determined, based on the weighed dietary records; the average 3rd grade pupil staple intake was multiplied by the number of enrolled pupils in school.</td>
<td>- the 2005-2006 list of production figures remains the same for 2006-2007; - all pupils in the school consume the same amount of staple food.</td>
</tr>
<tr>
<td>Demand per year per school (metric tonnes)</td>
<td>the demand per week per school was multiplied by the number of school weeks in one year.</td>
<td>- every school year has 32 weeks - the enrolment in the schools remains the same - the other Ghana SFP schools in the district are comparable to the selected school</td>
</tr>
<tr>
<td>Demand in district per year (metric tonnes)</td>
<td>the demand per year per school was multiplied by the number of schools enrolled in the Ghana SFP in July 2007.</td>
<td>- the pupils enrolled in the programme are equally divided among the districts - every school year has 32 weeks</td>
</tr>
<tr>
<td>Demand in district by the year 2010 (metric tonnes)</td>
<td>the mean staple intake of a 3rd grade pupil was multiplied by 7500 children (1.040.000 children divided by 138 districts)</td>
<td>- the pupils enrolled in the programme are equally divided among the districts - every school year has 32 weeks</td>
</tr>
<tr>
<td>Percentage of total production per district (metric tonnes)</td>
<td>the demand per district per year is expressed as percentage of the staple production in the agricultural season of 2005-2006</td>
<td>- the 2005-2006 list of production figures remains the same throughout the years;</td>
</tr>
<tr>
<td>Percentage of total production per district by the year 2010 (metric tonnes)</td>
<td>the demand for staples by the year 2010 is expressed as percentage of the staple production in the agricultural season of 2005-2006</td>
<td>- the 2005-2006 list of production figures remains the same throughout the years;</td>
</tr>
</tbody>
</table>