The United Republic of Tanzania

TRENDS IN FOOD INSECURITY IN MAINLAND TANZANIA

Food Security and Nutrition Analysis of Tanzania Household Budget Surveys 2000/1 and 2007

National Bureau of Statistics,
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The United Republic of Tanzania

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Acronyms

AAS	Amino Acid Score
ADER	Average Dietary Energy Requirement
BMI	Body Mass Index
BMR	Basal Metabolic Rate
COICOP	International Classification of Individual Consumption by Purpose
CPI	Consumer Price Index
CV	Coefficient of variation
DEI	Dietary Energy Intake
DES	Dietary Energy Supply
DEC	Dietary Energy Consumption
DSM	Dar es Salaam
EAR	Estimated Average Requirement
EC	European Community
FAO	Food and Agriculture Organization
FBS	Food Balance Sheet
FCT	Food Composition Tables
FSSM	Food Security Statistical Module
FPI	Food Price Index
HBS	Household Budget Survey
IMR	Infant Mortality Rate
ISU	International System of Units
MDER	Minimum Dietary Energy Requirement
MDG	Millennium Development Goals
NBS	National Bureau of Statistics
NPS	National Panel Survey
PAL	Physical Activity Level
PCFP	Prevalence of Critical Food Poverty
PDCAAS	Protein Digestibility Corrected Amino Acid Score
RNI	Recommendations of Nutrient Intake
SOFI	State of Food Insecurity
SPSS	Statistical Package for the Social Sciences
TSh	Tanzania Shilling
USDA	United States Department of Agriculture
WFS	World Food Summit
WHO	World Health Organization
UNU	United Nations University

Foreword

This report presents the findings of the joint research work by the National Bureau of Statistics (NBS) in collaboration with the Food and Agricultural Organization of the United Nations (FAO). The research is the result of further analysis of the 2000/01 and 2007 Tanzania Household Budget Surveys (HBS's) data. HBS surveys are conducted for a period of one year and contain rich information on the type, quantity and values of food consumed by the Tanzanians households.

This joint research was conducted under the framework of technical assistance from FAO and the financial support from the European Community (EC) to the NBS and other stakeholders on food security. The availability of the two HBS data sets has made the trend analysis of food security indicators possible.

The report presents both macro and micronutrients trends for Mainland Tanzania and therefore contributes to the availability of very useful information needed to assist policy makers and programme implementers to monitor and evaluate existing programmes and to design new food consumption related strategies. We therefore hope that the results of this study will be useful for advocacy, research, policy formulation, decision-making and program development.

One important aspect of this report is that it contains the trend analysis, which is imperative in tracking and assessing the country progress in achieving the country and global goals. For example, the report enables us to assess the progress made in achieving the Millennium Development Goal (MDG) Number 1.9 indicator, which advocates for the reduction of hunger; that is to reduce the proportion of the population below minimum level of dietary energy consumption by half by 2015.

The analysis was also meant to serve as a capacity building for the NBS and other stakeholders in using the food consumption data from Household Budget Surveys to derive food security indicators. This knowledge will enable the NBS staff to make more use of the HBS data in future and therefore contributes to the availability of food security information for development strategies of the country.

The FAO organized the National Demonstration Centre (NDS) on Food Security and Consumption Statistics in Dar es Salaam in February, 2010 that introduced the researchers to the Food Security Statistics Module (FSSM) software developed by FAO Statistics Division. The workshop was attended by 15 national officers from NBS, Office of the Chief Government Statistician (OCGS) - Zanzibar, Ministry of Agriculture, Food Security and Cooperatives, and the Ministry of Trade, Industry and Marketing. The FSSM software was eventually used in the analysis that produced inputs for this report.

Dr. Albina A. Chuwa
Director General – National Bureau of Statistics
December 2010

Acknowledgement

The NBS and FAO wishes to acknowledge the contribution of various people who made this report a huge success. First and foremost, we appreciate the technical assistance provided by Mr. Seevalingum Ramasawmy, FAO Statistician, Mr. Ricardo Sibrian, former FAO Senior Statistician and Ms. Ana Moltedo, FAO Consultant for their valuable support and contribution to this food security activity. Grateful appreciation to the FAO Representative in Tanzania, Ms Louise Setshwaelo and her staff who have provided the necessary administrative support since the inception of the project.

We are also grateful to the analysts and participants of the NDC, these are Aldegunda Komba, Mlemba Abassy, Elinzuu Nicodemo, Israel Mwakapalala, Devotha Antony, Norvati Buberwa, Stephen Maganda and William Mabusi of NBS; Mdachi Kombo and the late Bakari Hamad of OCGS; Onasimbo Ntikha of Ministry of Agriculture, Food Security and Cooperatives, Francis Lwesya of Ministry of Industry, Trade and Marketing and Mansura M. Kassim of the Ministry of Agriculture Zanzibar.

This report has benefited from contributions by experts from various Ministries and regional offices together with international experts from WFP, World Bank, DFID and UNICEF who participated in the National Seminar on Food Security Statistics and Multisectoral Perspectives, in October 2010, in Dar es Salaam, Tanzania.

We would also like to thank the Economic Commission of the European Union for their financial support to this successful food security activity in Tanzania.

Dr. Albina A. Chuwa
Director General – National Bureau of Statistics
December 2010

EXECUTIVE SUMMARY

At the start of the twenty-first millennium, one person out of four Tanzanians was not consuming enough food to cover his/her minimum daily requirements. Seven years later, even though the dietary energy consumption increased by 30 Kcal/person/day, the food deprivation level remained the same due to an increase in the inequality of access to food in the country.

Level of hunger as measure by the MDG indicator 1.9 varied differently from region to region during the seven-year period of study. Out of the 20 regions of Tanzania, 9 showed an increase in the level of food deprivation with Tabora and Dodoma regions moving from a low level to a high level of food deprivation. On the other hand, among regions, which experienced decreases in their food-deprived level, Dar es Salaam and Kilimanjaro regions reached moderate levels of food deprivation in 2007.

Level of hunger was not equally distributed over the country in 2007 when regions of Tanga, Morogoro and Iringa experienced moderate levels of food deprivation (10%) while Mara, Arusha, Manyara, Lindi, Mtwara, Rukwa, Kagera and Mwanza regions had more than 30 percent of their population suffering from hunger. It was observed that Mara was the region showing the maximum prevalence of undernourishment in Tanzania, with almost half of its population suffering from hunger.

The average daily dietary energy consumption (DEC) of Tanzania which was 2200 Kcal per person in 2000/1 increased to 2,230 kcal in 2007. Cereals and their products, mainly of maize and rice, were the major contributors of energy to the Tanzanian diet, followed by roots and tubers. During the period of study, it was observed a change in the pattern of calories consumed between urban and rural areas. While in 2000/1, households in rural areas were consuming more energy than those in urban ones, in 2007 this situation reversed. The range of dietary energy consumption fell from 2120 kcal in 2000/1 to 1790 kcal in 2007. Consumption in rural areas decreased from 2210 to 2190 kcal while that in urban areas increased from 2190 to 2280 kcal. In 2007, the lowest DEC of 1820 kcal was observed in Mara and the highest Dec of 2620 Kcal/person/day was in Morogoro. Among income groups, the lowest income quintiles had a significantly low DEC of 1690 kcal while those of the highest income quintile had the highest dietary consumption of 3480 kcal/person/day.

At the beginning of the decade, Tanzanians on average were spending 100.31 TSh to purchase 1000 kcal and this value was more than doubled to reach 215.85 TSh in 2007. However, food prices have gone up by only 54 percent during that seven-year period.

In both surveys, about two third of the household consumption budgets was devoted to food. Food consumption from own production represented about 25 percent of total food expenditures but contributed to about 40 percent of total dietary energy consumed. Urban areas had much higher share of food from purchases than rural areas, rending urban households very vulnerable to price fluctuations. While in the region of Shinyanga, big producer of cereals, reliance on own production was rending households of the region more vulnerable to changes in weather condition.

The inequality of access to food also increased as revealed by measures of coefficient of variation ($CV_{x/inc}$) of dietary energy consumption due to income. The $CV_{x/inc}$ for rural areas increased from 23.2 to 25 percent, while that of urban areas moved marginally from 26.3 to 26.7 percent. However, Dar es Salaam, which registered a moderate level of food deprivation, had its $CV_{x/inc}$ felt from 34.4 in 2001 to 25.2 in 2007.

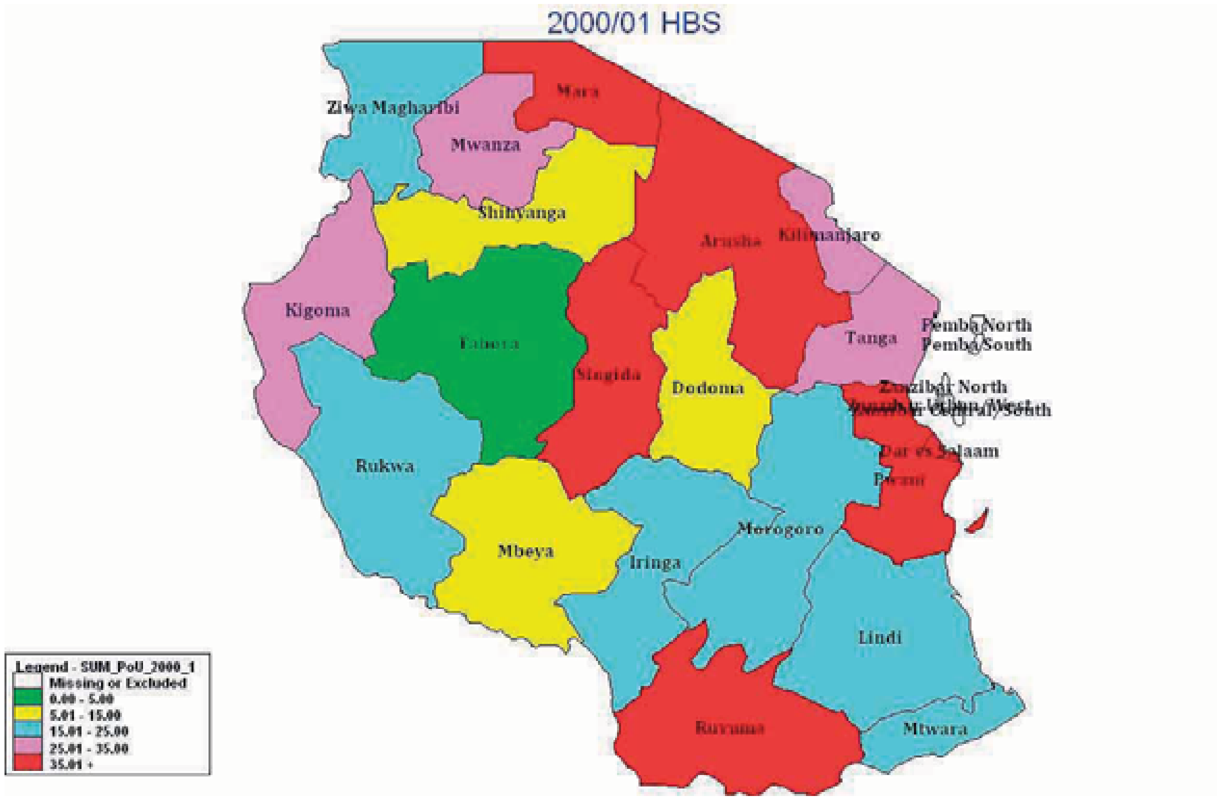
Cereals and their products, mainly maize and rice, were the main sources of dietary energy, followed by roots and tubers. The diet consumption during both reference periods was diversified as food items from thirteen commodity groups were usually consumed. There has been a rise in the protein and fat consumption at the expense of a decrease of carbohydrate products between the two reference periods. Tanzanians are moving towards a balanced micronutrients diet particularly those in Arusha, Dar es Salaam and Tabora. Populations of the other regions were high consumers of carbohydrates, which are mainly cereals products.

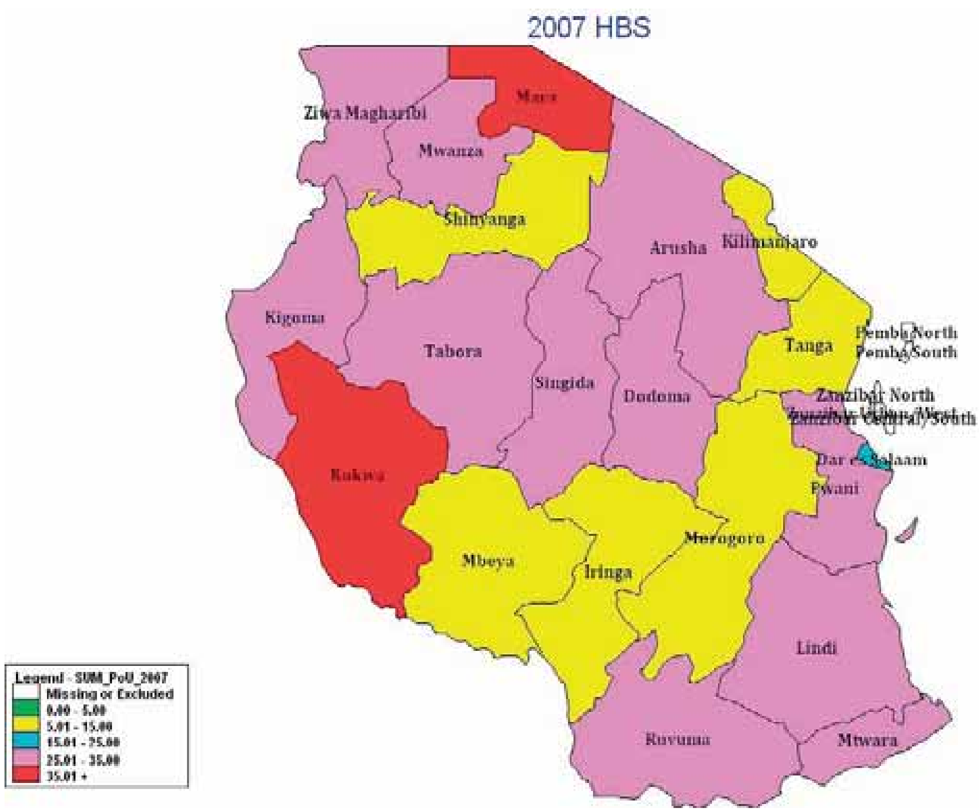
Food deprivation increased in poor households, particularly in the lowest income quintile, while it decreased in the rest of households nationwide. Food deprivation decreased in urban Tanzania, particularly in Dar es Salaam, while it failed in rural Tanzania; in 2000/1 rural households consumed more energy than those in urban ones, while in 2007 this situation reversed.

Among the twenty regions of Tanzania, nine regions registered increases in the prevalence of food deprivation while eleven had improved their food insecurity from 2000/1 to 2007.

The Tanzania diet has improved from the macronutrient viewpoint. The quality of protein consumed has improved with an increase in the share of animal protein from 21 percent in 2000/1 to 28 percent in 2007. However, total protein was still deficient in the essential amino acid lysine. Tanzania showed a low consumption of calcium and vitamin B12 in 2007, except the Iringa region with adequate calcium consumption.

Prevalence of Undernourishment (%) in Mainland Tanzania & Provinces





I. INTRODUCTION

Tanzania's economy has been growing steadily since the implementation of macroeconomic stabilisation and structural reform programme in the mid-nineties. Its annual growth rate of the gross domestic product (GDP) was between five and seven percent over the past decade. It relies heavily on agriculture, which accounts for nearly 25 percent of the GDP and employs about 80 percent of the labour force. The agricultural sector has benefited from the programme of the liberalisation of production and marketing structures and product prices. The service sector is growing, particularly the tourism, which ranks as the second highest foreign exchange earner after agriculture. Mineral production (gold, diamonds, and tanzanite) has grown significantly in the last decade. It represents Tanzania's biggest source of economic growth, provides over three percent of GDP and accounts for half of Tanzania's exports.

The 2009 population estimate of Tanzania was 41 million compared to 33 million in the 2002 Population census. About 70 percent of the population live in rural areas of which 38.7 percent were below the rural poverty line in 2001. The poverty rate in urban regions was 29.5 percent and indicated inequalities among households living in rural and urban areas. Tanzania was rated 164th out of 177 countries on the Human Development Index in 2005. Stunting of preschool age children has decreased from 38 to 35 percent from 2004 to 2010. Boys were more stunted, 46 percent, than girls, 39 percent. Rural children were more stunted, 45 percent, than urban. Dodoma showed the largest share of stunting, 56 percent, in contrast Dar es Salaam showed the lowest share, 19 percent.

The food consumption data collected in the 2000/1 and 2007 Tanzania HBS was analysed using the FAO statistical framework for the global estimation of the prevalence of undernourishment. The food security analysis of the Tanzania HBS was conducted in a training workshop in Dar es Salaam in February 2010 among national HBS experts of the National Bureau of Statistics and food security officers of the Tanzania Ministries of Agriculture and Trade and Commerce. The Food Security Statistics Module (FSSM) developed by FAO Statistics Division was applied to both the 2000/1 and 2007 Household Budget Survey (HBS).

This report presents a trend analysis of food security indicators derived from the food consumption data collected in the 2000/1 and 2007 Household Budget Survey (HBS). The assessment of food insecurity at national and sub national levels from the two surveys provides information for evaluating the impact of food policies and programmes implemented during the reference period of study. The report provides a suite of food security indicators, including the hunger indicator 1.9 of the MDG and an assessment of some micronutrients and essential amino acids of the Tanzanian diet.

II. MAINLAND TANZANIA HOUSEHOLD BUDGET SURVEYS (2000/1 & 2007)

II.1. Mainland Tanzania HBS

The regular HBS programme of Tanzania National Bureau of Statistics (NBS) started in 1991/92 to collect information on consumption and expenditure in households for poverty mapping and analysis of changes in living standards of Tanzanians over time. NBS conducted the 2007 HBS from January to December sampling 10,752 households and the 2000/1 HBS with 22,178 households. The set of questionnaires used for the 2000/1 HBS with some minor improvements was implemented in the 2007 HBS. Both collected a wide range of information on households and its members relating to geographical, demographic, health, and socio-economic dimensions.

The sampling design and selection of the 2000/1 HBS was based on information of the 1988 Population Census. Primary sampling units (PSU) in urban and rural areas were selected using probability proportional to size of households. A two stage stratified sampling was used and the selection of households in the sampled PSUs made using categories of household income. The same sampling design was implemented for the 2007 HBS using more up-to-date information from the 2002 Tanzania Population Census. Region was one of the sampling criteria in the 2000/1 HBS, but was not included in those for 2007 HBS.

Regional estimates are very useful for the location and identification of the food insecure population groupings as different regions may require different types of food policies and programmes. The twenty regions of Tanzania were well represented in the 2007 HBS sample of households and they were used for deriving food security estimates, which should be interpreted cautiously. Comparison of the regional estimates are useful to link changes in food insecurity with the local and national policies implemented.

II.2. Food Data of Mainland Tanzania HBS

Almost the same collecting instruments were used to collect household consumption and expenditure data in both surveys. A main household questionnaire was used to collect household and member characteristics. The daily diary was used for recording household consumption, expenditure and income over the household survey period of one month. A personal diary was given to each adult of the sampled households to record of daily outside home expenses. A recall questionnaire was used to collect information on non-food items purchased in the past year. Food consumption collected in both surveys included the purchases and non-purchases, which are the home produced food items, food received by the household (gifts or support from other households) and food payments in kind for work done. Both quantity and monetary values were recorded for each food item. Some quantities of a few food items were in local units of quantity measurement and were converted using appropriate conversion factors prepared by the NBS. Food items that had not been purchased were valued in monetary terms at local market prices. Both surveys have a common food list of 135 items.

II.3. Nutrients Conversion Factors

All food quantities were converted to nutrients values using corresponding nutrients values from the Tanzania Food Composition Table (TFCT), which contains information on 47 nutrients for over 400 food items including local dishes. The TFCT supplied most of nutrient conversion factors for the 135 food items of the HBS and a few missing ones were complemented with some additional information from the USDA Food Composition Table (FCT). The nutrients include macro and micronutrients, and amino acids, which allows further analysis of micro nutrient consumption and diet quality.

The quantities of all food items as reported in the HBS were in terms of purchased quantities. These quantities were converted to quantities consumed using corresponding values of edible portions. Edible portions coefficients from the USDA-FCT were used, as they were not available in the TFCT. Nutrient values for liquid and semi-liquid food items were given by 100 grams weight in the TFCT. Quantities for liquid and semi-liquid food items were converted to grams using specific density factors derived from the USDA-FCT.

II.4. Minimum Dietary Energy Requirement (MDER)

The daily minimum dietary energy requirement per person is one of the parameters for estimating food deprivation using the FAO methodological statistical framework in the global estimations of prevalence of undernourishment. The energy requirement of groups of *individuals* is the amount of energy from food intake that will balance energy expenditure when *individuals* have body size and composition, consistent with long-term good health, and allow *individuals* for performing physical activity, economically necessary and socially desirable.

The standards of energy requirement for populations by sex and age groups are reviewed and updated by experts in FAO/WHO/UN consultations regularly. The last update was held in Rome from 17-24 October 2001, in the 2004 Report of a Joint FAO/WHO/UNU Expert Consultation on Human Energy Requirements.

The human energy requirements are expressed as multiple of the Basal Metabolic Rate (BMR) based on the Physical Activity Level (PAL). The BMR is the energy needed for complete rest. The energy needed is BMR multiplied by the PAL index. Additional energy for growth in children and pregnancy and lactation in women is taken into account. The energy requirement for each sex-age group depends on body weight and index. For a given height, there is a range of body weight that is consistent with good health; similarly, there is a range of PALs that is consistent with the performance activity of economically necessary and socially desirable.

The minimum dietary energy requirement is the weighted average of low limits of energy requirements estimated for each sex and age group. The low limit of energy requirement corresponds to the low acceptable weight-for-height and the low acceptable physical activity, that is, sedentary.

The weighted MDER estimates for all national and sub-national population groupings for the 2000/1 and 2007 HBS were calculated using as weights the sex and age population structures derived from household member data on sex and age of the corresponding HBS.

The MDER is used as the cut-off point for estimating the prevalence of food deprivation within the statistical framework under the assumption that DEC is distributed as lognormal.

MINIMUM DIETARY ENERGY REQUIREMENT (MDER)

In the entire population, the minimum dietary energy requirement is the weighted average of the minimum energy requirements of the different sex and age groups in the population. In a specified sex and age group, the amount of dietary energy per person that is considered adequate to meet the energy needs for minimum acceptable weight for attained-height maintaining a healthy life and carrying out a sedentary physical activity level.

Height data were not available from any of the two surveys. However, the attained-height data were available from the recent 2008 anthropometric panel survey and was used for deriving body weight for estimating MDER for both surveys on the assumption that attained height varies slowly over time.

The MDER estimates ranged from 1655 to 1782 kcal/person/day. There was no significant change in MDER in Tanzania at the national and sub national levels from 2000/1 to 2007. The national age and sex structure of the population of Mainland Tanzania has not changed significantly see figure 1.

Figure 1: Population Pyramids 2000 and 2005

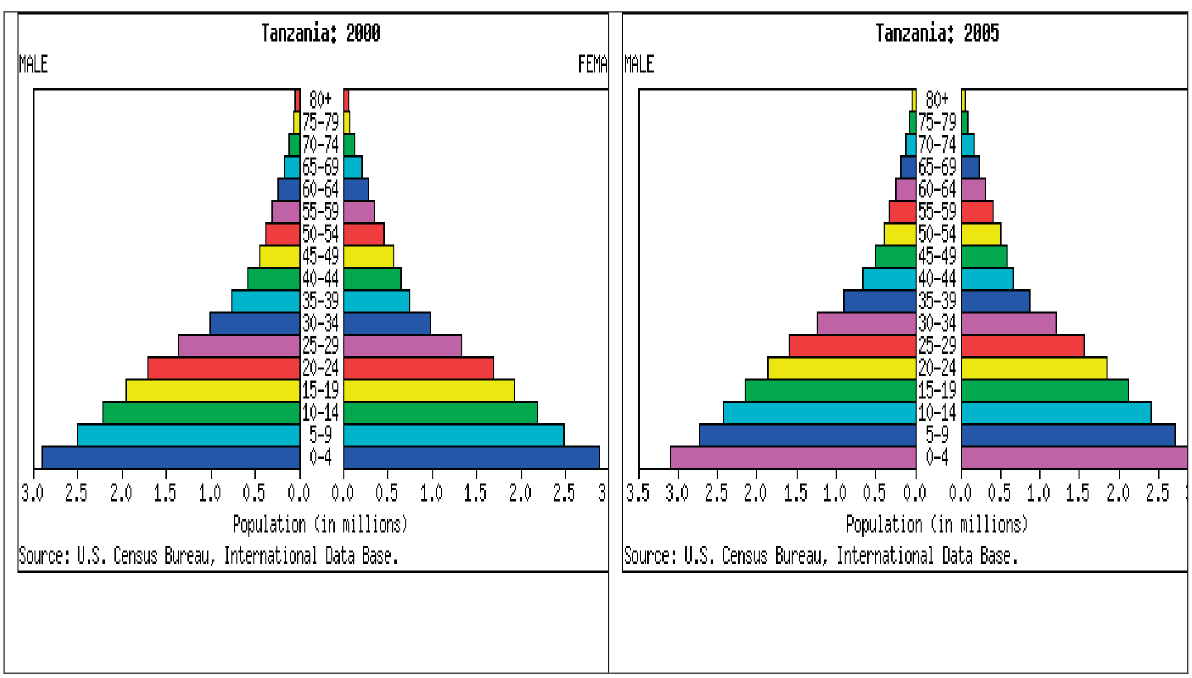
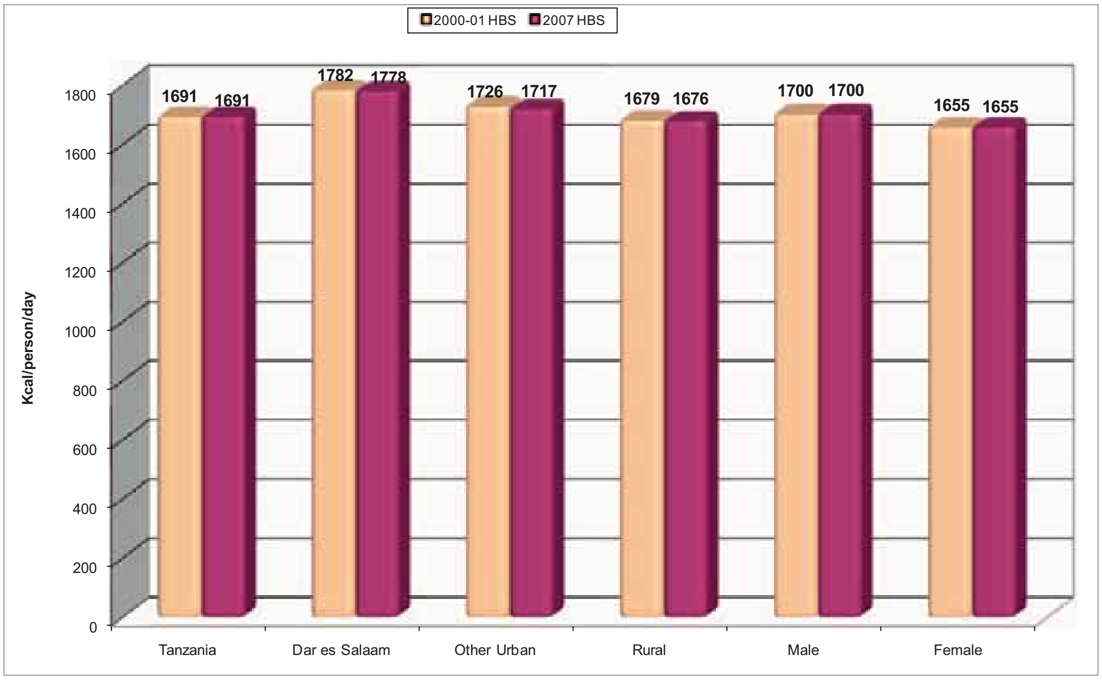


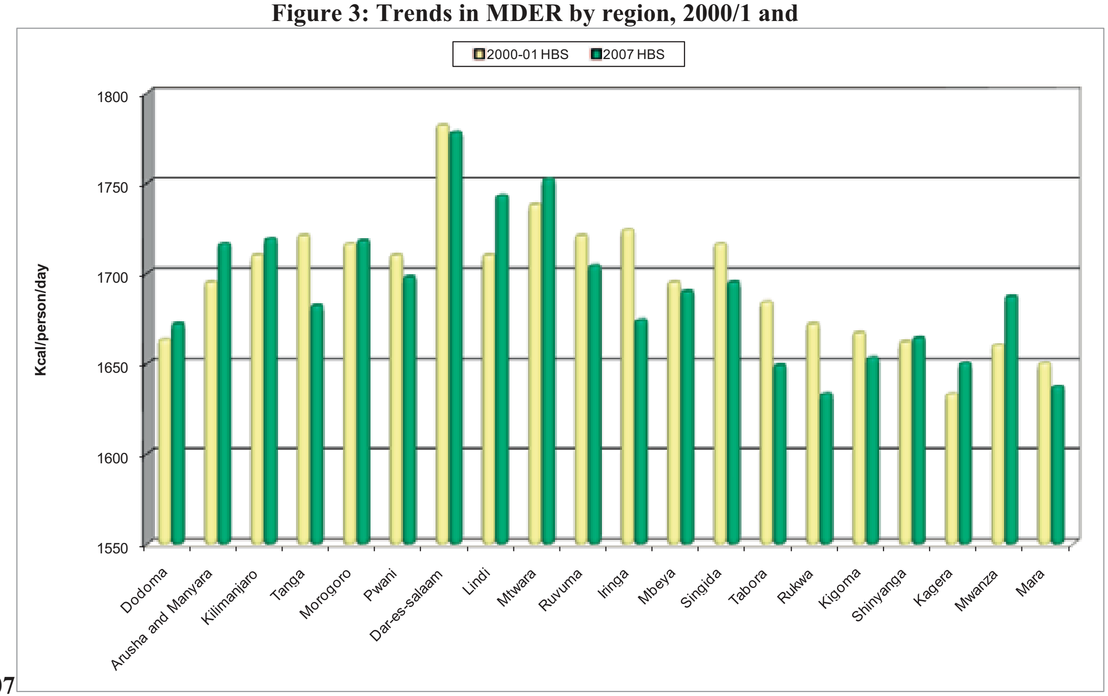
Figure 2 shows the MDER estimates from both surveys for Mainland Tanzania, by area of residence and gender of head of household.

Figure 2: Trends in MDER in Tanzania, by area and household-head gender, 2000/1 and 2007



However, the MDER by region changed significantly as shown in Figure 3. MDER increases were noted in the regions of Lindi, Arusha and Manyara and Mwanza. These increases are due to higher percentage of adults. The remaining 11 regions showed decreases up to three percent (Iringa). These shifts in the age and sex structure of those regions could be explained by migration of the population across of regions.

Figure 3: Trends in MDER by region, 2000/1 and



2007

III. TREND ANALYSIS OF FOOD SECURITY INDICATORS

This section presents the results and findings derived from a cross section analysis of the food consumption data with households' and household members' characteristics collected in the two HBS, 2000/1 and 2007. The derived food security information is useful to identify the direction of trends and quantify the magnitude of food insecurity as well as locate and identify the food deprived population groupings in terms of geographic, demographic and socio economic population factors available in the HBS. Total household expenditure is used as a proxy of income as the data contained inconsistencies due to misreporting and sensitivity of income among Tanzanian households. The trend analysis use the regional groupings as for the 2000/1 HBS. The statistics derived are indicative within acceptable limits of reliability.

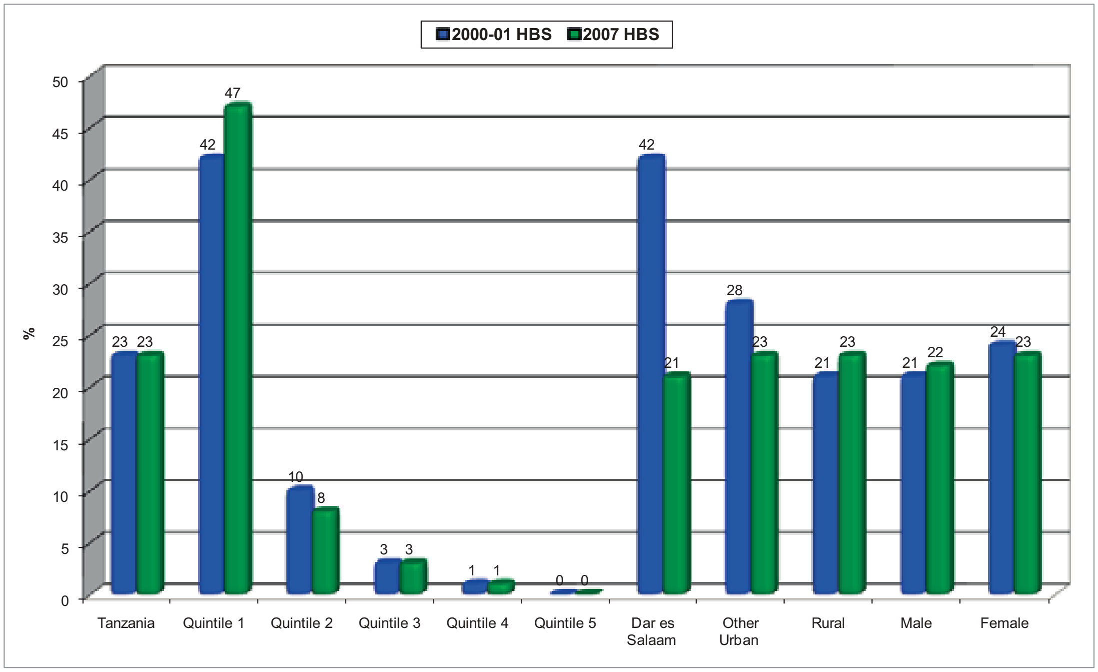
III.1. Prevalence of Food Deprivation

The prevalence of food deprivation, as defined by the FAO methodology, is based on a parametric approach with three key parameters. Two parameters are for the specification of the distribution of dietary energy consumption (DEC) under the assumption of log normality, the mean or average dietary energy consumed (Section III.3), and the variance of the distribution estimated as a non-linear function of the coefficient of variation reflecting the inequality in access to food (Section III.4). The third parameter is the cut-off value of DEC below which within the distribution of DEC food deprivation occurs, that is, the minimum dietary energy requirement (MDER) for a minimum acceptable body weight for attained-height and carrying out a minimum acceptable level of light physical activity while maintaining a healthy life and (Section II.4).

The prevalence of food deprivation is thus the proportion of people whose daily DEC is lower than the MDER. It is assumed that DEC is the closest measure of dietary energy intake (DEI), which is very difficult to measure through HBS in practical and conceptual terms.

Between the two HBS, 2000/1 and 2007, the prevalence of undernourishment did not change, being 23 percent for Mainland Tanzania as shown in Figure 4.

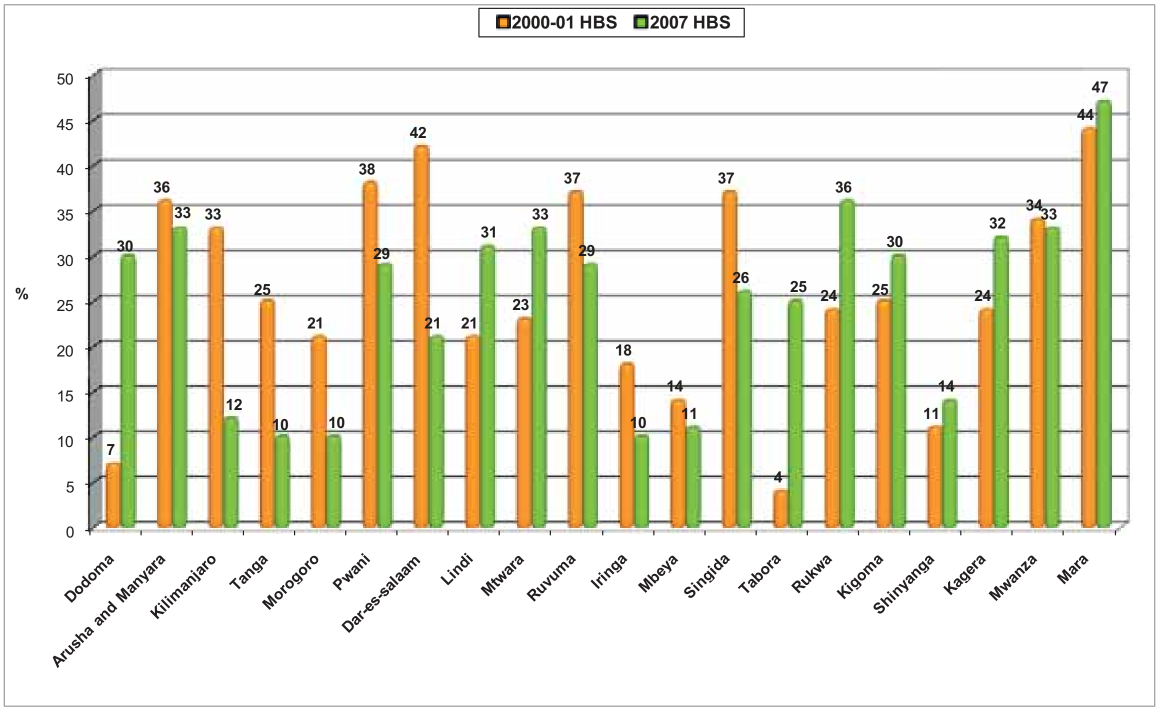
Figure 4: Trends in prevalence of undernourishment in Tanzania by income level, area and household-head gender, 2000/1 and 2007



Not all extremely poor population groups are food deprived. Less than one half were food deprived in households in the lowest income quintile in both reference periods. The population in this group of households showed an increase from 42 to 47 percent in the prevalence of food deprivation, while the second income quintile decreased from 10 to 8 percent. No change was noted for households of the other quintiles grouping which had marginal low food deprivation. However, Dar es Salaam showed a decrease of 21 percentage points in the prevalence of undernourishment; this indicates that food security has improved in the commercial capital city of Mainland Tanzania. While in 2001 rural households were more food secure than urban ones, the level of prevalence of undernourishment became 23 percent for both of them in 2007. Food insecurity by gender of head of households showed stagnation among male-headed households, 21 and 22 percent, and among female-headed households, 24 and 23 percent

Figure 5 shows levels of prevalence by region. Eleven of the twenty regions showed reductions in the level of undernourishment from 2000/1 to 2007. Within these regions, Dar es Salaam, Kilimanjaro, Tanga and Morogoro reduced their level of undernourishment more than half, but still the former had a high value of prevalence of undernourishment (21 percent). Among the regions increasing of their level of undernourishment, the regions of Dodoma and Tabora increased their prevalence from 7 to 30 percent and from 4 to 25 percent respectively. In the region of Mara the prevalence was more than 40 percent in 2000/1 and got worse becoming 47 percent in 2007.

Figure 5: Trends in prevalence of undernourishment by region, 2000/1 and 2007



III.2. Depth of Hunger

Depth of hunger is measured as the food gap between the minimum dietary energy needs and the average dietary energy consumption of the food-deprived population.

The daily food gap in terms dietary energy per food deprived person was 262 Kcals in 2007, which slightly increased from 2000/1 as depicted by Figure 6. In terms of food grain, the daily Tanzanian food gap per food deprived person, is equivalent to more than 75 grams of cereals for removing individuals out of food deprivation, that is, more than 28 kg of cereals per person per year. While the food-deprived population of rural areas faced an increment of 16 Kcals gap needed, those food deprived in urban areas decreased energy gap by 13 Kcals, excluding Dar es Salaam that decreased food gap substantially, 130 Kcals. Food gap of undernourished population in male-headed households increased while in female-headed households decreased.

Figure 6: Trends in depth of hunger (kcal/person/day) in Tanzania by area and household-head gender, 2000/1 and 2007

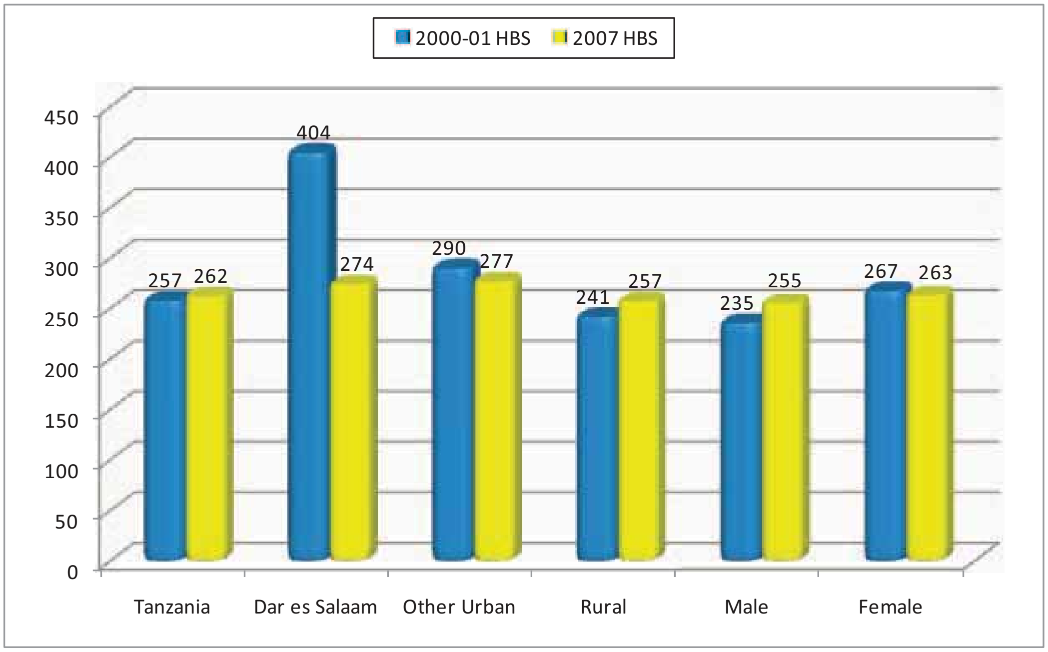


Figure 7: Trends in depth of hunger by region, 2000/1 and 2007

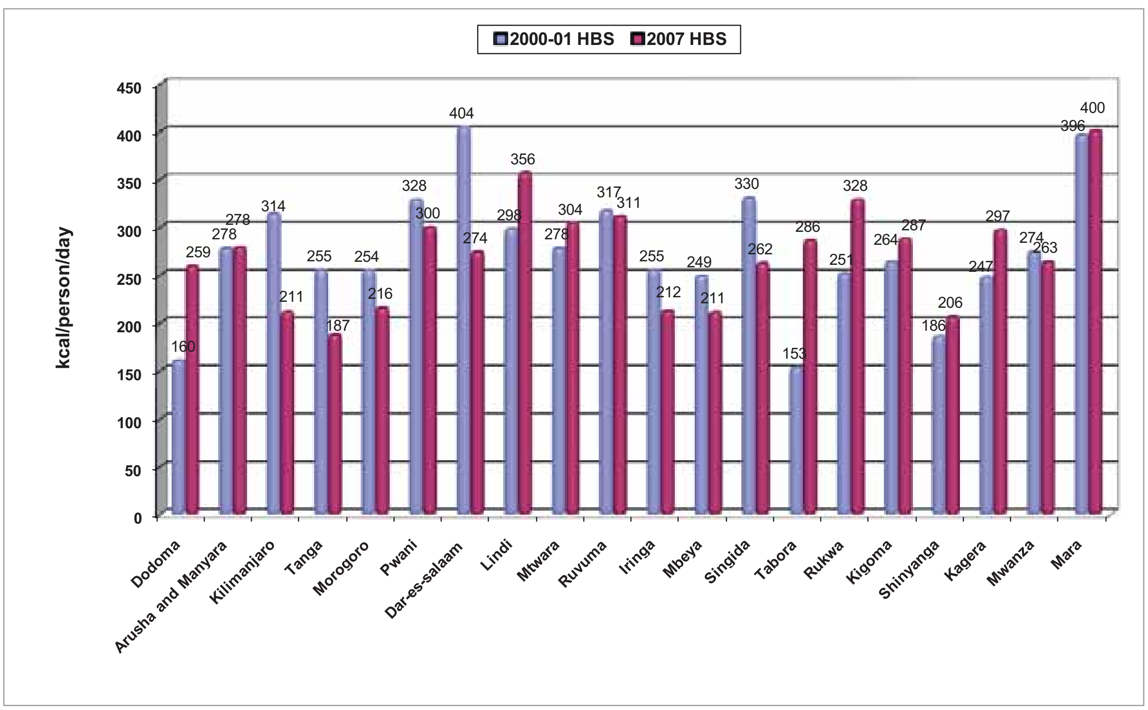
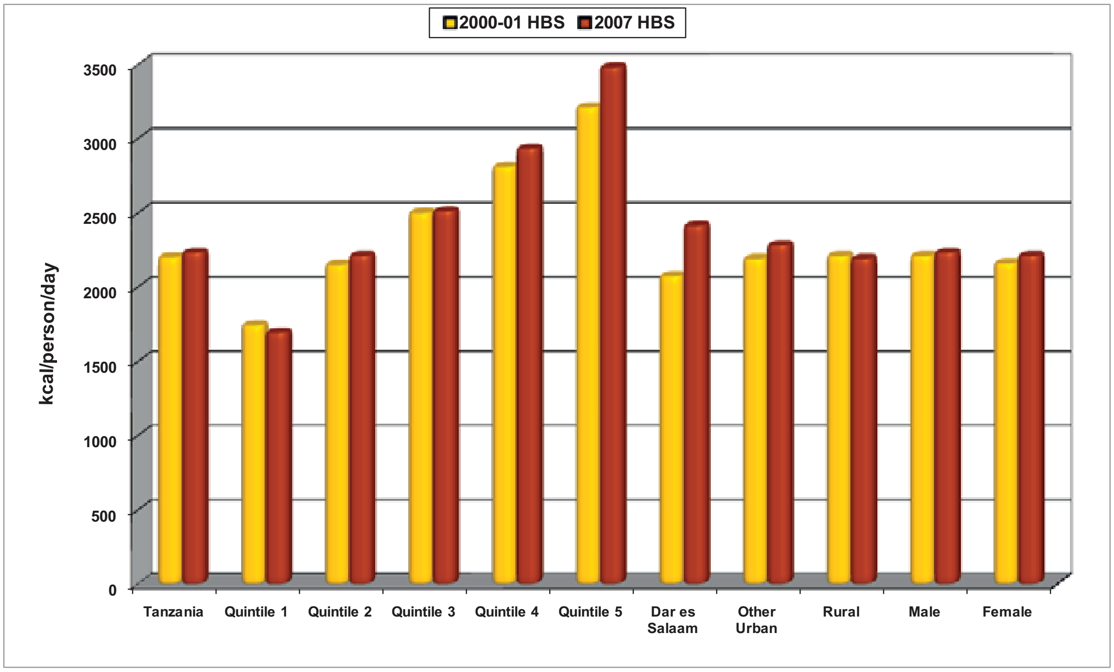


Figure 7 shows the evolution of the food gaps of food deprive people by region between 2000/1 and 2007 in Tanzania. On one hand, Dar es Salaam and Kilimanjaro decreased in their food gap by 130 Kcals and 103 Kcals respectively. On the other hand, Tabora increased their food gap by more than 130 Kcals and Dodoma by almost 100 Kcals. In 2007, the regional food gaps of food deprive people varied from 187 Kcals in Tanga to 400 Kcals in Mara.

III.3. Dietary Energy Consumption (DEC)

Mainland Tanzanian DEC was 2230 Kcals in 2007, 30 Kcals higher than 2200 Kcals in 2000/1.

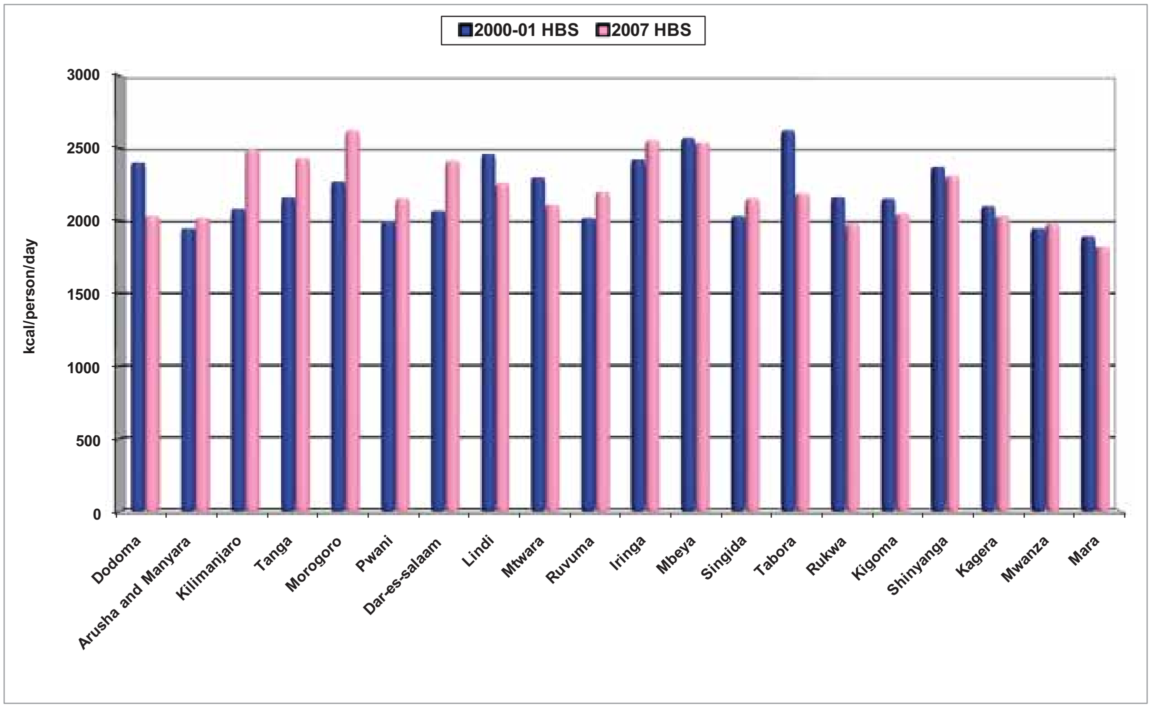
Figure 8: Trends in DEC in Tanzania by income level, area and household-head gender, 2000/1 and 2007



Dietary energy consumption increased with higher income as depicted by the income quintiles in Figure 8. Households in the highest income quintile acquired and consumed larger quantities of food as compared to those of the lowest income quintile, whose average DEC decreased from 1740 Kcals in 2000/1 to 1690 Kcals in 2007. Households in rural areas decreased by 20 Kcals their average DEC from 2210 Kcals in 2000/1, while in urban areas the DEC increased by 90 Kcals, from 2190 Kcals in 2000/1, excluding Dar es Salaam with an increase of 340 Kcals, from 2070 Kcals in 2000/1.

The DEC by region of Tanzania is shown in Figure 8. The half of the regions decreased DEC from 2000/1 to 2007. Dodoma faced the highest decrease of DEC, from 2400 Kcals to 2030 Kcals and Tabora from 2620 Kcals to 2190 Kcals. On the contrary, the regions of Kilimanjaro, Morogoro and Dar es Salaam experienced the highest increments of DEC with 410, 350 and 340 Kcals, respectively, more than in 2000/1. The DEC by region ranged from 1890 Kcals in Mara to 2620 Kcals in Tabora, in 2001. This range increased in 2007, from 1820 Kcals in Mara to 2620 Kcals in Morogoro.

Figure 9: Trends in dietary energy consumption by region, 2000/1 and 2007



III.4. Food Expenditure

Food was mainly obtained from purchases whether to be consumed inside the household or outside usually in restaurants, canteens, food courts, food street vendors, etc. Household food consumed came also from own production, food business, received from friends or relatives or even as payment in kind. All food acquired which were not purchased had to be valued using the corresponding unit prices from purchased food items.

The average Tanzanian household spent on food a daily average of 481 TSh per person in 2007, which was more than doubled the 221 TSh in 2000/1. The increase over the six-year period was about 117 percent, but when adjusted with the food inflation rate over the period, the increase was more than 45 percent. Figures 10 and 11 show that food expenditure has increased in all population groups, except the region of Mtwara where households decreased by 12 percent their food expenditure at 2007 constant prices.

Figure 10: Trends in daily food expenditure per person (TSh at 2007 constant prices) in Tanzania by income level, area and household-head gender, 2000/1 and 2007

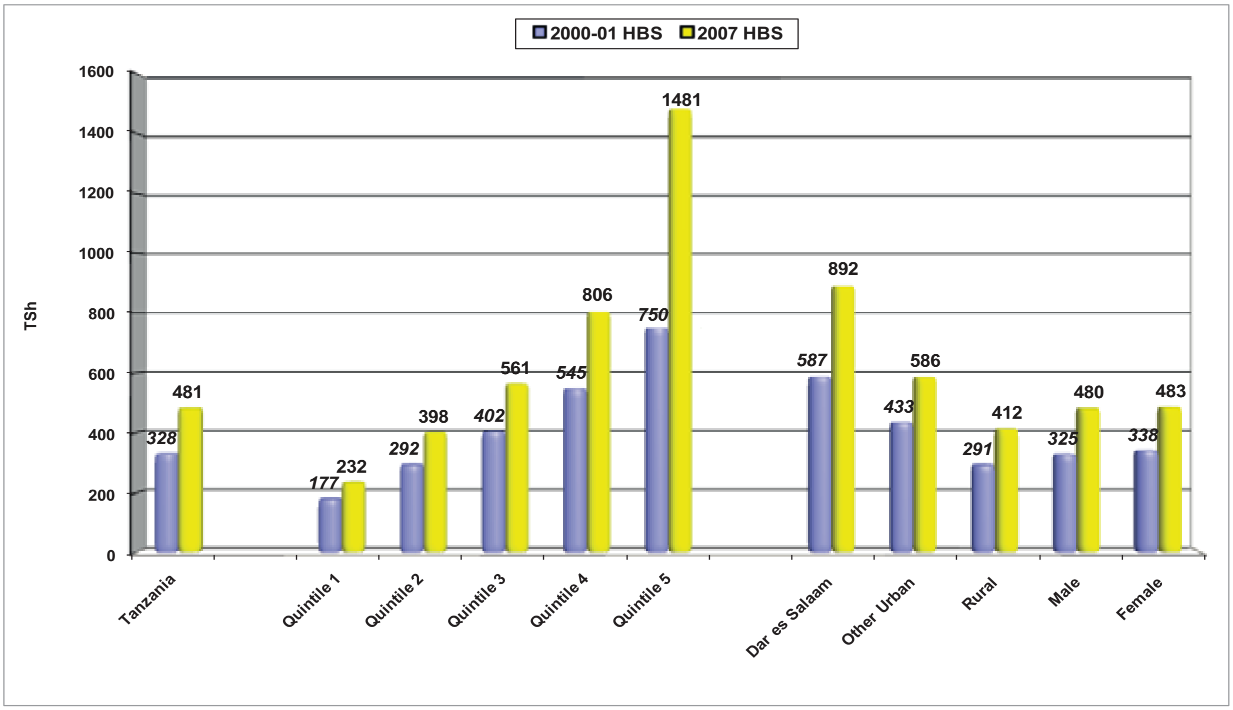


Figure 11: Trends in daily food expenditure per person (TSh at 2007 Constant Prices) by region, 2000/1 and 2007

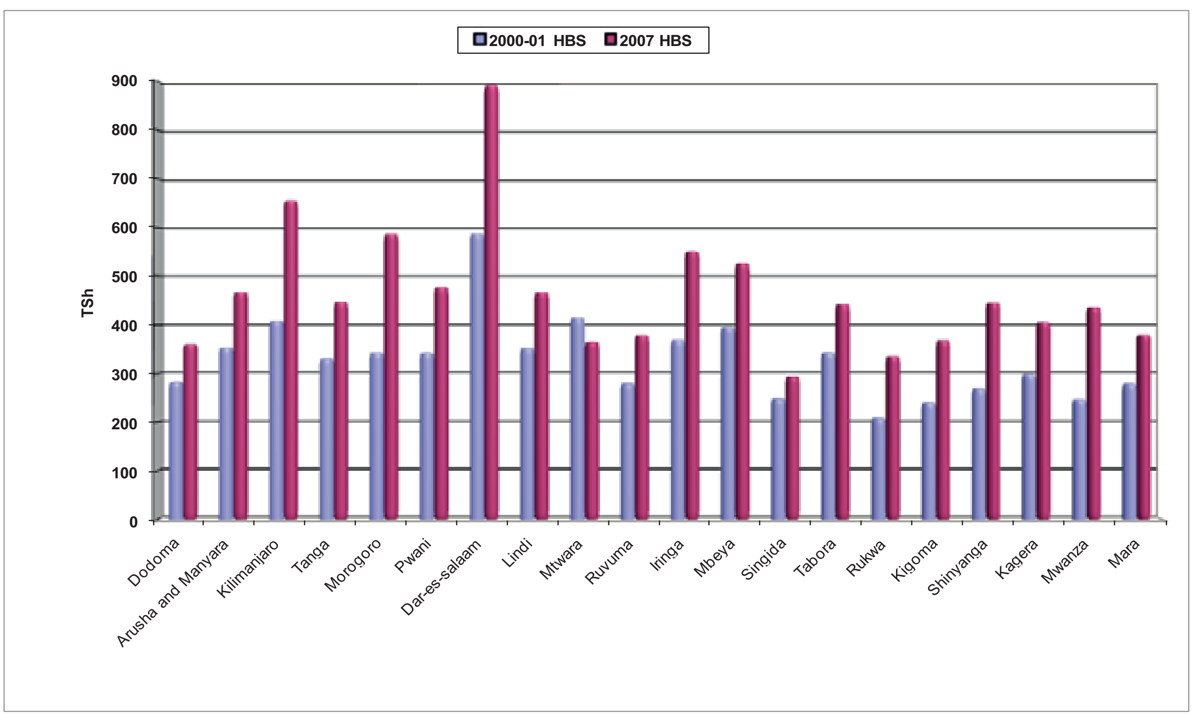


Figure 10 illustrates that households in the highest income group registered the highest food expenditure increase, which was almost 100 percent more than the 2000/1 value, at 2007 constant prices. Rural households spent on food less than urban households. In Dar es Salaam, food expenditure was significantly higher at a value of 892 TSh in 2007. Female-headed households had slightly higher food expenditure than counterpart male-headed households.

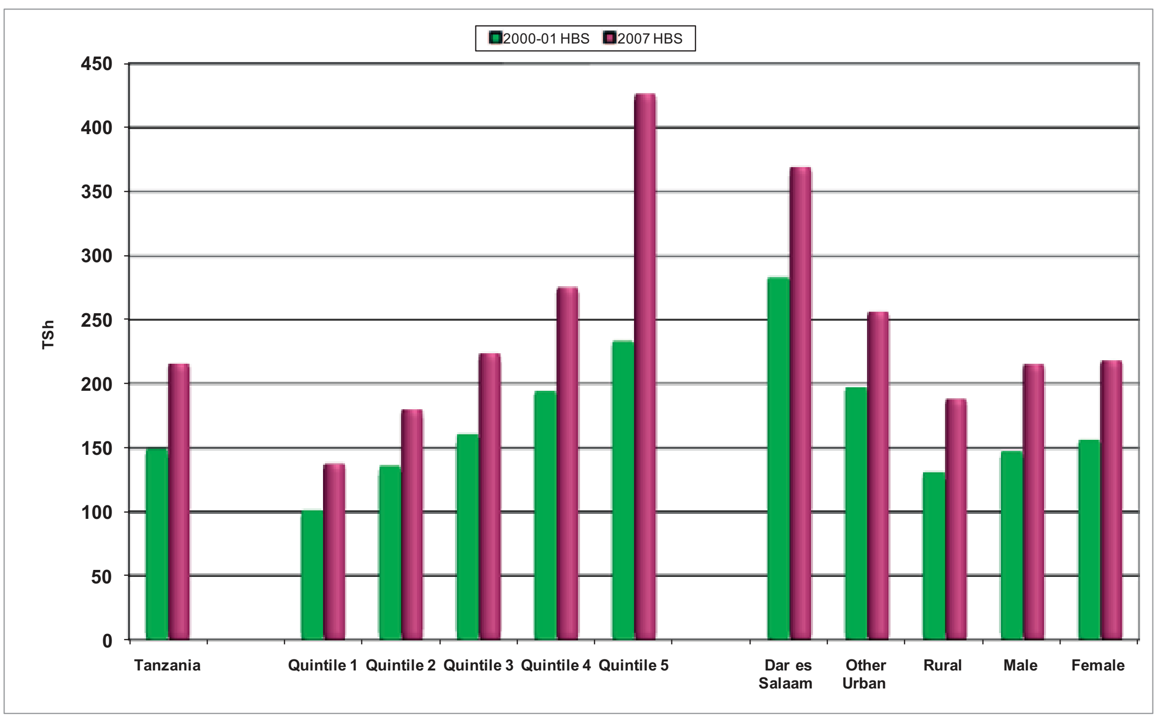
As mentioned above Dar es Salaam was the region where food expenditure was the highest and has registered the highest increase from 2000/1 to 2007 as shown in Figure 10 at 2007 constant prices. The region of Singida had the lowest food expenditure in 2007. The region of Rukwa had the lowest food expenditure in 2000/1; however, food expenditure rose by 61 percent in 2007.

III.5. Food Dietary Energy Cost

The general increase in food expenditure was greater than the food inflation rate from 2000/1 to 2007; it may be attributed to higher food prices reflected by increasing unit cost of calories.

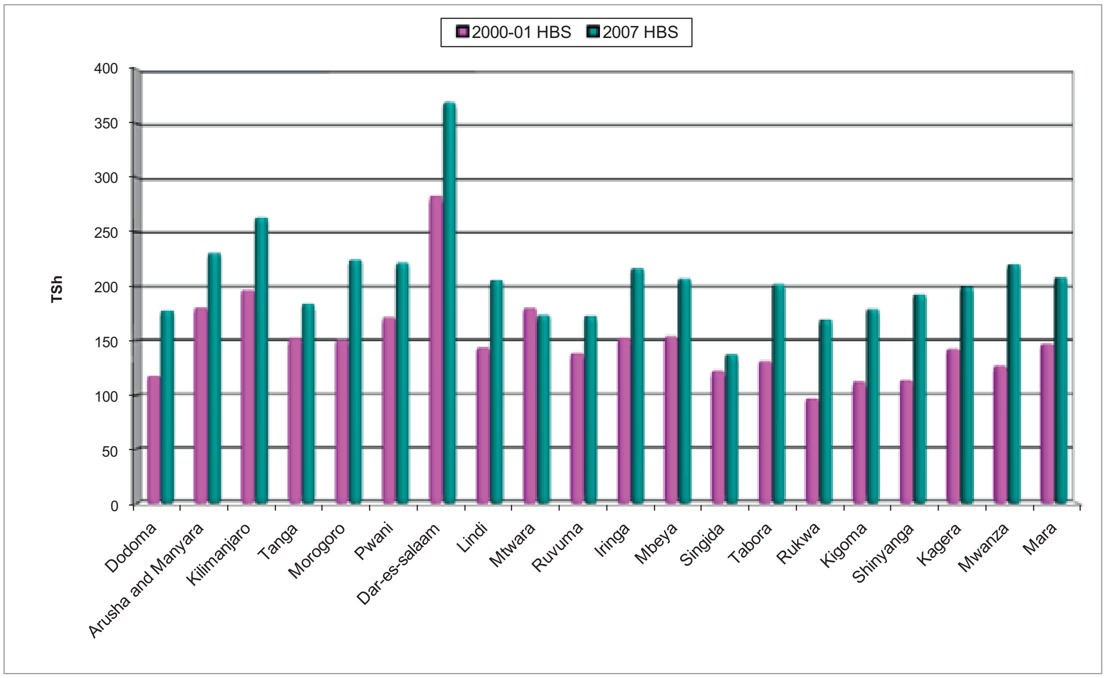
The Figure 12 illustrate that the cost of 1000 Kcals consumed increased by 45 percent, using 2007 constant prices, at national level from 2000/1, being 216 TSh in 2007. Dietary energy cost was lower in rural areas than in the capital city and urban areas. Most food is produced in rural areas and available at lower prices. Food prices in urban areas and Dar es Salaam include transportation and other overhead costs. Female-headed households paid a higher value for acquiring 1000 Kcals.

Figure 12: Trends in cost of 1000 kcal in food consumed (TSh at 2007 constant prices), in Tanzania by income level, area and household-head gender, 2000/1 and 2007



The unit energy cost of 1000 Kcals by region is shown in Figure 13. All the regions, except Mtwara showed a decrease in cost, from 180 to 173 TSh. The region of Mwanza experienced the highest increase of 94 percent between 2000/1 and 2007. Dar es Salaam had the highest unit energy cost of 369 Tsh, while the region of Singida had the lowest of 137 Tsh per 1000 Kcals in 2007.

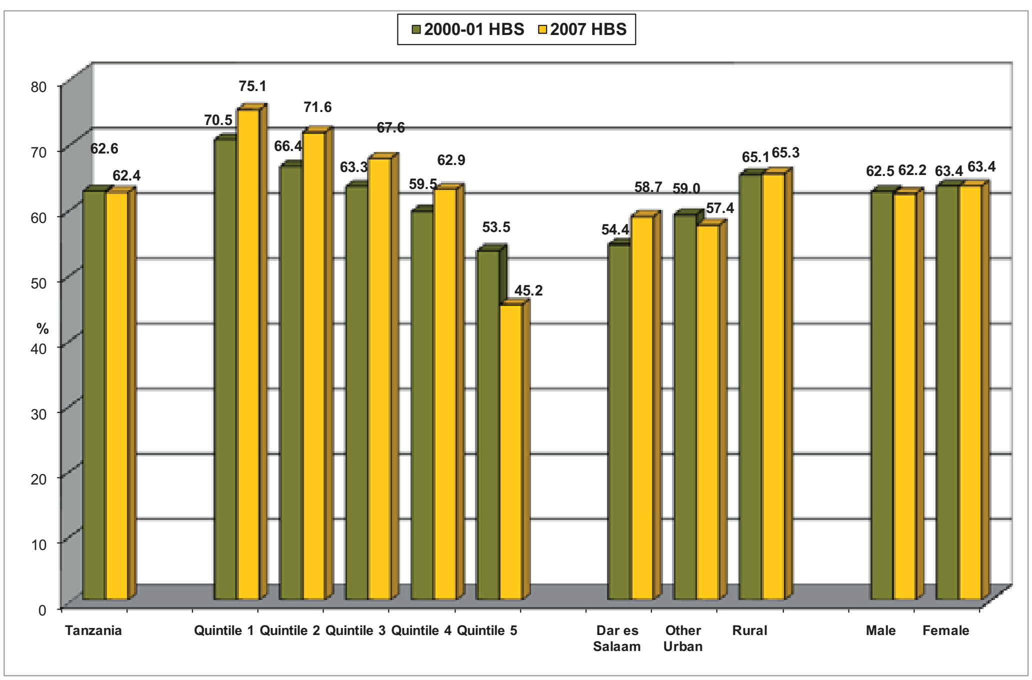
Figure 13: Trends in cost of 1000 kcal in food consumed (TSh at 2007 constant prices) by region, 2000/1 and 2007



III.6. Food Share in Total Consumption

The food share is the percentage of household consumption expenditure that goes to food. Following the Engel's law, food share decreases with increasing income and is an indicative measure of wealth and quality of life in a country.

Figure 14: Trends in food shares to total consumption (percent) in Tanzania by income level, area and household-head gender, 2000/1 and 2007



While the national level food share remained almost stable at around 62.5 percent, there had been some changes in food shares in sub-national population groups as shown in Figure 14.

Increase in food shares were observed in all income quintiles, except the highest, indicating higher amounts of income going to food for those households in 2007 for 80 percent of the population. Even Dar es Salaam had its food share increased. The food share in the highest income quintile fell by eight percent points from 2000/1 to 2007.

Figure 15: Trends in food shares to total consumption (percent) by region, 2000/1 and 2007

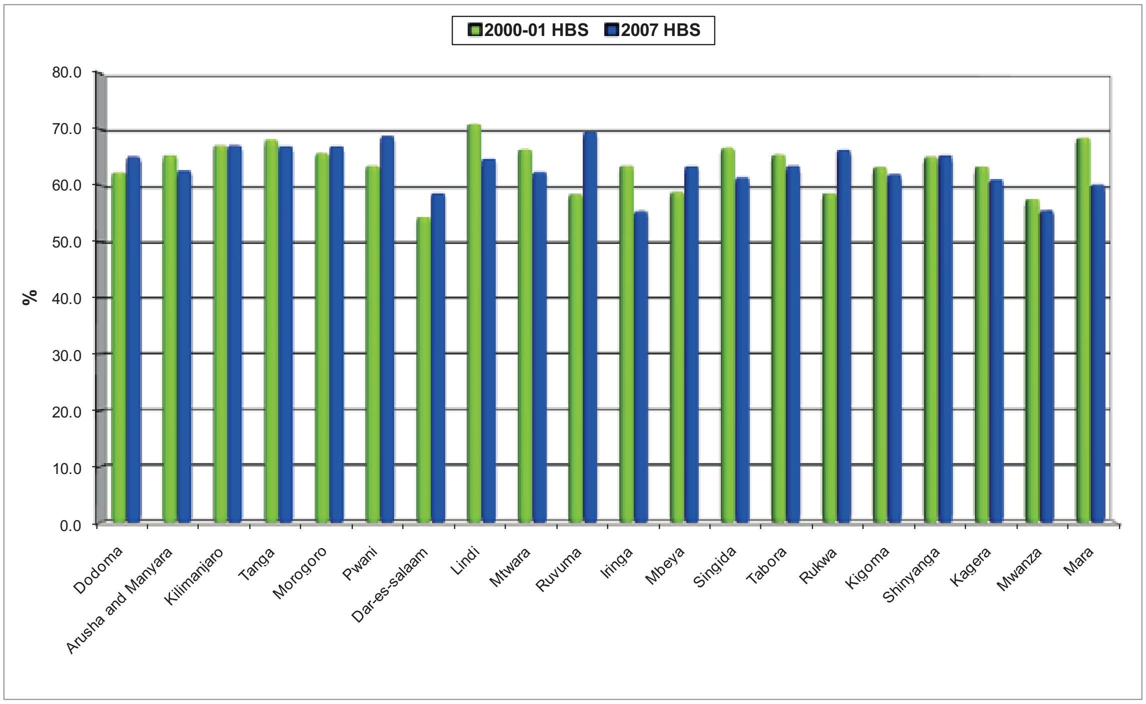


Figure 15 shows food shares by region. Although there had been changes in food shares from 2000/1 to 2007, food shares by region are less sensitive to changes. The highest changes were observed in the regions of Iringa and Mara, both decreased by eight percent points their food share. In the region of Ruvuma, on the contrary, the food share increased from 58.5 to 69.5 percent. In 2007, the regional food shares ranged from 55 to 70 percent.

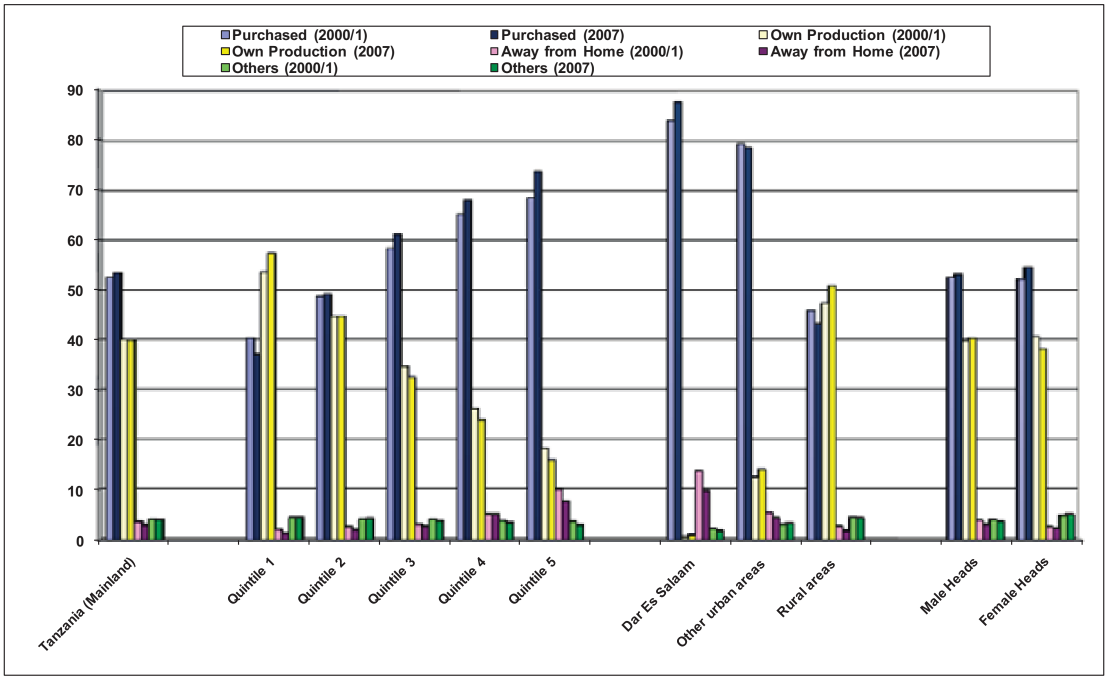
III.7. Food Consumption by Sources

Figure 16 depicts household food acquisition for dietary energy consumption by sources of food. Purchases were the main source of food acquisition, including food consumed away from home, for most households followed by own production and from other sources (friends or relatives or even receive as income in kind). At national level, more than one-half of food in energy terms was acquired by purchases. Food from own production represented in monetary terms 26.4 and 23.6 percent in 2000/1 and 2007 respectively, while in energy represented 40 percent of total energy consumed in HBS.

The contribution of own production to the total DEC was lower as with higher income levels. It was more than one-half of total DEC in households of the lowest income quintile compared to less than one fifth of total DEC in the wealthiest population group. It was half of total DEC in rural households in 2007. The highest share of energy from purchases as food consumed away from home (AFH) in total DEC, as expected occurred in Dar es Salaam and among the other regions the shares were very low; it was also higher as with higher income levels.

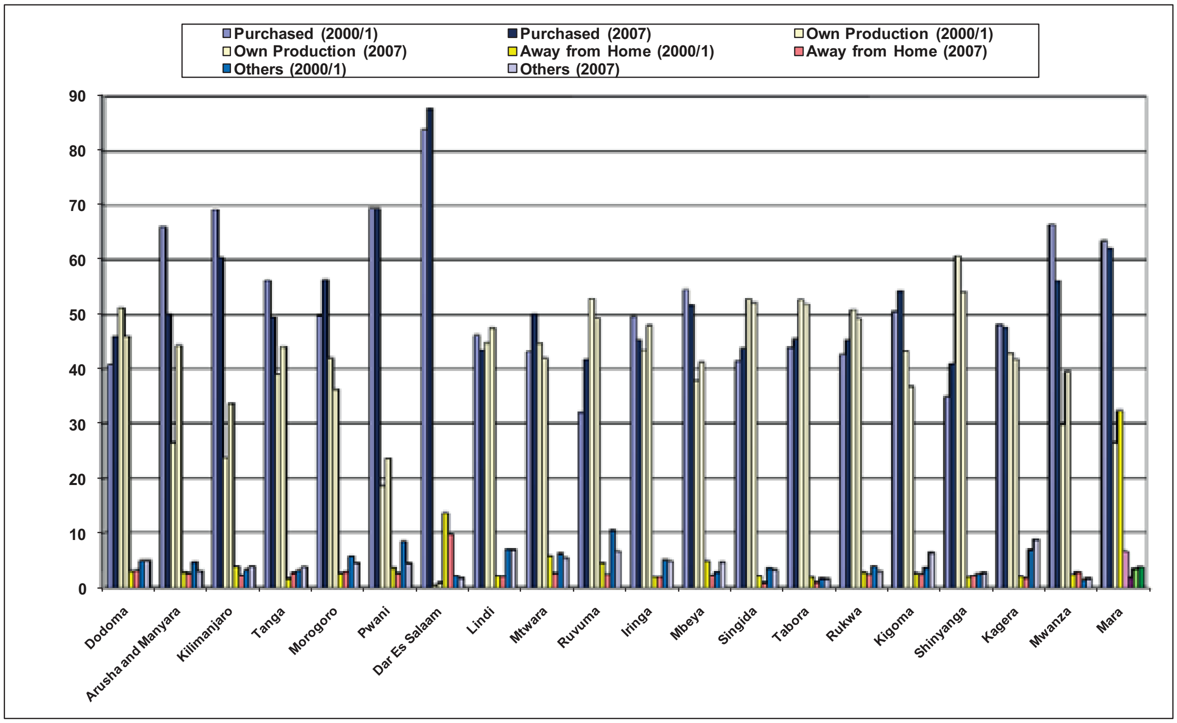
More than one-half of total DEC nationwide was acquired on markets but this share was higher among households of the two highest income quintiles, more than 70 percent.

Figure 16: Share of DEC by food source in Tanzania by income level, area and household-head gender,



As expected by region, the highest share of energy from purchases in total DEC was in Dar es Salaam and among the other regions the shares ranged from 41 to 69 percent reflecting the importance of food markets in the local economy in 2007 as shown in Figure 17.

Figure 17: Share of DEC by food source in Tanzania by Regions, 2000/1 and 2007



III.8. Analysis of inequality in access to food

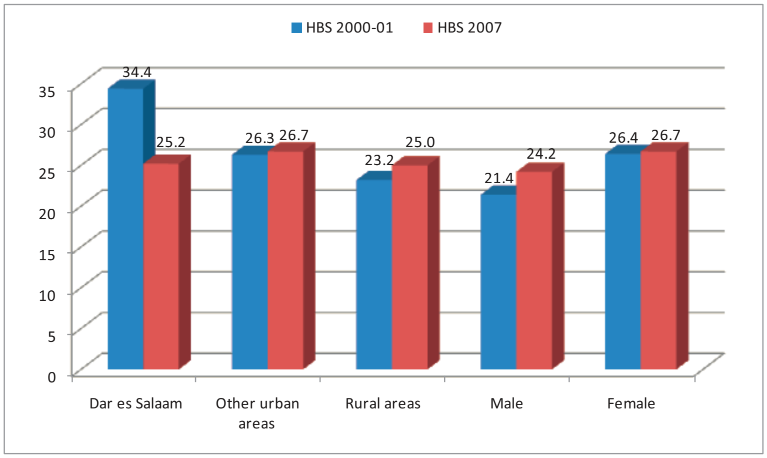
Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life.

Inequality in access to food, measured by the coefficient of variation (CV) of the dietary energy consumption distribution, is one of the key parameter in estimating the prevalence of food deprivation using the FAO approach. The CV is measured as the aggregation of the variation of DEC due to income level and the variation of DEC due to energy requirement levels among sex and age population groups in the study total population. The variation of DEC due to energy requirement levels depends on the range of weights for attained-heights and the range of physical activity levels by age and sex population groups weighted by the sex and age population structures at national and sub-national levels. The CV of DEC due to energy requirements is usually very close to 20 percent.

The CV of DEC is estimated for sub-national population groups. The analysis of inequality in access to food mainly focuses on CV at sub national levels and dispersion ratios will be discussed when needed to complement the analysis of inequality at national level. The national prevalence of food deprivation is derived from those corresponding to rural and urban areas weighted by sampled population.

Figure 18 shows that in 2000/1 inequality in access to food due to income was higher in urban areas than in rural areas.

Figure 18: Coefficient of variation of DEC due to income (percent) in Mainland Tanzania by area and household-head gender, 2000/1 and 2007



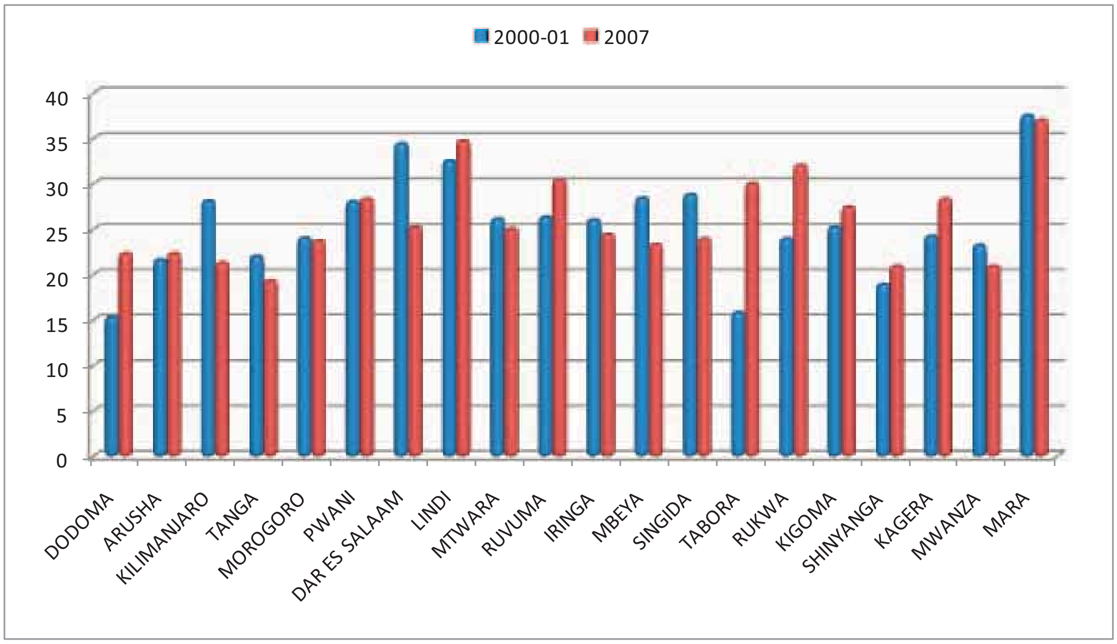
Dar es Salaam showed the highest level of inequality among urban areas with a CV of 34 percent compared to 26 percent in other areas and 23 percent in rural areas. However, in 2007 Dar es Salaam decreased inequality to 25 percent, while other urban areas remained at 27 percent and rural areas at 25 percent.

Both HBS showed that inequality was higher among households headed by women compared to households headed by men. The CV values for women-headed and men-headed households respectively were 26.4 and 21.4 percent in 2000/1 and 26.7 and 24.2 percent in 2007.

Figure 19 shows the trends in levels of inequality of DEC due to income by region. Ten out of 20 regions increased in inequality from 2000/1 to 2007, which in part may have increased the magnitude of food deprivation, in particular in Dodoma, Tabora, Rukwa and Kagera where the DEC decreased. In the region of Ruvuma the increase in inequality may have been compensated by the increase in DEC, already described in Figure 8. Dar es Salaam, Kilimanjaro, Mbeya and Singida showed decreases in inequality, which may have contributed to decrease the magnitude of food deprivation, in particular in Dar es Salaam, Kilimanjaro and Singida where DEC increased; however, in Mbeya the decrease in DEC may have cancel the effect of decreasing inequality.

Still in 2007, CV of DEC due to income was very high (over 30 percent) in the regions of Mara, Lindi and Rukwa, high (20-30 percent) in other 16 regions and only the region of Tanga showed a moderate level of less than 20 percent.

Figure 19: Coefficient of variation of DEC due to income (percent) by region, 2000/1 and 2007



III.9. Analysis of Diet Composition

The FAO/WHO/UNU recommendations for a macronutrient balanced diet the contribution of energy-yielding macronutrients in total energy range from 55 to 75 percent from carbohydrate, from 15 to 30 percent from fat and from 10 to 15 percent from proteins.

➔ ***Macro nutrient consumption***

Mainland Tanzania average diet has improved in its consumption of macronutrient towards the balanced diet recommended norms. Nationwide the share of energy from carbohydrate, fat and protein in total DEC have improved towards mid-values of recommended ranges from 2000/1 to 2007. As depicted by Figure 20, the share of energy from carbohydrate in total DEC decreased from 74 to 70 percent, while the share from fats increased from 16 to 18 percent and for protein from 10 to 12 percent. The patterns of micronutrients contributions to total DEC were within the recommended ranges in both survey periods.

Households with higher income tended to substitute food sources of carbohydrate with a food high in fat, keeping total protein consumption at the same level. There have been decreases of consumption of carbohydrates food products towards those of high fat content in all population groupings, except in the region of Shinyanga, which showed a slight increase. Thus, the fat dietary energy contribution increased from 15.8 to 19 percent over the reference period. Protein consumption has marginally improved among many population groupings. The population of Pwani regions showed a deficiency in food of high protein content as its contribution was below the recommended norms of 10 percent.

Figure 20: Share of macronutrients (carbohydrate, fat and protein) in total DEC in Mainland Tanzania by income level, area, household-head gender, 2000/1 and 2007

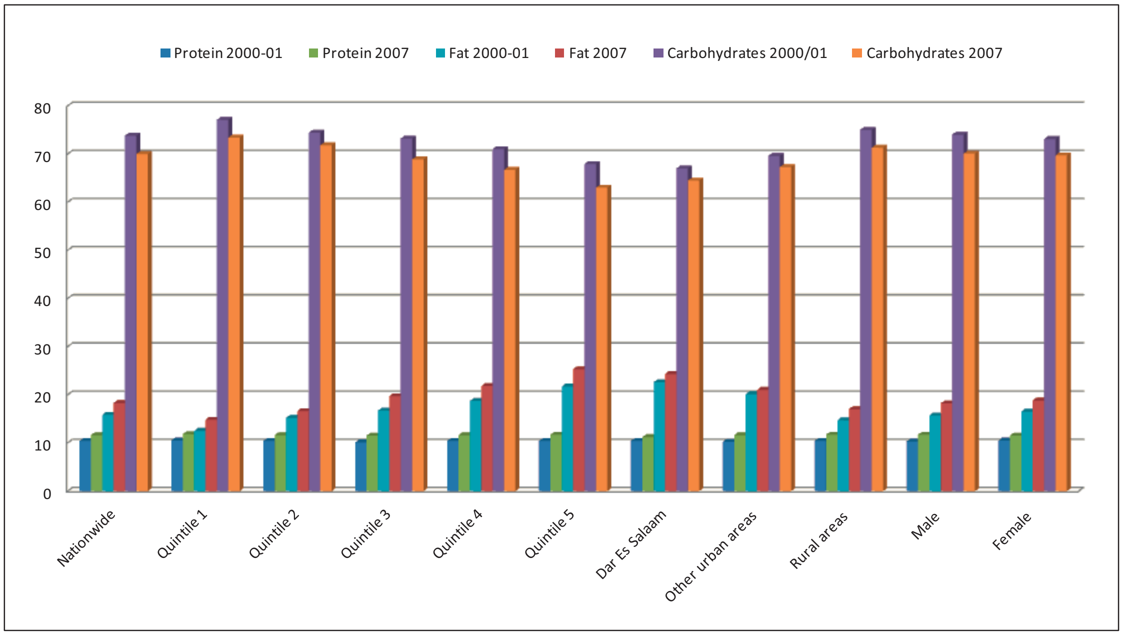
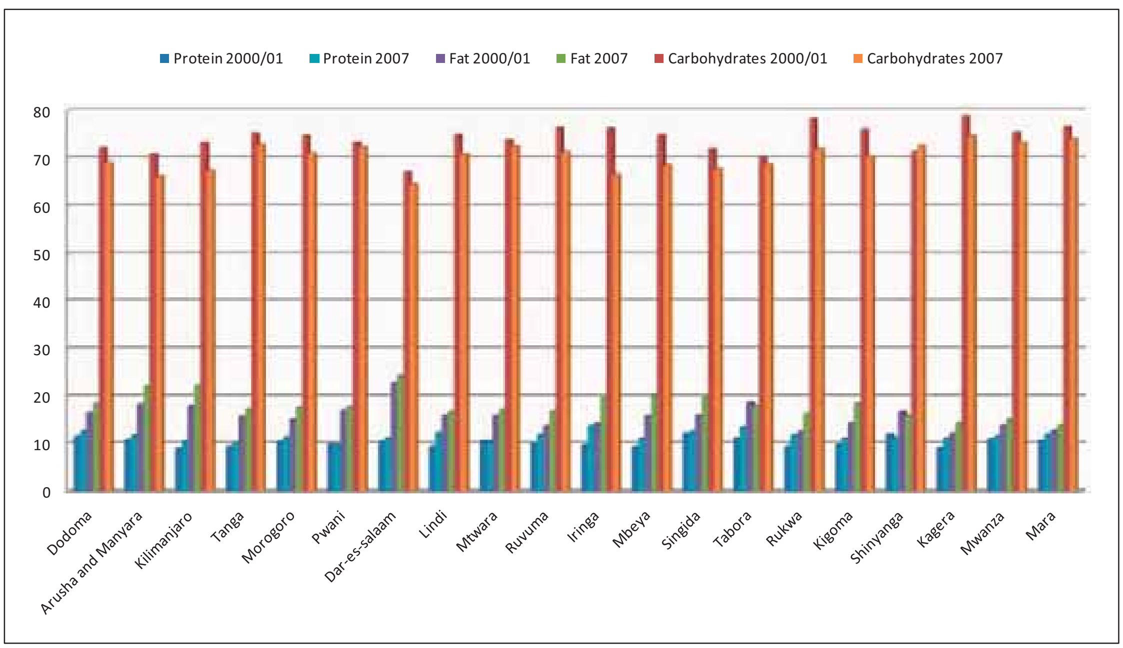


Figure 21: Share of macronutrients (carbohydrate, fat and protein) in total DEC in Mainland Tanzania by region, 2000/1 and 2007



Urban households consumed more fatty food and less starchy food than rural households. From 2000/1 to 2007, carbohydrate and fat contributed respectively more than 70 percent and less than 18 percent of the total DEC in rural areas, while in urban ones these shares ranged from 64 to 70 percent and from 20 to 24 percent.

There were some regional differences in the share of energy from protein in total DEC were observed in 2007. For example, the highest shares in the regions of Iringa and Tabora with more than 13 percent, while the lowest share in the region of Pwani less than 10 percent.

Although the share of DEC from protein remained at the same level from 2000/1 to 2007 among several population grouping and most particularly income quintiles, the share of animal protein in total protein consumed increased for all income levels (Figure 22).

Figure 22: Share of animal protein in total protein energy contribution in Mainland Tanzania by income level, area of residence, 2000/1 and 2007

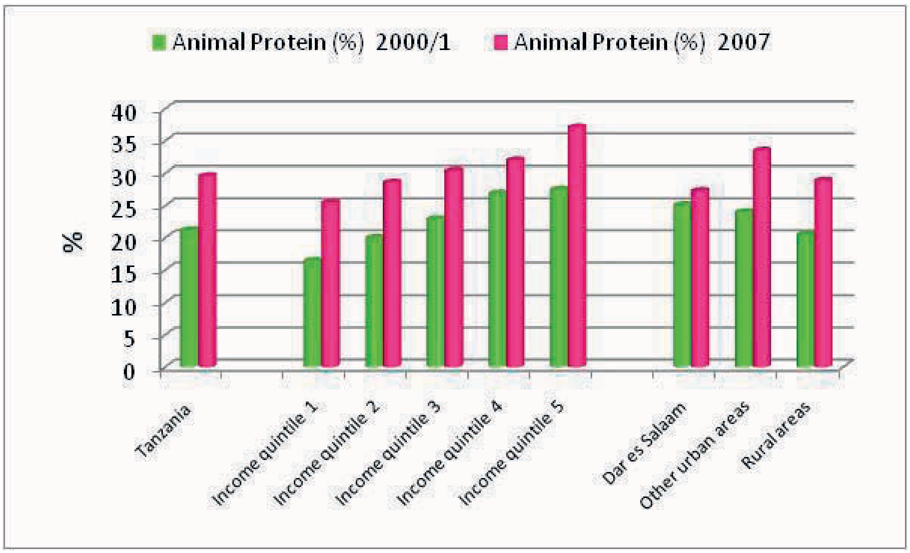
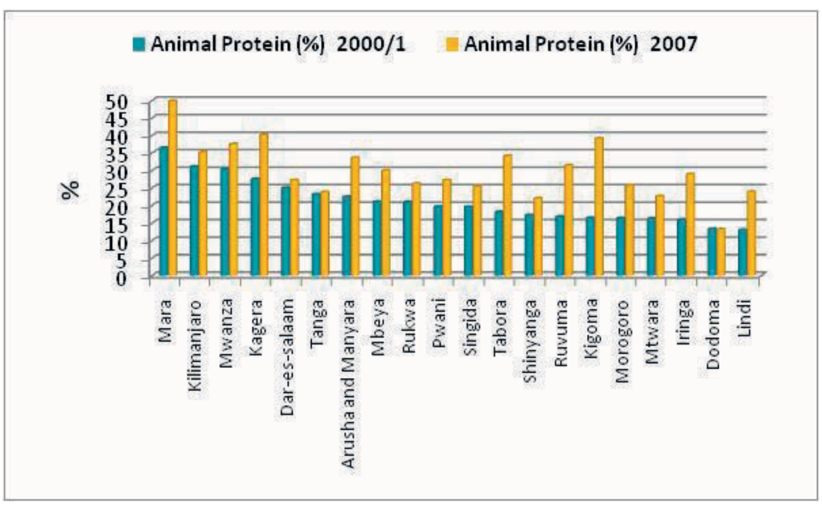


Figure 23: Share of macronutrients (carbohydrate, fat and protein) in total DEC in Mainland Tanzania by region, 2000/1 and 2007

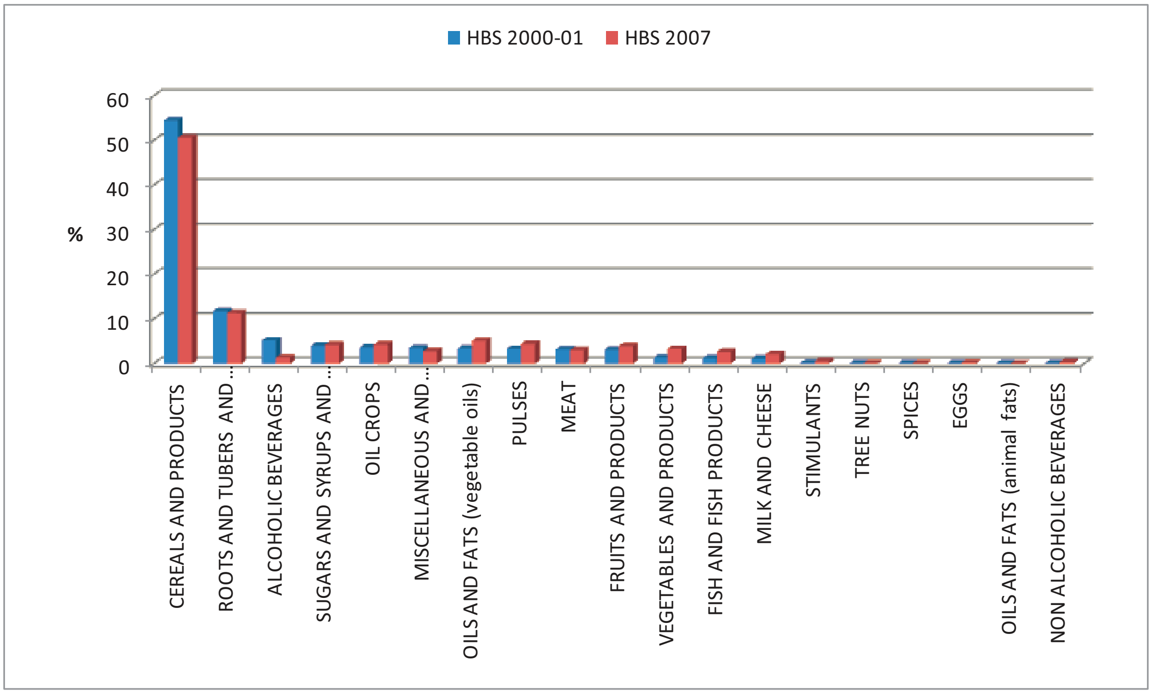


From 2000/1 to 2007, all regions improved or maintained the quality of protein consumed, the share of animal protein in total protein increased or remained the same as illustrated in Figure 23. In 2007, the regions with the highest share of animal protein in total protein were Mara, Kagera and Kigoma with more than 35 percent, while the region with the lowest share was Dodoma with 13 percent.

➔ ***Composition of food consumption***

Cereals were the most consumed food commodity group contributing to total energy 55 and 51 percent in 2000/1 and 2007 respectively as depicted by Figure 24. Food items of the toots and tubers commodity group were the next most consumed contribution to an average of 11.5 percent of total DEC.

Figure 24: Share of each food group to the total DEC in Mainland Tanzania, 2000/1 and 2007

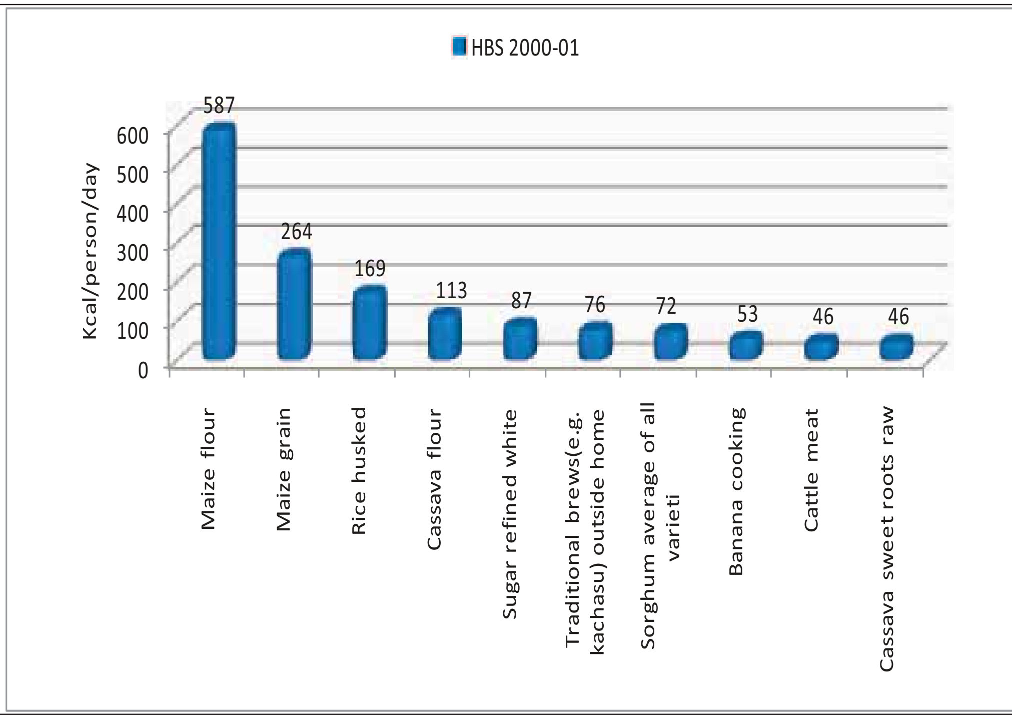


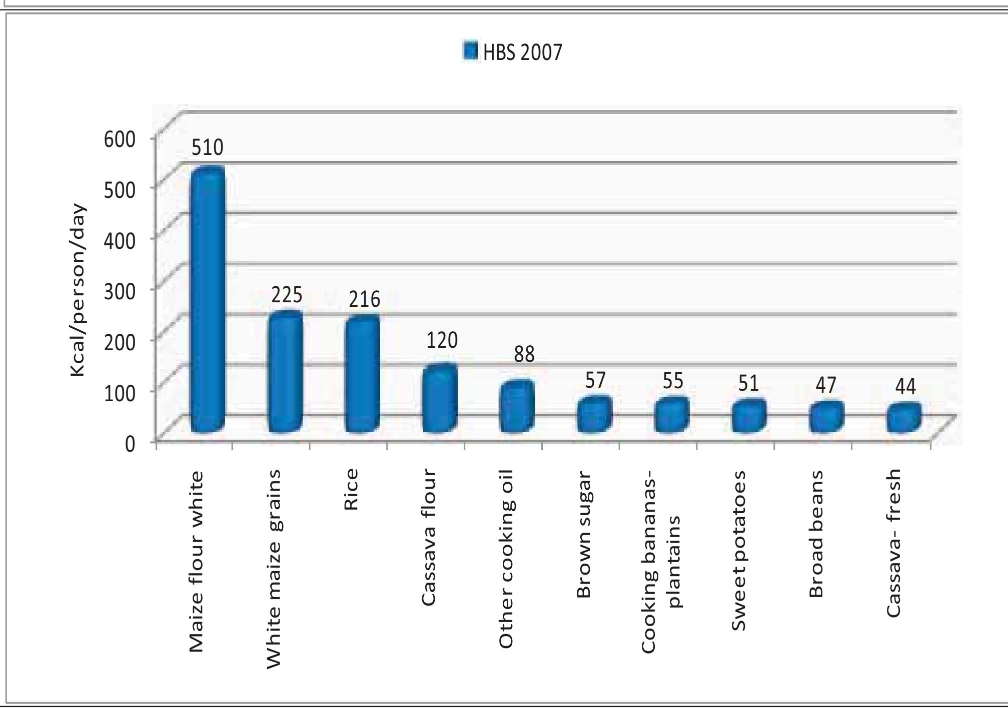
The contribution of alcohol in 2000/1 was most from the consumption of *kashasu,* which is a traditional brew. A daily consumption of about 45 grams per person at national level was reported. The *kashasu* may provide an alcohol concentration ranging from 10 to 70 percent with average of 33 percent as in the TFCT and the dietary energy consumption may range from 7 to 50 Kcals[1]. The *kashasu* consumption may become an issue, given that alcohol and sugar are sources of empty-energy (no additional nutrients provided) and it share of energy in total DEC may increase, thus affecting negatively the quality of diet in Tanzania. In particular, *kashasu* was consumed in rural areas with a daily consumption per person of 54 grams (125 Kcals) compared to 29 grams (67 Kcals) in other urban areas or 13 grams (30 Kcals) in Dar-es-Salam. It is worthy noting that the alcohol consumption fell down from five percent in 2000/1 to one percent in 2007.

Oil crops, vegetable oils and fats, and pulses where altogether contributing to 10 percent of DEC in 2000/1, while their contribution increased to 14 percent in 2007. While meat; and sugars and syrups consumption remained at the same level, the consumption of vegetables, fish, milk and cheese doubled from 2000/1 to 2007.

[1] one gram of alcohol yields 7 Kcals.

Figure 25: DEC of ten food items in Mainland Tanzania, 2000/1 and 2007



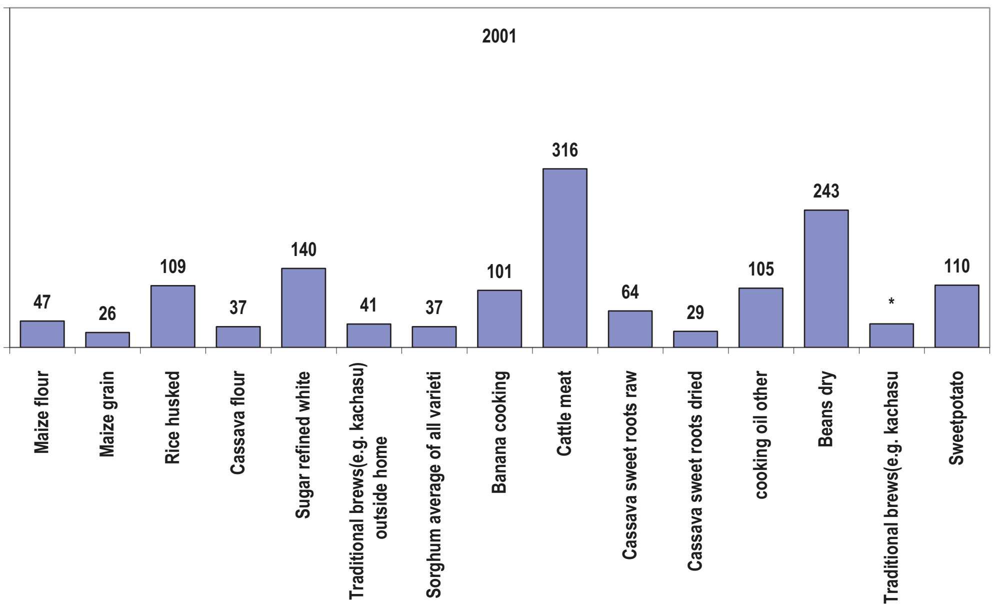


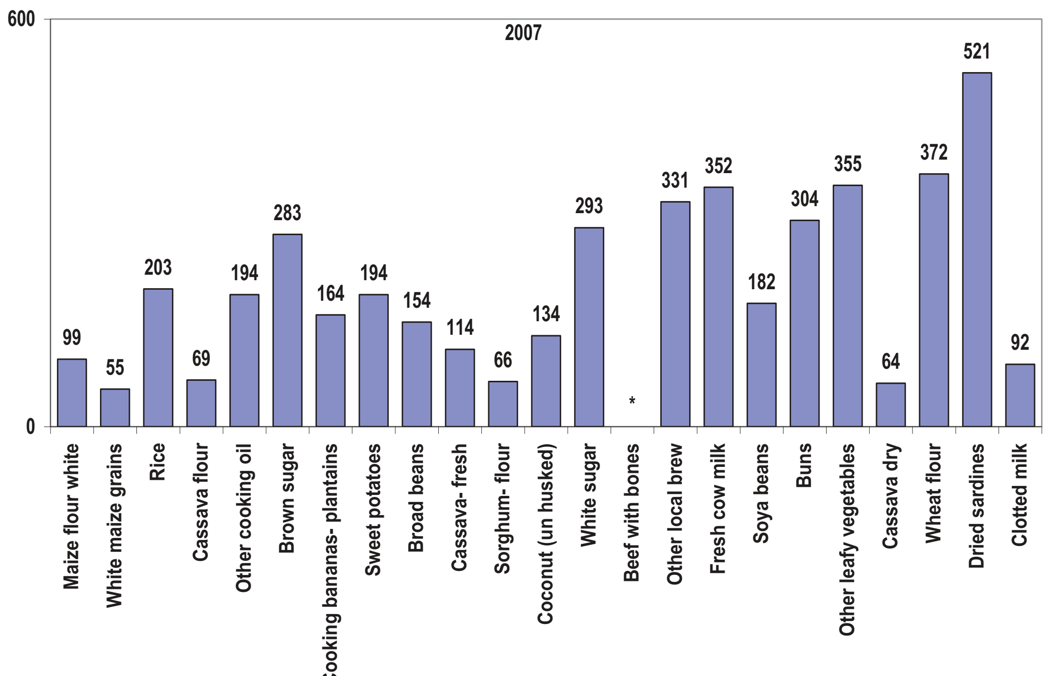
Ten food items shown in Figure 25 accounted for 69 percent of DEC in 2000/1 and 63 percent in 2007. Maize (flour or grain) was the most consumed food item and its daily consumption per person decreased from 164 grams in 2000/1 to 144 grams in 2007, which corresponds to one third of total DEC. Meats are sources of protein rather than dietary energy. While cattle meat was the first source of animal protein in 2000/1, it disappeared from the top ten food items listed by share of energy in total DEC in 2007. However as indicated above the share of animal protein increased as shown in Figure 21, other meats increased in consumption from 2000/1 to 2007.

➔ ***Analysis of dietary energy unit cost of food item***

The dietary energy unit cost of top food items providing at least 80 percent of DEC in order of their contributions at national level in 2000/1 and 2007 at 2007 constant price are shown in Figure 26.

Figure 26: Energy unit costs (TSh per 100 Kcals) of top food items providing at least 80 percent of DEC in Mainland Tanzania, 2000/1 and 2007





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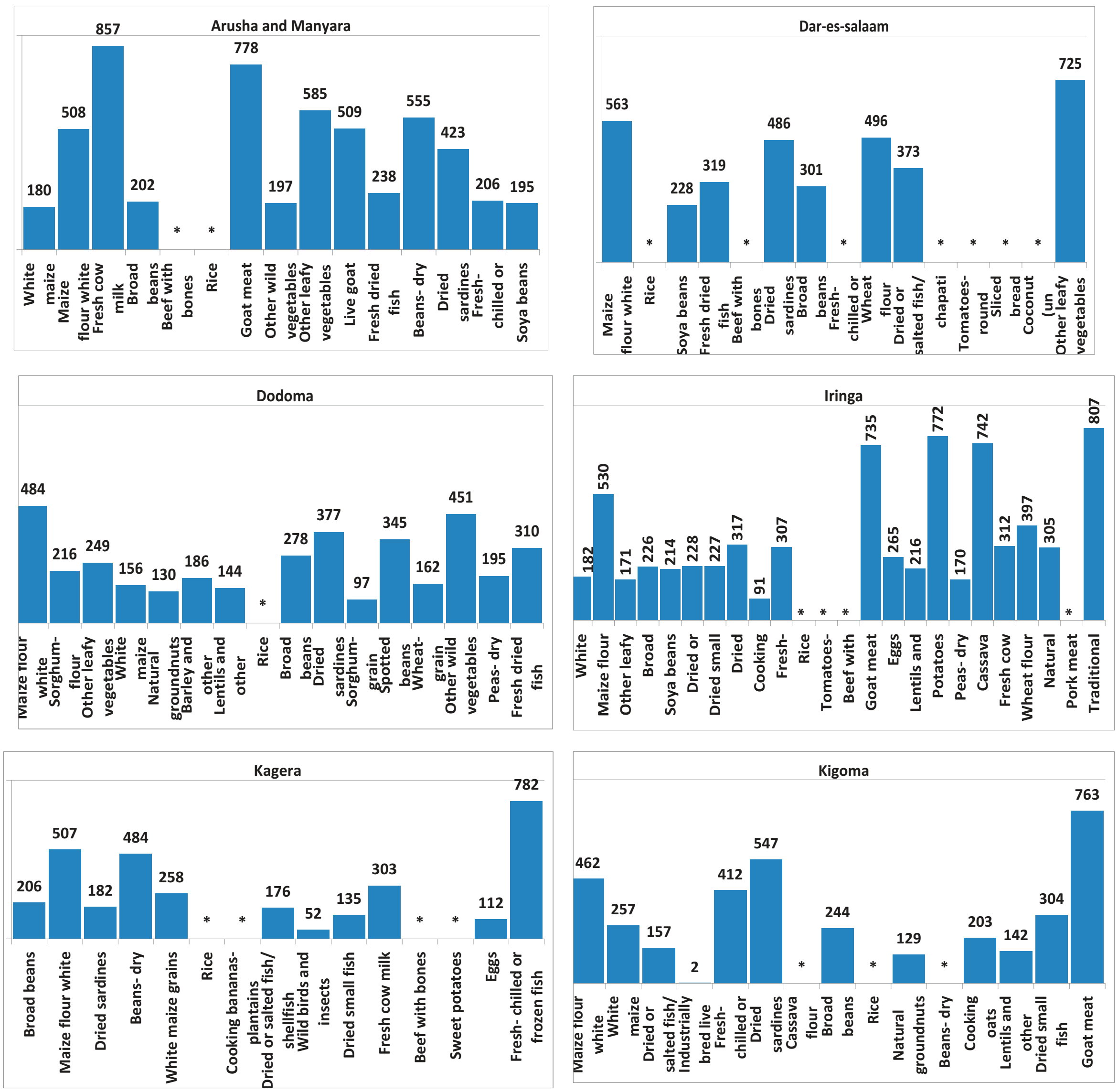
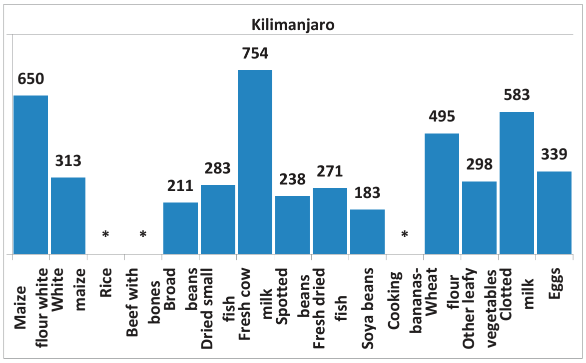
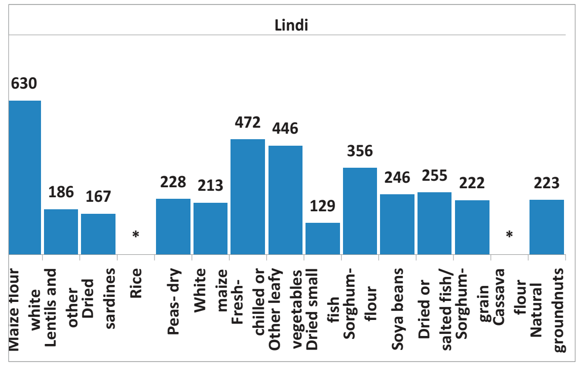
From 2000/1 to 2007, although dietary energy costs increased for most food items, the diet diversity increased, for example, 80 percent of energy was provided by a range of 15 to 23 food items. The first four common food items provided 53 percent of DEC in 2000/1 and 50 percent of DEC in 2007 due to the fall in consumption of cereals food items. The major source of energy, more than 500 Kcals, were from maize as flour in both HBS, even if its energy unit cost was more than double, from 47 TSh in 2000/1 to 99 TSh per 1000 Kcals in 2007.

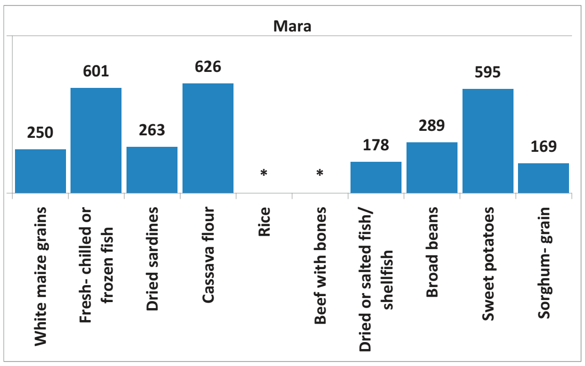
Figure 27 gives the protein unit costs for main food items for each region of Mainland Tanzania for 2007.

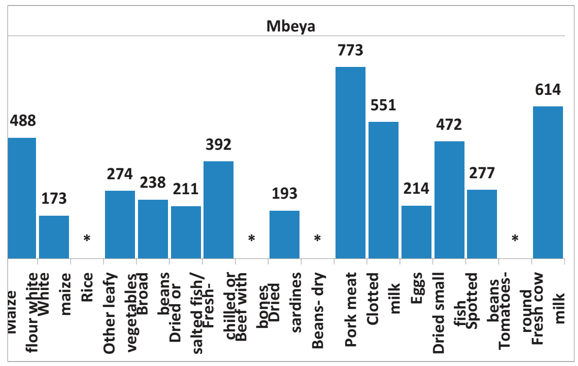
Figure 27: Protein unit cost (TSh per 100 grams) of food items providing at least one of protein per person per day by region in 2007

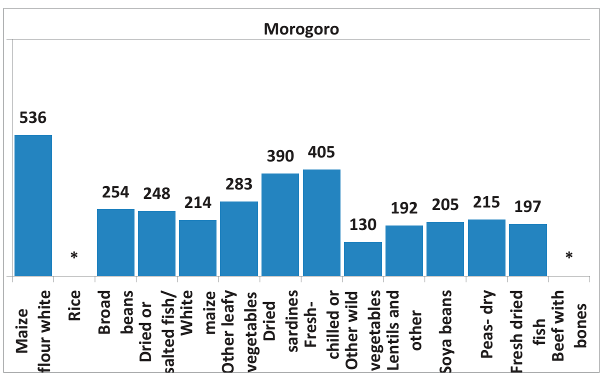


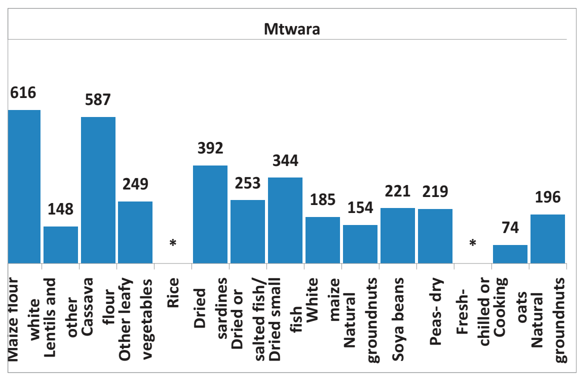

Kilimanjaro
650
313
*
*
211
283
754
238
271
183
*
495
298
583
339
Maize flour white
White maize
Rice
Beef with bones
Broad beans
Dried small fish
Fresh cow milk
Spotted beans
Fresh dried fish
Soya beans
Cooking bananas-
Wheat flour
Other leafy vegetables
Clotted milk
Eggs

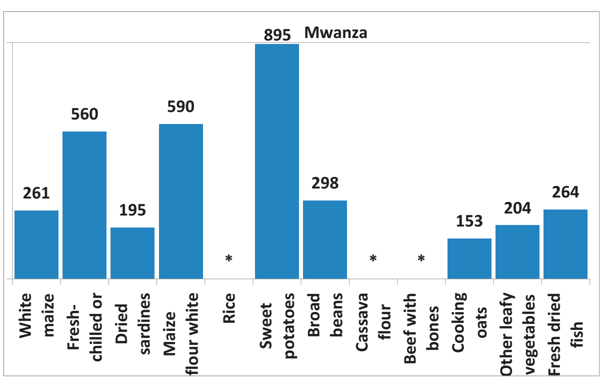

Lindi
630
186
167
*
228
213
472
446
129
356
246
255
222
*
223
Maize flour white
Lentils and other
Dried sardines
Rice
Peas- dry
White maize
Fresh- chilled or
Other leafy vegetables
Dried small fish
Sorghum- flour
Soya beans
Dried or salted fish/
Sorghum- grain
Cassava flour
Natural groundnuts

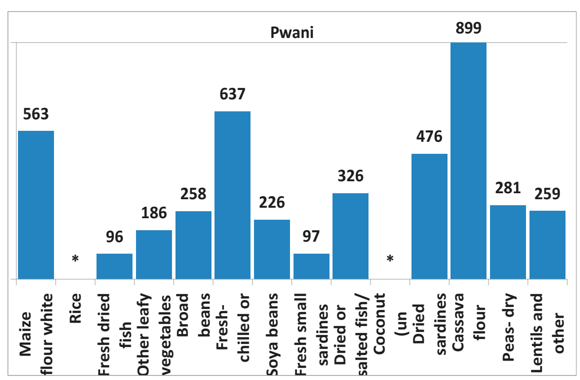

Mara
250
601
263
626
*
*
178
289
595
169
White maize grains
Fresh- chilled or frozen fish
Dried sardines
Cassava flour
Rice
Beef with bones
Dried or salted fish/ shellfish
Broad beans
Sweet potatoes
Sorghum- grain

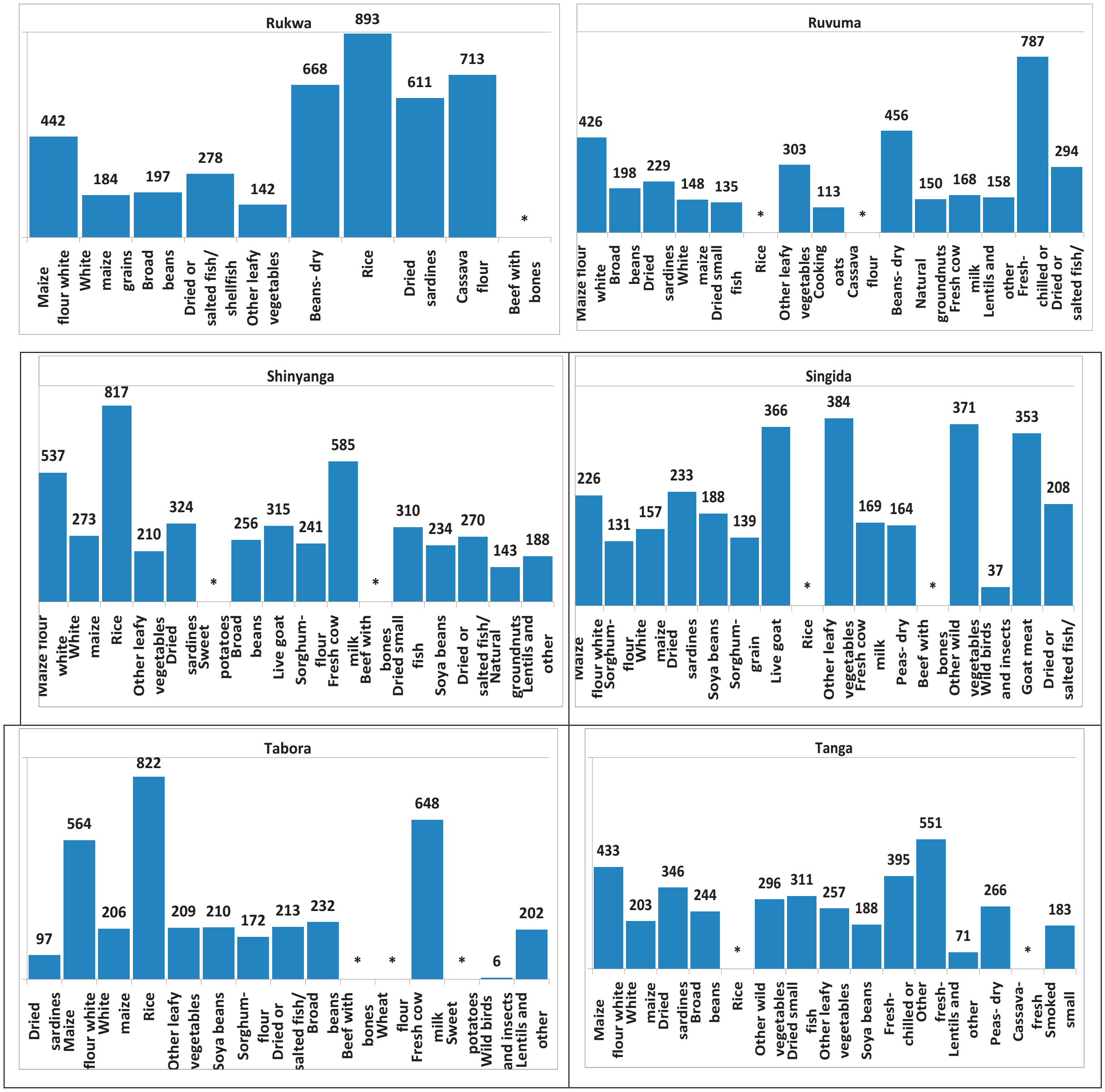

Mbeya
488
173
*
274
238
211
392
*
193
*
773
551
214
472
277
*
614
Maize flour white
White maize
Rice
Other leafy vegetables
Broad beans
Dried or salted fish/
Fresh- chilled or
Beef with bones
Dried sardines
Beans- dry
Pork meat
Clotted milk
Eggs
Dried small fish
Spotted beans
Tomatoes- round
Fresh cow milk


Morogoro
536
*
254
248
214
283
390
405
130
192
205
215
197
*
Maize flour white
Rice
Broad beans
Dried or salted fish/
White maize
Other leafy vegetables
Dried sardines
Fresh- chilled or
Other wild vegetables
Lentils and other
Soya beans
Peas- dry
Fresh dried fish
Beef with bones


Mtwara
616
148
587
249
*
392
253
344
185
154
221
219
*
74
196
Maize flour white
Lentils and other
Cassava flour
Other leafy vegetables
Rice
Dried sardines
Dried or salted fish/
Dried small fish
White maize
Natural groundnuts
Soya beans
Peas- dry
Fresh- chilled or
Cooking oats
Natural groundnuts


Mwanza
261
560
195
590
*
895
298
*
*
153
204
264
White maize
Fresh- chilled or
Dried sardines
Maize flour white
Rice
Sweet potatoes
Broad beans
Cassava flour
Beef with bones
Cooking oats
Other leafy vegetables
Fresh dried fish


Pwani
563
*
96
186
258
637
226
97
326
*
476
899
281
259
Maize flour white
Rice
Fresh dried fish
Other leafy vegetables
Broad beans
Fresh- chilled or
Soya beans
Fresh small sardines
Dried or salted fish/
Coconut (un
Dried sardines
Cassava flour
Peas- dry
Lentils and other


Rukwa
442
184
197
278
142
668
893
611
713
*
Maize flour white
White maize grains
Broad beans
Dried or salted fish/ shellfish
Other leafy vegetables
Beans- dry
Rice
Dried sardines
Cassava flour
Beef with bones
Ruvuma
426
198
229
148
135
*
303
113
*
456
150
168
158
787
294
Maize flour white
Broad beans
Dried sardines
White maize
Dried small fish
Rice
Other leafy vegetables
Cooking oats
Cassava flour
Beans- dry
Natural groundnuts
Fresh cow milk
Lentils and other
Fresh- chilled or
Dried or salted fish/
Shinyanga
537
273
817
210
324
*
256
315
241
585
*
310
234
270
143
188
Maize flour white
White maize
Rice
Other leafy vegetables
Dried sardines
Sweet potatoes
Broad beans
Live goat
Sorghum- flour
Fresh cow milk
Beef with bones
Dried small fish
Soya beans
Dried or salted fish/
Natural groundnuts
Lentils and other
Singida
226
131
157
233
188
139
366
*
384
169
164
*
371
37
353
208
Maize flour white
Sorghum- flour
White maize
Dried sardines
Soya beans
Sorghum- grain
Live goat
Rice
Other leafy vegetables
Fresh cow milk
Peas- dry
Beef with bones
Other wild vegetables
Wild birds and insects
Goat meat
Dried or salted fish/
Tabora
97
564
206
822
209
210
172
213
232
*
*
648
*
6
202
Dried sardines
Maize flour white
White maize
Rice
Other leafy vegetables
Soya beans
Sorghum- flour
Dried or salted fish/
Broad beans
Beef with bones
Wheat flour
Fresh cow milk
Sweet potatoes
Wild birds and insects
Lentils and other
Tanga
433
203
346
244
*
296
311
257
188
395
551
71
266
*
183
Maize flour white
White maize
Dried sardines
Broad beans
Rice
Other wild vegetables
Dried small fish
Other leafy vegetables
Soya beans
Fresh- chilled or
Other fresh-
Lentils and other
Peas- dry
Cassava- fresh
Smoked small

IV. FOOD DIET IN TERMS OF MICRONUTRIENTS AND PROTEIN QUALITY

IV.1. Micronutrient in Food Consumed

Micronutrients deficiencies among the population of developing countries are becoming a serious concern for the public health and are severely influencing the socio-economic development. Iron, Iodine, Zinc, Vitamin A deficiencies among others are some underlying causes of malnutrition, morbidity and mortality in developing countries. Comprehensive micronutrient assessments on national coverage are rarely available due to the high costs involved in collecting relevant data. The food security analysis is using the available food consumption data collected from national household surveys to perform an assessment of micronutrient, which is based on the quantities of food available for human consumption at household level, which is the basic unit for food consumption, by individual members for meeting their specific RNIs.

Micronutrients may be loss at different stages of the food chain such as during food storage and processing, both industrially and at home, from acquisition to preparation, from preparation to serving and before the food item is actually consumed, ingested, digested and absorbed. In additional, food availability is often seasonal in many countries. In the micronutrients assessment, neither supplementation nor fortification aimed for vulnerable population groups were taken into consideration as such information is not available. Food preparation varies among cultures and customs. Food items are prepared using cooking methods that may enhance or deteriorate the micronutrient content in the final prepared meals. For example, the Mayan culture adds calcium to maize when cooked for preparing tortillas; others may decrease ascorbic acid content of fruits when cooked to make desserts. Therefore, the derived estimates are indicative and they should not be interpreted as a result of the evaluation of intake by individuals in the population groups.

However under the assumption that household members have access to the meals prepared with a food mixture acquired by the household, the micronutrient assessment of food available for human consumption at national and sub-national levels provides inputs for:

- actions, preventive as well as correctives,
- formulate food security policies in the areas of public nutrition research and evaluation,
- food production,
- food trade and commercialization,
- agro-industry,
- food industry,
- food stocks and distribution,
- food pricing,
- Income generation.

The objective of the micronutrient assessment of food available for human consumption is indicative given that from acquisition to intake, there are many factors that may affect actual micronutrient bio-availability. Experts have provided average ***Recommendations of Nutrient Intakes*** (**RNI**s) which are daily intakes, which meets the nutrient requirements of almost all (97.5 percent) apparently healthy individuals in an age and sex-specific population group. The RNIs are usually assumed to take values two standard deviations above the ***Estimated Average Requirements*** (**EAR**). These referenced values are used for assessing adequacy of population intakes.

In this study, the population-based estimates of EARs and RNIs are weighted by the sampled sex and age population structures of each of the population groups.

The assessment of vitamins and minerals is usually expressed as ratios of intakes to recommendations or requirements in absolute values or standardized to 1000 kilocalories. The assessment methodology takes into consideration the distribution of micronutrients at the population or population groups level, but is limited to a non-parametric approach using data at household level. This approach yields estimates of the proportion of low or high levels of micronutrient consumption using as arbitrary cut-off ratios of micronutrient consumption to EARs or RNIs levels, for example 70 percent for low levels or 130 percent for excess. The meaning of the proportion of low levels, for example using 70 percent, is different from micronutrient to micronutrient due to their different scales and the distributions are not necessarily comparable.

The worldwide concern among experts on some micronutrients such as calcium, iron and vitamin A is that RNI levels are very difficult to meet. For example, the low consumption of dairy products makes RNIs values for calcium a difficult target, however, the use of the average (EAR) calcium requirement may be more realistic. In the case of iron and folic acid, particularly for vulnerable population groups such as pregnant and childbearing women, RNIs values can be met mainly with iron and folic acid supplementation.

This report includes the food security statistics and indicators for some micronutrients available for consumption with reference to EARs or NRIs for the population groups. Users may analyse the results with some freedom and caution. In addition, the results on micronutrients available for human consumption are classified among three categories, namely low, middle and high availability levels. Low availability level of the nutrient refers to when the average of the nutrient available for human consumption (Y) is lower than the corresponding population-based average estimated requirement (EAR). A high availability refers to when it is higher than the corresponding population-based average of nutrient recommended intake (RNI). When the average of the nutrient available for human consumption is between EARs and RNIs the availability is deemed as acceptable (table 1 below).

Table 1: Classification Categories of Micronutrients Available for Human Consumption

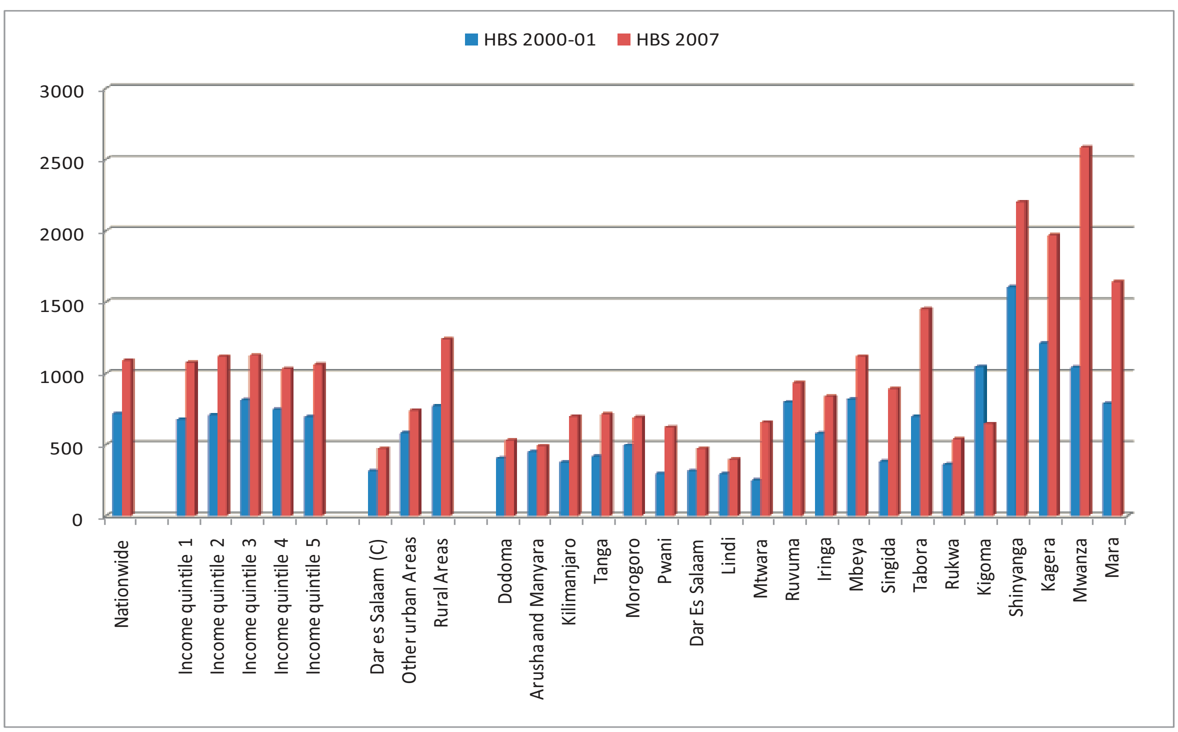
Classification Groups	Criteria value range
Low	Y < EAR
High	Y > RNI
Middle	EAR< Y > RNI

→ Vitamin A

Vitamin A is essential to the normal structure and function of the skin and mucous membranes. It is also required for cell differentiation and therefore for normal growth and development, and for normal vision and for the immune system. Deficiency leads to poor vision in dim light and eventually to blindness. Vitamin A is found in two forms: as *retinol* in foods from animal sources, and as *carotenoids* in foods from plant sources. Beta-carotene being the most common carotenoid. The total vitamin A content of the diet (from both animal and plant sources) is normally expressed as retinol equivalents. Retinol is found in liver, whole milk, cheese and butter. Carotenes are found in milk, carrots, dark green leafy vegetables and orange coloured fruits. Some food products (margarine) are fortified with vitamin A (and vitamin D).

In Mainland Tanzania, sources of vitamin A were mainly from starchy food such as sweet potato or plantain, leafy food such as spinach or vegetables sponge leaves, tomatoes, pumpkins, and cow milk.

Figure 28: Daily vitamin A available for consumption per person (mcg) in Tanzania by income level, area and region, 2000/1 and 2007



The daily vitamin A availability expressed as mcg of Retinol Activity Equivalent (RAE) per person at national level increased from 717 mcg in 2000/1 to 1088 mcg in 2007 as depicted by Figure 28. These levels of availability of vitamin A were considered high as they were was greater than the RNI of 527 mcg RAE for the Tanzanian population.

Income was not influencing the level of vitamin A availability for consumption. Availability of Vitamin A was lower in urban than in rural areas and varied significantly among regions and over the reference period. Regions of Shinyanga, Kagera, and Mwanza had the highest levels of vitamin A available for consumption, higher than 1000 mcg RAE, mainly obtained from sources of carotenes such as sweet potatoes, in both survey periods.

From 2000/1 to 2007, all regions, except of Kigoma, showed increments on vitamin A availability for consumption. This decreased in the region of Kigoma is partially due to 60 percent decreased in sweet potato available for consumption.

The region Mtwara increased vitamin A availability from 250 mcg RAE in 2000/1, less than the estimated EAR of 281 mcg RAE, to more than 650 mcg RAE in 2007, higher than the RNI of 533 mcg RAE. Even though the vitamin A available in the regions of Lindi, Dar es Salaam, Arusha and Manyara increased since 2000/1, its availability was still less than RNI levels in 2007.

→ ***Thiamin (B1), Riboflavin (B2), Pyridoxine (B6) and Cobalamine (B12)***

Thiamin (Vitamin B1) is needed to release energy from carbohydrate. The amount required is related to the amount of carbohydrate eaten. Deficiency of Thiamin causes beri-beri, a disorder of the nervous system, which occurs in communities where white rice is the main food eaten. A different type of thiamin deficiency affecting brain function is sometimes seen in alcoholics, where daily Thiamin intake is low and absorption and utilisation of the vitamin is impaired. Thiamin is found in whole grains, nuts and meat, especially pork. Some food items such as white and brown flour and many breakfast cereals are fortified with Thiamin.

Riboflavin (Vitamin B2) is required to release energy from protein, carbohydrate and fat. It is also involved in the transport and metabolism of iron in the body and is needed for the normal structure and function of mucous membranes and skin. Major dietary sources of riboflavin are milks, eggs, fortified breakfast cereals, liver and green vegetables.

Pyridoxine (Vitamin B6) is essential as a cofactor in the metabolism of protein. It is also involved in iron metabolism and transport. Together with folate and vitamin B12, vitamin B6 is required for maintenance of normal blood homocysteine levels. Vitamin B6 is found in a variety of foods such as beef, fish and poultry are rich sources. It also occurs in eggs, whole-grains and some vegetables.

The Thiamin (vitamin B1), Riboflavin (vitamin B2) and Pyridoxine (vitamin B6) availability for consumption were above RNI values at national level, all income levels, in urban and rural areas and in all regions.

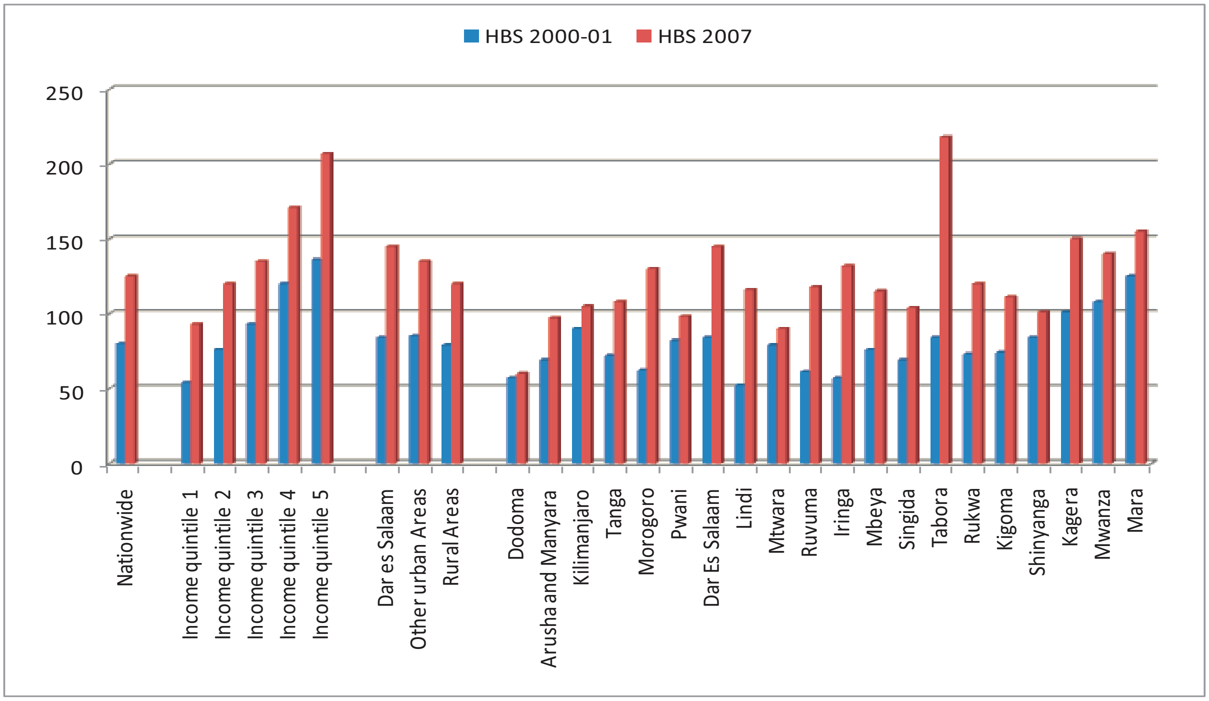
With a daily average Thiamin (vitamin B1) availability for consumption per person of 2.13 and 2.45 mg, in 2000/1 and 2007 respectively, above the RNI level of 0.98 mg in Tanzania. Maize of all kind and dry green beans were among the main source of thiamine. Even though, the maize consumption decreased at national level, the increment of 61 percent of dry green beans consumption increased the availability of thiamine. The region of Tabora showed an increment from 2.4 mg in 2000/1 to 6.8 mg, above RNI level, due to an increment on dry green beans consumption.

The availability of daily average Riboflavin (vitamin B2) for consumption per person was relatively high with an average consumption of 1.75 and 3.87 mg, in 2000/1 and 2007 respectively, well above RNI of 1.01 mg. These levels were mainly explained by the high consumption, especially in 2007, of leafy vegetables as sources of vitamin B2 as well as maize. All regions increased their availability of riboflavin, in particular Iringa due to a high increment on leafy vegetables consumption.

At national level the daily availability of Pyridoxine (vitamin B6) per person remained almost at the same level, from 2.3 to 2.4 mg, in 2000/1 and 2007 respectively, which was above RNI of 1.1 mg. Maize, cassava and rice were the major sources of Vitamin B6 in Tanzania. Even if Lindi and Tabora regions showed the highest decrease, from 2.7 to 2.3 mg, the Vitamin B6 availability was still above the RNI. This reduction is attributed to the fall in the consumption of maize and rice.

Salted dried sardine, dried fish, cattle meat and cow milk were the main sources of Cobalamin (Vitamin B12) in Tanzania. At national level the daily availability of Cobalamin per person increased from 1.63 mcg in 2000/1, lower than RNI level of 2.03 mcg, to 2.53 mcg in 2007, above the RNI level. The availability of Cobalamin was affected by income. Households in the lowest income quintile showed an availability of less than their RNI level in 2007, probably they could not afford more food from animal origin as depicted in Figure 29.

Figure 29: Ratio of consumption to recommendation values of Vitamin B12 (percent) in Tanzania by income level, area and region, 2000/1 and 2007



In 2000/1, the regions Kagera, Mwanza and Mara showed availability of Cobalamin higher than RNI levels. In 2007, it was noted a substantial increment of Cobalamin availability for regions. However, it was insufficient to average their RNI levels in the regions of Dodoma and Mtwara.

→ *Ascorbic acid*

Ascorbic acid (Vitamin C) is a water-soluble vitamin required for normal structure and function of connective tissue (in skin, cartilage and bone) as it is involved in the production of collagen - the protein in connective tissue. It is also involved in the normal structure and function of blood vessels and neurological function. Vitamin C also contributes to the absorption of iron, particularly from *non-heme* sources such as plant foods. This vitamin also has anti-oxidant activities, potentially protecting cells from free radical oxidative damage. Ascorbic acid is found almost exclusively in foods from plant sources, although fresh milk and liver contain small amounts.

The Mainland Tanzania, national daily average availability for consumption per person of ascorbic acid (Vitamin C) increased from 92 mg in 2000/1 to 127 mg in 2007, above the RNI of 40 mg.

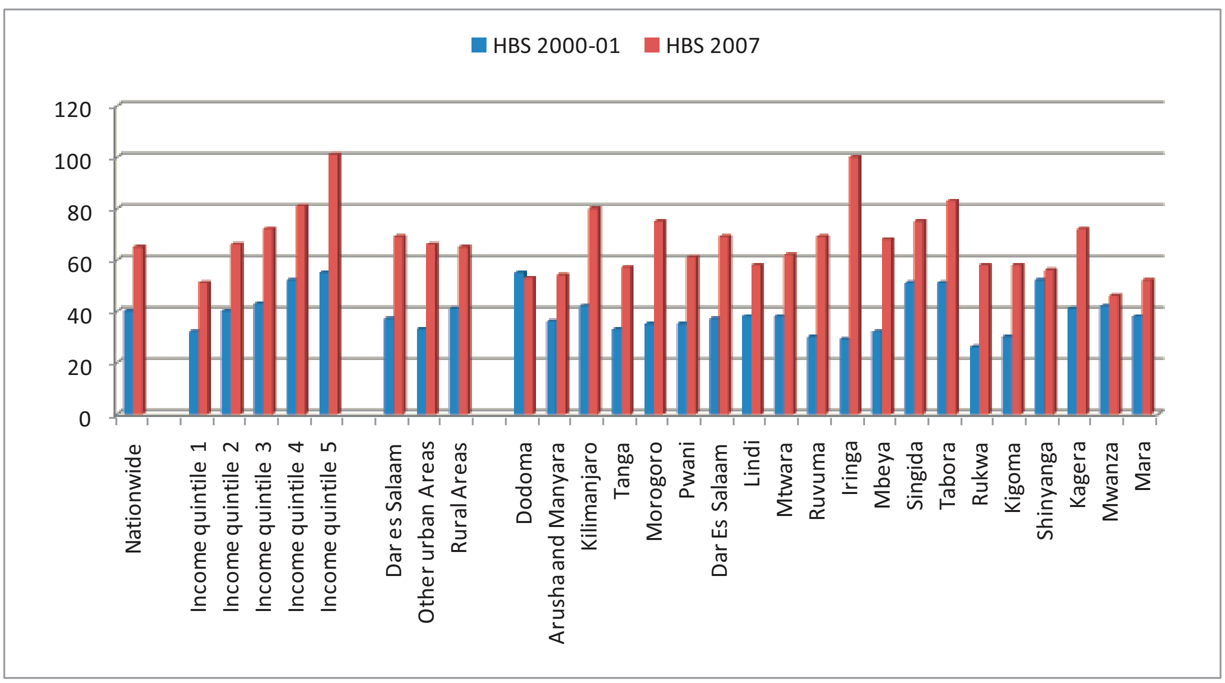
In 2000/1, the region of Singinda was the only region with Vitamin C available of 33.5 mg, below its RNI of 40 mg. However, in 2007 its availability increased to 80.6 mg, twice the RNI level. This increase is explained mainly due to the increase of cabbage and sweet potato consumption in Singida. Even though Lindi was the only region decreasing Vitamin C availability from 2000/1 to 2007, its level was still over the RNI level.

→ *Calcium*

Calcium is the main constituent of hydroxyapatite, the principal mineral in bones and teeth. Calcium also plays an essential role in intracellular signalling and is therefore necessary for nerve and muscle function. It is also involved in blood clotting. The absorption and excretion of calcium are controlled by several hormones and by vitamin D. An adequate calcium intake is vital for health, particularly in times of growth, e.g. childhood, adolescence, pregnancy, and during lactation. Foods that are particularly rich in calcium are milk, cheese and other dairy products (excluding butter). white and brown flour. Calcium is most readily absorbed from milk and dairy products. It is often less available from plant foods where the calcium may be bound by phytates (found in wholegrain cereals and pulses) and oxalates (found in spinach and rhubarb) in foods, which makes the calcium unavailable for absorption from the intestine into the blood.

Although the daily calcium availability per person increased from 296 mg in 2000/1 to 486 mg in 2007 as shown in Figure 30, this level was still below RNI levels and wide-spread in Tanzania at national level and for most population groups analyzed, that is, by income level, area of residence and region. Dodoma was the only region experiencing a decrease in the availability of calcium from 407 mg in 2000/1 to 388 mg in 2007. However, households in the highest income quintile and the region of Iringa with calcium availability of 765 and 747 mg respectively reached their RNI levels of 756 and 747 mg respectively in 2007.

Figure 30: Ratio of consumption to recommendation values of Calcium (percent) in Tanzania by income level, area and region, 2000/1 and 2007

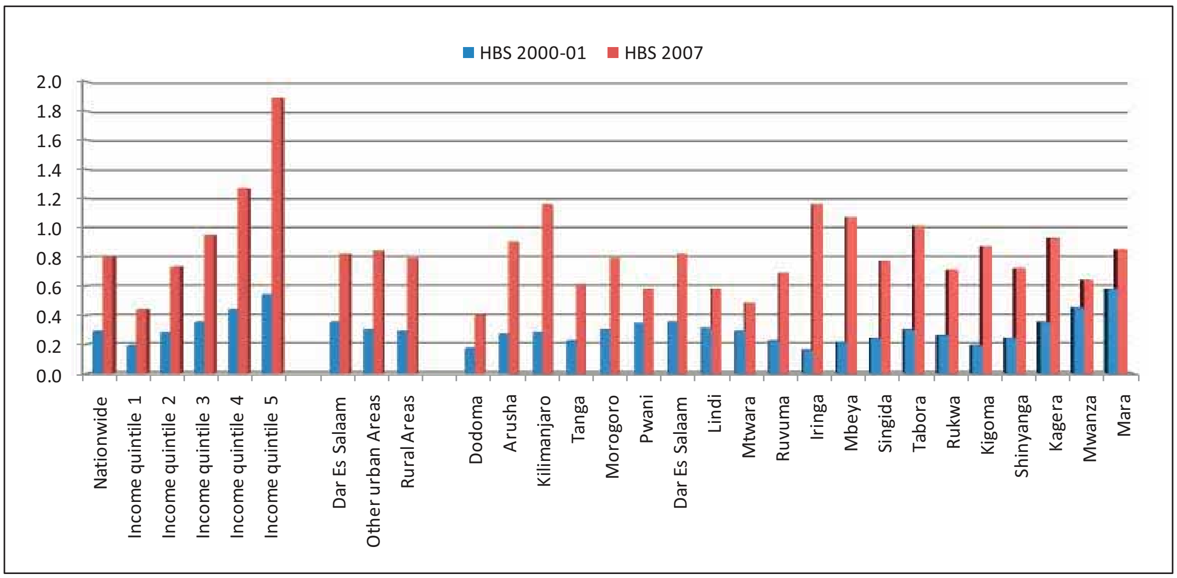


→ *Iron*

Iron is required for the formation of haemoglobin in red blood cells, which transport oxygen around the body. Iron is also required for normal energy metabolism, and for metabolism of drugs and foreign substances that need to be removed from the body. The immune system also requires iron for normal function. A lack of iron leads to low iron stores in the body and eventually to iron deficiency anaemia. Iron is found in animal and plant sources. Iron from animal sources (*haem iron*) is better absorbed than iron from plant sources (*non-haem iron*). Absorption of non-haem iron is affected by various factors in food. Phytate (in cereals and pulses), fibre, tannins (in tea) and calcium can all bind non-haem iron in the intestine, which reduces absorption. On the other hand, vitamin C, present in fruit and vegetables, aids the absorption of this kind of iron when eaten at the same time. The same applies to meat, fish and poultry.

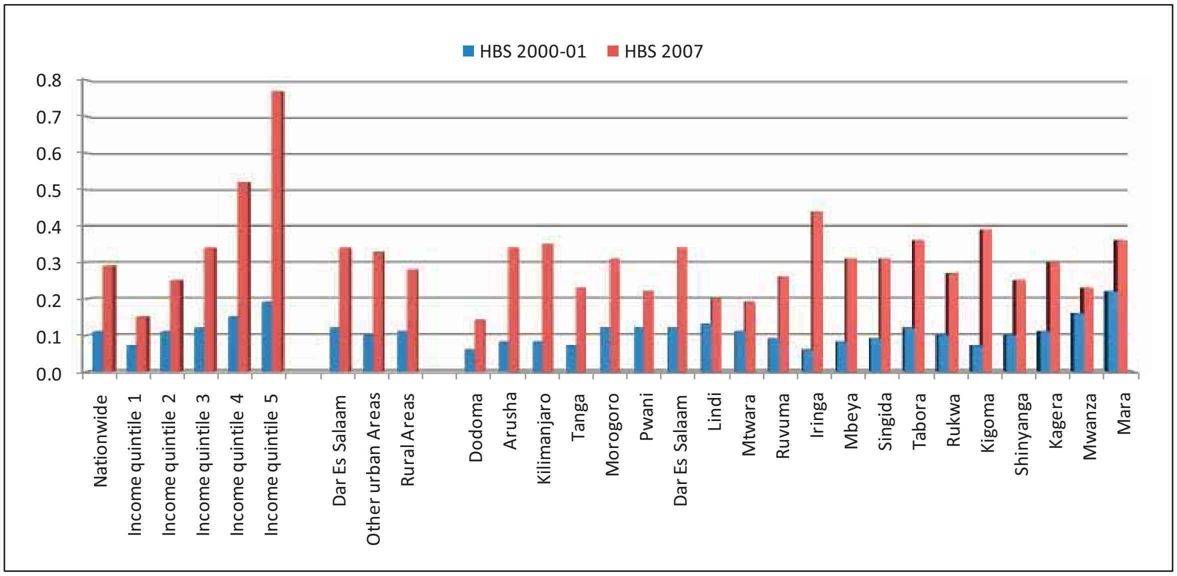
The daily iron availability per person of animal origin increased from 2000/1 to 2007 at national, residence area and regional levels shown in 31.

Figure 31: Iron of animal origin available (mg) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007



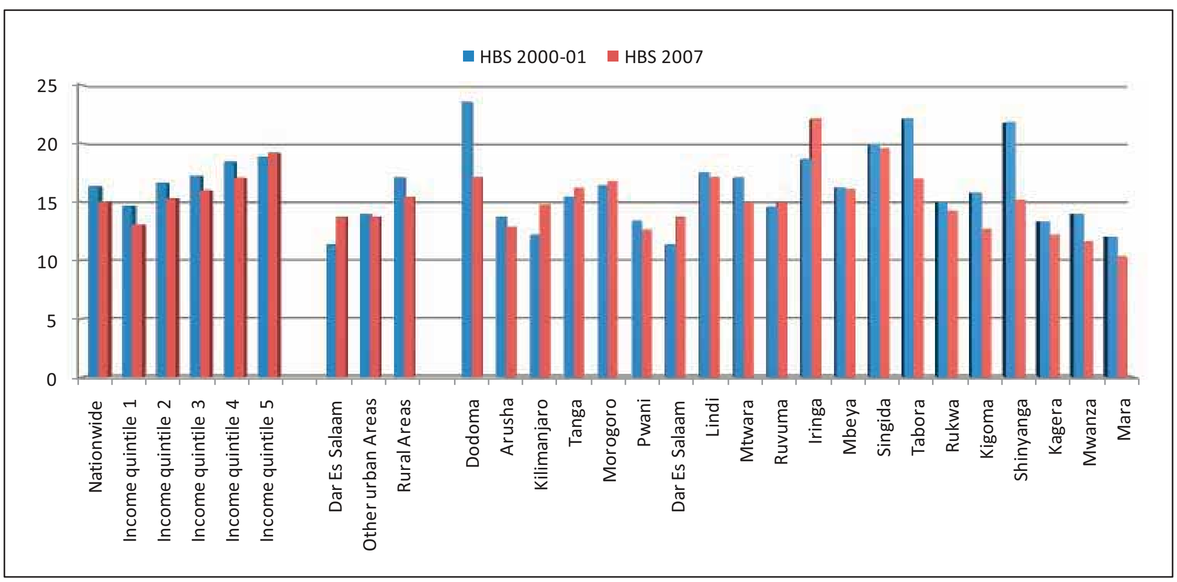
The amounts of animal-origin iron available were significantly higher in households of higher income, not different by area of residence and different among regions. Dodoma and Mtwara showed the lowest availability in animal iron (less than 0.5 mg), while Kilimanjaro, Iringa and Mbeya showed the highest levels (above one mg); the remaining regions ranged from 0.5 to 1.0 mg per person per day. A similar situation was found with the amounts of heme-iron available as shown in Figure 32; however all levels were less than 0.5 mg, except for the 20 percent population in households of the two high-income quintiles.

Figure 32: Heme-iron available (mg) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007



However in terms of daily non-heme iron availability per person decreased slightly from 2000/1 to 2007 at national, residence area and regional levels, except in the regions of Dodoma, Shinyanga and Tabora with high decrease and the region of Iringa with high increase as shown in Figure 33.

Figure 33: Non-heme iron available (mg) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007



The levels of absorption of non-heme iron available in food consumed will be inhibited or promoted by various factors. The HBS data made possible to estimate some of these factors and figure 34 shows ascorbic acid (vitamin C) as promoting factor of non-heme absorption. The availability of vitamin C increased from 2000/1 to 2007 at national level, by income and area levels. However, the region of Arusha remained at the same already low level of availability that would not promote the already low non-heme iron available. Important sources of ascorbic acid are citric fruits, for example lemon, that can be added to prepared food before intake.

Figure 34: Ascorbic acid (vitamin C) available (mg) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007

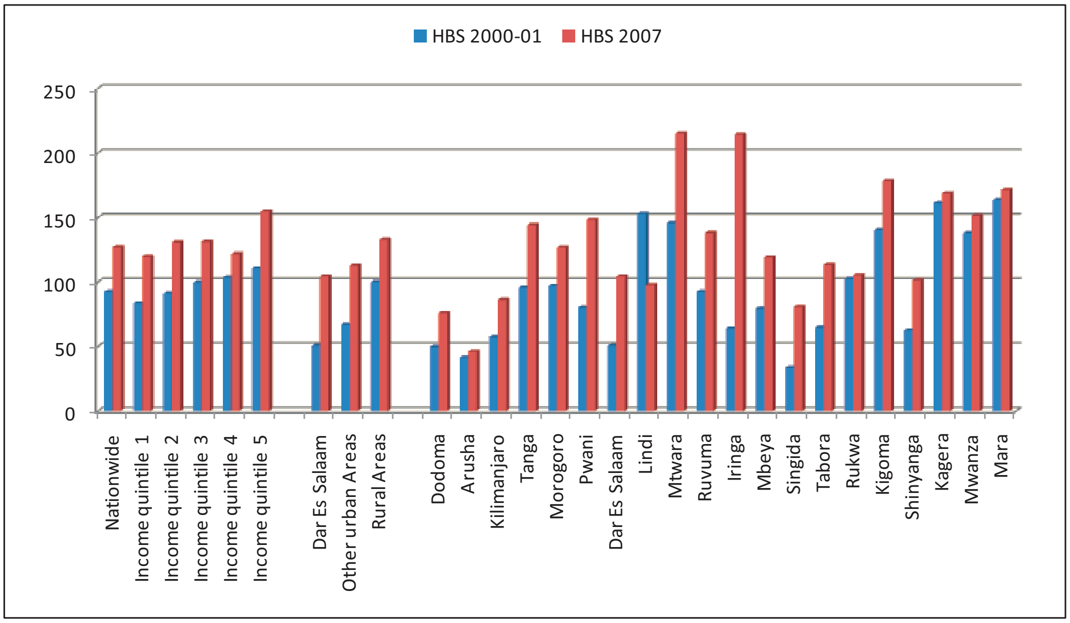


Figure 35 shows meats and fish consumption as promoting factor of non-heme absorption. The availability of these two food groups increased from 2000/1 to 2007 at national level, by income and area levels; however in the region of Dodoma meats and fish consumption decreased so that it would not promote the observed decreasing trend of non-heme iron availability and likely would counter-act the increase in vitamin C availability.

Other regions that remained with less or around 40 grams per person per day of meats and fish available with no increase in the promotion of non-heme iron available were Mtwara, Rutwa, Tanga and Shinganga as well as the population living in households of the lowest income quintile.

Figure 35: Meats and fish available (g) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007

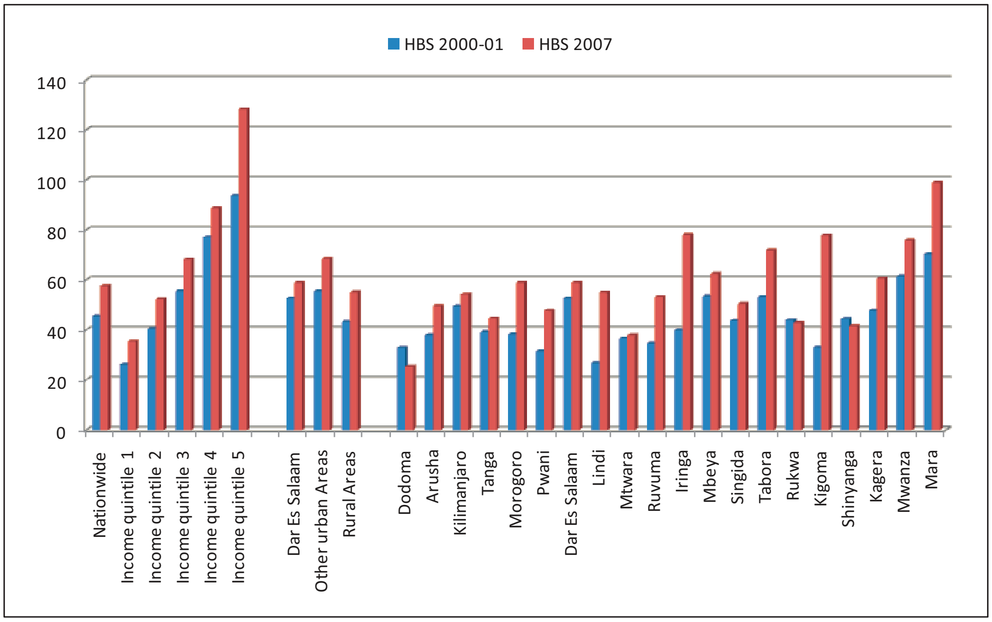


Figure 36 shows phytate levels in food consumed as an inhibitor factor of non-heme absorption. The availability of phytates decreased from 2000/1 to 2007 at national level and by income levels. At regional level phytates availability decrease in Dodoma, Iringa, Tabora, Kigoma, and Shinyanga among others, but it increased in Dar es Salaam and Lindi. In some regions the level of phytate availability would inhibit non-heme iron absorption, in particular regions with low non-heme iron availability.

Figure 36: Phytate available (mg) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007

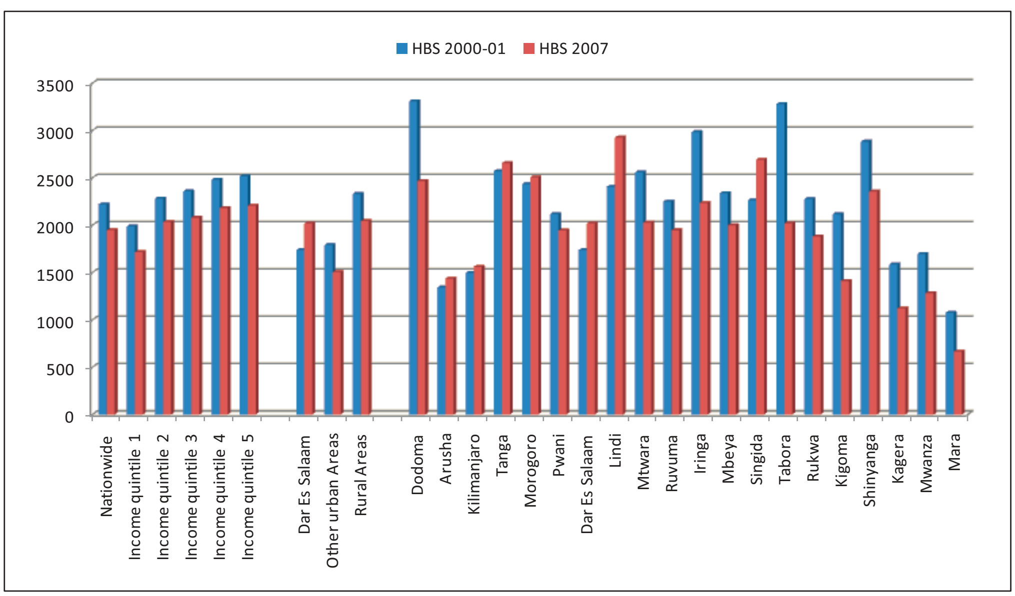


Figure 37: Polyphenol available (mg) in food acquired for consumption in Tanzania and by income, area and region, 2000/1 and 2007

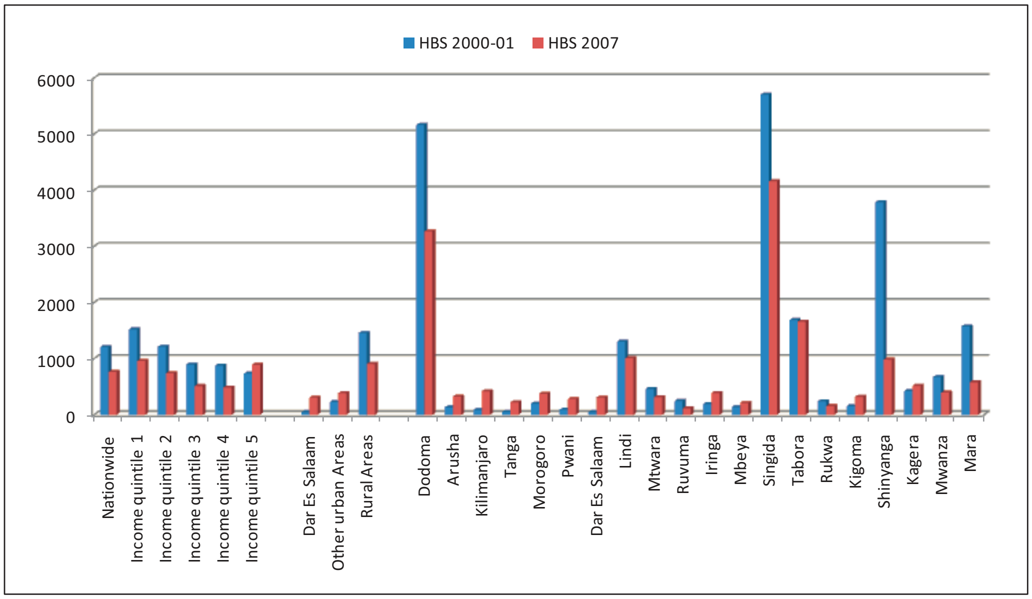


Figure 37 shows polyphenol levels in food consumed as an inhibitor factor of non-heme absorption. The availability of polyphenol decreased from 2000/1 to 2007 at national level and by income levels, except the highest income quintile. Rural areas showed a decrease in availability. However at regional level, polyphenol availability decreased significantly in Dodoma, Singida, Shinyanga and Mara. Still in 2007, high availability was observed in Singida, and Tabora where polyphenol available in food consumed would inhibit non-heme iron absorption.

The micronutrients available for human consumption are classified in three categories (Table 1) of low, middle and high availability levels, except iron availability that needs to consider promoting and inhibiting factors. Table 2 gives the classification of the micronutrient availability of food consumed in Mainland Tanzania by income groups, area of residence and regions for both survey periods.

Calcium, cobalamin (vitamin B12) and vitamin A showed, among the micro-nutrients included in the assessment, low availability in food acquired for human consumption. The major sources of calcium are in fish and dairy products, while of cobalamin are fish and meats, and of vitamin A as retinol are dairy products, meats, eggs and fish and products while as carotene are yellow tubers, roots, fruits and vegetables.

Table 2: Categories of micronutrient availability in food consumed in Tanzania by income level, area and region, 2000/1 and 2007

Categories and Groupings	Vitamin A		Vitamin B1		Vitamin B2		Vitamin B6		Vitamin B12		Vitamin C		Calcium	
	HBS 2000-01	HBS 2007	HBS 2000-01	HBS 2007	HBS 2000-01	HBS 2007	HBS 2000-01	HBS 2007	HBS 2000-01	HBS 2007	HBS 2000-01	HBS 2007	HBS 2000-01	HBS 2007
Nationwide	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Income quintile 1	1	1	1	1	1	1	1	1	3	2	1	1	3	3
Income quintile 2	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Income quintile 3	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Income quintile 4	1	1	1	1	1	1	1	1	2	1	1	1	3	3
Income quintile 5	1	1	1	1	1	1	1	1	2	1	1	1	3	1
Dar es Salaam (C)	2	2	1	1	1	1	1	1	3	1	1	1	3	3
Other urban Areas	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Rural Areas	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Dodoma	2	1	1	1	1	1	1	1	3	3	1	1	3	3
Arusha and Manyara	2	2	1	1	1	1	1	1	3	2	1	1	3	3
Kilimanjaro	2	1	1	1	1	1	1	1	3	1	1	1	3	3
Tanga	2	1	1	1	1	1	1	1	3	1	1	1	3	3
Morogoro	2	1	1	1	1	1	1	1	3	1	1	1	3	3
Pwani	2	1	1	1	1	1	1	1	3	2	1	1	3	3
Dar Es Salaam	2	2	1	1	1	1	1	1	3	1	1	1	3	3
Lindi	2	2	1	1	1	1	1	1	3	1	1	1	3	3
Mtwara	3	1	1	1	1	1	1	1	3	2	1	1	3	3
Ruvuma	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Iringa	1	1	1	1	1	1	1	1	3	1	1	1	3	1
Mbeya	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Singida	2	1	1	1	1	1	1	1	3	1	1	1	3	3
Tabora	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Rukwa	2	1	1	1	1	1	1	1	3	1	1	1	3	3
Kigoma	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Shinyanga	1	1	1	1	1	1	1	1	3	1	1	1	3	3
Kagera	1	1	1	1	1	1	1	1	2	1	1	1	3	3
Mwanza	1	1	1	1	1	1	1	1	2	1	1	1	3	3
Mara	1	1	1	1	1	1	1	1	2	1	1	1	3	3

Category 1: High availability
Category 2: Medium availability
Category 3: Low availability

Table 3 summarizes the sources of micro-nutrients by food groups. The main sources of retinol were dairy products and potentially meat, eggs and fish; beta-carotenes were available in substantial amounts from roots & tubers and products, mainly from sweet-potatoes as well as from vegetables and products. Less than five percent retinol-activity-equivalent was obtained from retinol available only in animal food products. Vitamin C sources were mainly from roots & tubers and products and vegetables, follow by fruits and products. Vitamin B1 sources were mainly from vegetables and products and cereals and products, while for vitamin B2 the main sources were vegetables and products; on the other hand vitamin B6 sources were mainly cereals and products, while for vitamin B12 the main sources were fish and products and potentially meats and dairy products.

In relation to minerals, calcium sources were mainly fish & products, followed by vegetables & products and dairy products. Still in 2007, the levels of availability were very low, almost everywhere.

Finally, the assessment of iron availability in food consumed is quite complex. The iron of animal origin was available from fish, meats and airy products and potentially from eggs. Heme-iron was available mainly from meat and fish. In Mainland Tanzania in 2007, the heme-iron available on average was 0.29 mg. Thus, it would be required that 100 percent of that amount of the heme-iron and an additional of 0.80 mg (about 5%) from 16.33 mg of non-heme iron be absorbed, after taking into account the effect of promoting and inhibiting factors and their interactions, to reach the average 1.09 mg iron required in absorption. Up to this report, there is no reliable algorithm for assessing the amount of iron available for absorption.

Similarly, in the lowest income quintile in 2007, where the lowest heme-iron available of 0.15 mg on average was observed,. It would be required that 100 percent of it and 0.92 mg (8.6 %) from 13.04 mg of non-heme iron be absorbed, after taking into account the effect of promoting and inhibiting factors and their interactions, to reach average 1.07 mg iron required in absorption.

Again, in the region of Dodoma 2007, where the heme-iron available on average was 0.14 mg, it would be required that 100 percent of it and 0.90 mg (5.3 %) from 17.14 mg of non-heme iron be absorbed, after taking into account the effect of promoting and inhibiting factors and their interactions, to reach average 1.04 mg iron required in absorption.

The three situations described above the non-heme absorptions aim to reach EARs levels rather than NRIs levels, hence the nutritional status of iron could be near the border line of EARs. Consequently, near one half of the Tanzanian population would be with low levels of iron availability for absorption.

Table 3: Micronutrient availability in food consumed in Tanzania by food groups, 2000/1 and 2007

Item group	Retinol	Beta caroteno	RAE of vitamin A	animal iron	non animal iron	heme iron	non heme iron	vitamin C	vitamin B1	vitamin B2	vitamin B6	vitamin B12	calcium
		mcg/person/day					mg/person/day					mcg/person/day	mg/person/day
ROOTS AND TUBERS AND PRODUCTS	0	9141	762	0,00	1,6	0,00	1,6	52	0,2	0,2	0,5	0,0	45
VEGETABLES AND PRODUCTS	0	2333	202	0,00	2,3	0,00	2,3	47	1,1	3,0	0,3	0,0	87
FRUITS AND PRODUCTS	0	704	61	0,00	0,4	0,00	0,4	24	0,1	0,1	0,2	0,0	12
CEREALS AND PRODUCTS	0	106	11	0,00	6,8	0,00	6,8	0	0,8	0,3	1,1	0,0	39
SPICES	0	18	2	0,00	0,1	0,00	0,1	0	0,0	0,0	0,0	0,0	19
PULSES	0	11	1	0,00	1,9	0,00	1,9	1	0,2	0,1	0,1	0,0	25
OIL CROPS	0	2	0	0,00	1,4	0,00	1,4	1	0,0	0,0	0,0	0,0	27
NON ALCOHOLIC BEVERAGES	0	0	0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,0	0,0	1
MILK AND CHEESE	33	0	33	0,10	0,0	0,00	0,1	0	0,0	0,1	0,0	0,2	55
MEAT	7	0	7	0,32	0,0	0,17	0,1	0	0,0	0,0	0,1	0,4	2
EGGS	6	0	6	0,04	0,0	0,00	0,0	0	0,0	0,0	0,0	0,0	2
FISH AND FISH PRODUCTS	4	0	4	0,34	0,0	0,12	0,2	2	0,0	0,0	0,1	1,9	156
OILS AND FATS (aninal fats)	0	0	0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,0	0,0	0
SUGARS AND SYRUPS AND PRODUCTS	0	0	0	0,00	0,1	0,00	0,1	0	0,0	0,0	0,0	0,0	13
ALCOHOLIC BEVERAGES	0	0	0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,1	0,0	3
TREE NUTS	0	0	0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,0	0,0	1
STIMULANTS	0	0	0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,0	0,0	0
OILS AND FATS (vegetable oils)	0	0	0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,0	0,0	0
	50	**12316**	**1088**	**0,80**	**15**	**0,29**	**15**	**127**	**2,4**	**3,9**	**2,4**	**2,5**	**486**

IV.2. Analysis of Quality of Protein

Protein is needed for growth and repair of the body. It also provides energy and 1 gram provides 4 kilocalorie. Different foods contain different amounts and combinations of amino acids, which ate the building blocks of proteins. Amino acids are compounds containing carbon, hydrogen, oxygen, nitrogen and, in some cases, sulphur. All amino acids have an acid group and an amino group attached to a carbon atom. There are about twenty different amino acids commonly found in plant and animal proteins and are classified as *Essential and Non-Essential amino acids.*

After a protein is eaten, it is broken down by digestion into amino acids, which are then absorbed and used to make other proteins in the body. Sometimes it is possible for the amino group of an amino acid to be transferred to another molecule by a process called transamination. In this way the human body is able to make some amino acids for itself and these are known as *Non-Essential* or dispensable amino acids. However, the human body is not able to do this process for every amino acid the body needs. Thus, a certain number of amino acids must be supplied by the diet. They are known as the *Essential* (or indispensable) amino acids and for the human adult there are eight:

- Leucine
- Isoleucine
- Valine
- Threonine
- Methionine
- Phenylalanine
- Tryptophan, and
- Lysine.

All animal and plant cells contain some protein but the amount of protein present in food varies widely by type of food. It is not just the amount of protein that needs to be considered, but the quality of the protein is also important which depends on the amino acids that are present in the food.

If a protein contains the indispensable amino acids(Essentials) in the approximate proportion required by humans, it is said to have a high biological value. If it is comparatively low in one or more of the essential amino acids, it is said to have a low biological value.

The amino acid that is in shortest supply in relation to need is termed the limiting amino acid. In general, proteins from animal sources have a higher biological value than proteins from plant sources, but the limiting amino acid varies.

Lysine is the limiting amino acid in wheat protein, Tryptophan in maize protein, and Methionine and Cysteine in beef protein. Among the vegetable sources, soya protein is the most complete.

→ ***Protein quality***

The measurement of protein quality in food available for human consumption is necessary to determine the capacity of food sources to provide a diet that may satisfy essential amino acids needed by the population. One of the most frequent indicators for evaluating the protein quality is the Protein-Digestibility-Corrected Amino Acid Score (PDCAAS[2]), proposed in 1991[3] and reviewed in 2002[4]. The value of PDCAAS is calculated from the estimate of protein digestibility and the Amino Acid Score (AAS). The AAS is based on a comparison of the amino acid composition of digestible protein consumed with respect to the pattern of essential amino acids per gram of protein required by the population. The essential amino acids in available food for human consumption are expressed on protein-consumed basis, while the essential amino acids required by the population are expressed on mean protein requirement basis. The protein requirements vary by sex and age. The limiting amino acid is the one, which has the minimum PDCAAS value.

The experts have suggested different patterns of essential amino acids required for different population groups, which are: infants, preschool-aged children (1-2 years), children and adolescents (3-18 years) and adults (over 18 years). However, they recommended the use of the preschool children pattern for assessing the quality of the protein by the estimation of the PDCAAS. This report presents also findings of the quality of the protein using the population-based pattern of essential amino acids required, weighted by the sex and age population structure.

The values of PDCAAS, using any pattern, can overestimate or underestimate protein quality since the assessment takes all food items available as a whole. This is due to the fact that food items are available and consumed in a less or more efficient combination to provide essential amino acids than the optimal combination of all food items as a whole in estimating PDCAAS values.

Food may be physically available depending on, for example, seasonal variations and commercialization schemes. The economic access to food may be subject to the income scheme of households (daily, weekly, monthly or seasonal) to acquire food (bought, own-produced or others) and types of food commercialization, among other factors. Food consumption may also depend on cultural aspects such as food habits, forms of food preparations and intra-household distribution according age and sex of members..

In view of the above, the values of PDCAAS for population groups are indicative and they do not have to be interpreted as a result of the evaluation of consumption by individuals in the population

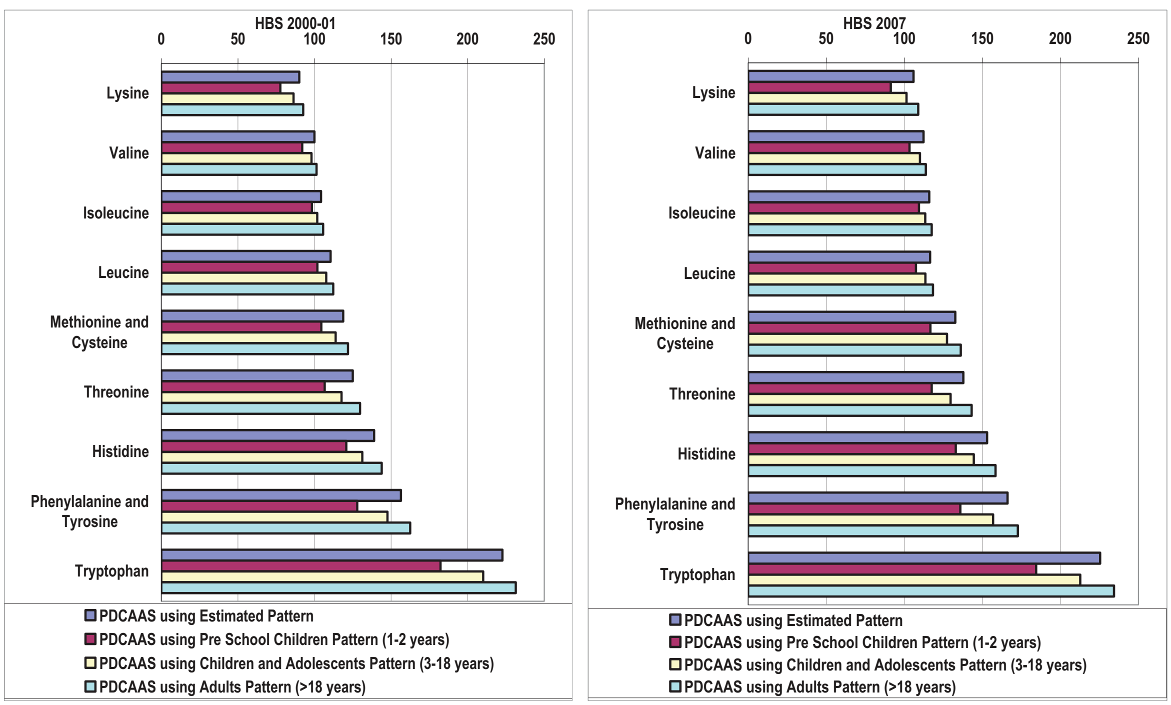
[2] PDCAAS = Minimum of [(EAAi/protein in food) / (EAAi /protein required)]* PD where EAAi is the ith essential amino acid and PD is weighted protein digestibility. EAAi, protein and PD are expressed in milligrams, grams and percentage, respectively.
[3] FAO (1991). Protein quality evaluation in human diets. Report of a joint FAO/WHO expert consultation. FAO Food and Nutrition Paper no. 51. Rome, Italy.
[4] WHO (2002). Protein and amino acid requirements in human nutrition. Report of a Joint WHO/FAO/UNU Expert Consultation. WHO technical report series ; no. 935. Geneva, Switzerland.

groups. The combination of essential amino acids of food mixtures consumed in households can vary by preparation methods of meals. Nevertheless under the assumption that household members have access to the meals prepared with a food mixture acquired by households, the protein quality of foods available for human consumption, guides the formulation of policies on food production, import and export as well as on food industry and food commercialization.

→ ***Protein quality assessed using different patterns of essential amino acids***

The quality of protein of the Tanzanian diet improved from 2000/1 to 2007 as shown in Figure 38. Food sources of essential limiting amino acid lysine were consumed in higher quantities in 2007 with respect to 2000/1. These food sources were fish, dried and fresh. Lysine among all essential amino acids showed the lowest PDCAAS value using the normative preschool children pattern, suggested by experts, as well as the population-based pattern which weighted by the sex and age population structures. However, the lysine PDCAAS value using the preschool children normative pattern in general yielded lower values than the population-based pattern.

Figure 38: Protein digestibility-corrected amino acid score (PDCAAS) in Tanzania, 2000/1 and 2007



Even though the lysine PDCAAS values increased for each income group in 2007 with respect to 2000/1, using the population-based pattern, protein was still limiting in lysine amino acid in households in the lowest income quintile as depicted in Figure 39. The food sources of lysine were consumed in higher quantities in 2007 with respect to 2000/1, in all income levels but not enough in households in the lowest income quintile.

By area of residence, in 2000/1, urban and rural areas showed lysine was the limiting amino acid using the preschool children pattern, but in 2007 lysine increased not enough in Dar es Salaam and rural areas

Figure 39: PDCAAS of lysine population-based in Tanzania, by income quintile, 2000/1 and 2007

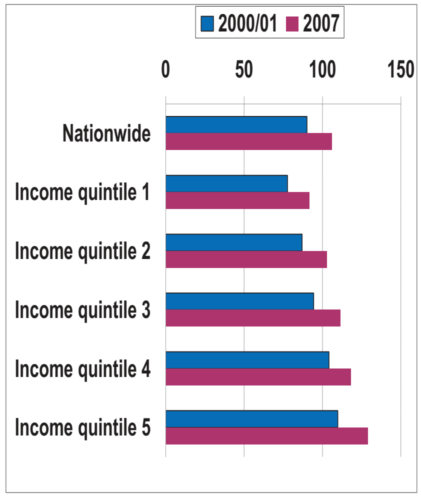
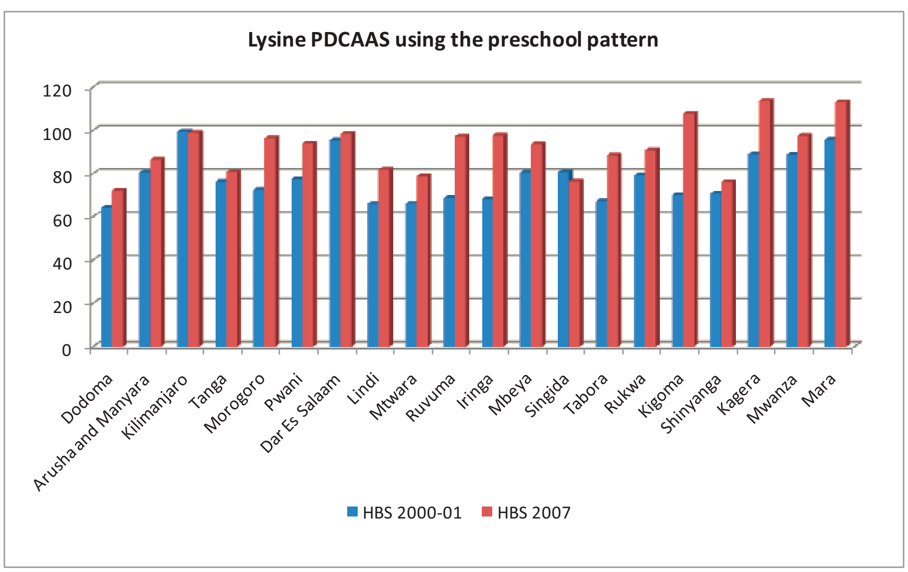


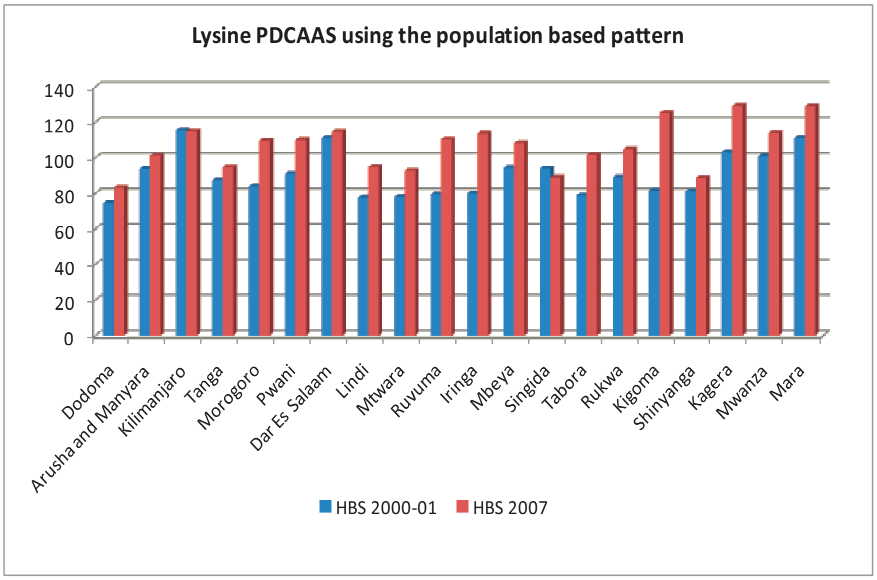
Figure 40 illustrates lysine PDCAAS values using preschool children and Figure 41 that one with the sampled population-based essential amino acid patterns by region. Using the preschool children pattern, all regions in 2000/1 had lysine as the limiting essential amino acid, even though lysine availability increased in 2007, all regions, except Kigoma, Kagera and Mara, had still lysine as limiting amino acid.

Figure 40: Lysine PDCAAS with preschool children patterns by region, 2000/1 and 2007



On the other hand, using the population-based pattern, except Kilimanjaro, Dar es Salaam, Kagera and Mara, the other 16 regions had lysine as limiting amino acid in 2000/1, while only six regions (Dodoma, Tanga, Lindi, Mtwara, Singida and Shinyanga) still had lysine as limiting amino acid in 2007.

Figure 41 Lysine PDCAAS with population-based patterns by region, 2000/1 and 2007



On the other hand, the estimated daily protein digested per person in Tanzania increased in all income quintiles from 2000/1 to 2007. Households in the first income quintile showed digested protein below the national level of 54 grams in 2007 as depicted in Figure 42.

While in 2000/1 protein digested per person per day ranged from 41 grams in Dar es Salaam to 47 and 46 grams in rural and other urban areas respectively, in 2007 it was more homogeneous with average of 54 grams for all three population groups (not shown).

Figure 42: Estimated digested protein in Tanzania, by income quintile, 2000/1 and 2007

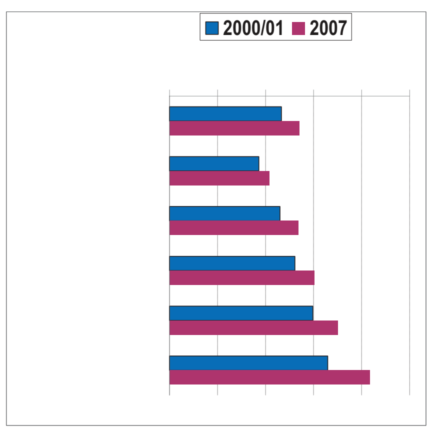
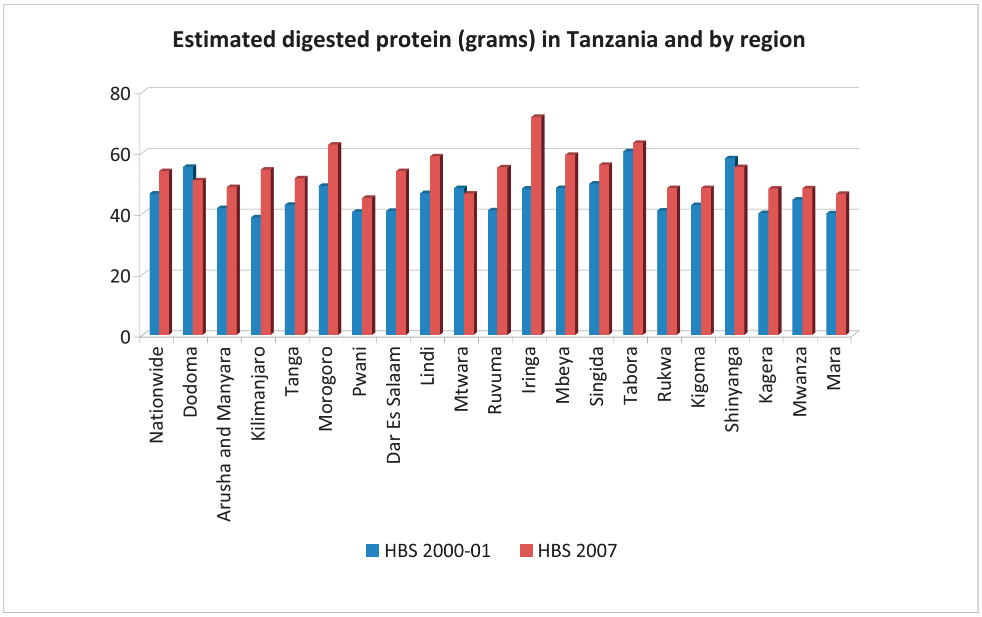


Figure 43 illustrates protein digested in Tanzania and by region. The increased in digested protein at national level was due to the increase observed in almost all regions, except in Dodoma, Mtwara and Shinyanga.

Figure 43: Estimated digested protein (grams) in Tanzania and by region

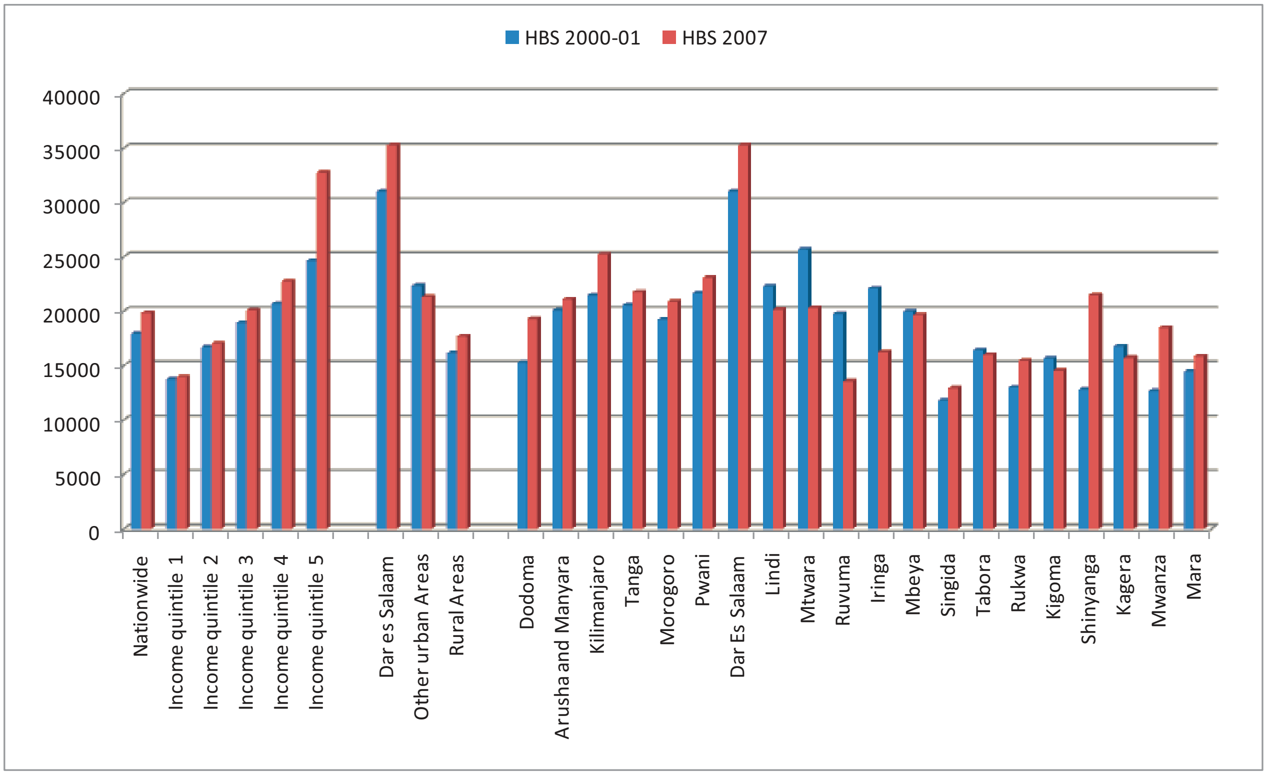


→ ***Lysine unit cost***

Figure 44 shows lysine unit costs in Tanzania and by income level, area and region. The lysine unit cost at national level increased by 11 percent, 17937 and 19830 TSh (at 2007 constant price) per 100 grams in 2000/1 and 2007 respectively. Households in the highest income quintile paid more in 2007 than in 2000/1. It increased more, 14 percent, in the region of Dar-es-Salam, almost 31000 and 35277 TSh in 2000/1 and 2007 respectively (at 2007 constant price) per 100 grams. Lysine was twice more expensive in Dar es Salaam than in rural areas and about one and half than the other urban areas.

The region of Shinyanga showed an increment of 65 percent in the cost of lysine at 2007 constant price. The main sources of lysine in Shinyanga changed from 2000/1 to 2007, being dried sardines and yoghurt in the former year and dried sardines and rice in the latter one. So, the increase in the lysine cost in this region was because lysine from rice was much more expensive than from yoghurt. In 2007 the cost of lysine from rice was 248 while the cost from yoghurt was 23 TSh per gram of lysine. On the contrary, in Iringa there was a decrease of 28 percent in the lysine cost. In 2000/1 one of the main sources of lysine was cattle meat which was replaced in 2007 by dried fish. The cost of lysine, in Iringa, from cattle meat in 2007 was 185 TSh per gram of lysine while from dried fish was 26 TSh. In almost all the regions fish was the least expensive source of lysine and the lowest costs were observed in regions of Pwani, Lindi, Ruvuma and Kagera close to water resources.

Figure 44: Unit cost of amino acid lysine (TSh constant price 2007) per 100 grams in Tanzania by income level, area and region, 2000/1 and 2007



V. CONCLUSIONS AND RECOMMENDATIONS

- The magnitude of food deprivation of one person out of four suffering from hunger did not change from 2000/1 to 2007 in Tanzania.
- Even though, the minimum dietary energy requirement was the same in both periods and the dietary energy consumed in 2007 was higher than in 2000/1 the prevalence remained the same because the inequality in access to food increased during the period of study.
- The deprived population showed that the gap of between average dietary energy consumed and minimum dietary energy required, increased from 2000/1 to 2007 about 72 grams of cereal-equivalent per person per day.
- The increase in vegetables, oil and fish consumption improved micro nutrients and protein quality consumption from 2001 to 2007.
- Energy from cereals decline 6 percent (74 Kcal/person/day) and from alcohol 75 percent (86 Kcal/person/day).
- Cobalamin deficiency was widespread in 2000/1 and 2007; however it improved in 2007 due to an increment of seven percentage points of protein coming from food of animal origin. Dodoma and Mtwara regions were still deficient in vitamin B12 in 2007
- The Tanzania's population in 2007 improved access to calcium with respect to 2001 but it was not enough to reach recommended calcium intake. All regions with the exception of Iringa were deficit in Calcium.
- In spite of the fact that protein quality improved from 2001 to 2007, lysine was still limitiing essential amino acid using preschool children normative pattern in most regions. Food security policies should address protein quantity where protein consumption falls below national protein quantity consumption and protein quality where PDCAAS falls below 100 percent (national PDCAAS level). Regional policies should concentrate on promoting an increase of lysine food sources consumption such as fish, meat and dry legumes (pulses) focusing regions of Dodoma, Singida and Shinyanga where protein corrected amino acid scores had lysine as limiting amino acid in 2007.
- Dietary energy consumed at national level was balanced in terms of energy-yielding macronutrients. However, the protein and fat contribution were near low limits of recommended intakes. Therefore, addressing the issue of food deprivation by an increase of food availability and access to fats (from vegetable oil) and proteins (from dry legumes (pulses), meat and milk) would help to increase dietary energy consumption, protein quality and vitamin B12 intake level. Policies should focus on improving access and availability of calcium by fortifying milk and maize flour.

- Other possible solutions policies could focus on are linked to public educate about foods sources from local production in certain vitamins and minerals, disease control such as malaria, measles, diarrhoea, and parasitic infections to help absorption and retention of essential vitamins and minerals by the body, food aid programmes such as school feeding and micronutrients supplements in tablets or syrups.

Recommendations

- The analysis of diet quality relies on food conversion values to obtain nutrient values and consequently it is highly recommended that food-item descriptions of food consumed collected in household surveys be as exhaustive as possible. In case of the THBS, many food items were not well described and some decisions were made with respect to collected data on food items.
- THBS was collecting many food items in non-standard unit of measurement. Then conversion factors for non-standard units of measurement into standard units require a proper documentation based on information from local markets.
- Food consumption from wild animals in rural household may be very high in a short period of reference, so it is suggested to exclude them in future surveys.
- Finally, if in 2000/1 the high share of alcohol consumption in rural areas and regions such as Iringa, Rukwa and Mbeya did not reflect actual consumption then the issue needs to be addressed in terms of data collection or alcohol content in traditional brew. If on reverse, it is true that in some regions alcohol consumption is high then the issue need to be addressed in terms of impact of such high alcohol consumption in overall productivity of people.

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GLOSSARY OF TERMS ON FOOD SECURITY

ANTHROPOMETRY
Use of human body measurements to obtain information about nutritional status.

AVERAGE ENERGY REQUIREMENT
It refers to the amount of energy considered adequate to meet the energy needs for normative ***average*** acceptable weight for attained height while performing ***moderate*** physical activity in good health.

BALANCED DIET
The diet is balanced when it is judged to be consistent with the maintenance of health in a population. The balance can be examined in terms of the contribution of the various energy-yielding macronutrients and other nutrients. A macronutrient-based balance food consumption pattern should contribute to total energy from proteins, fats and carbohydrates within recommended ranges as follows: proteins from ten to 15 percent, fats from 15 to 30 percent and carbohydrates from 55 to 75 percent, as from a technical report of a 2002 Joint WHO/FAO Expert Consultation (WHO 2003).

CRITICAL FOOD POVERTY
The prevalence of critical food poverty (pCFP) refers to the proportion of persons living on less than the cost of the macro-nutrient balanced MDER (for Minimum Dietary Energy Requirement see below and for balanced diet see above) with food prices from households in the lowest income quintile. It can be estimated at national and sub-national levels.

DEGREE OF FOOD DEPRIVATION
A measure of the overall food insecurity situation in a country, based on a classification system that combines prevalence of undernourishment, i.e. the proportion of the total population suffering from a dietary energy deficit, and depth of undernourishment, i.e. the magnitude of the undernourished population's dietary energy deficit.

DEPTH OF FOOD DEPRIVATION
It refers to the difference between the average dietary energy intake of an undernourished population and its average minimum energy requirement (MDER).

DIETARY ENERGY UNIT COST
The dietary energy unit cost is the monetary value in local currency of 1000 kilo-calories of food consumed.

DIETARY ENERGY CONSUMPTION
Food consumption expressed in energy terms. At national level, it can be calculated from the FBS (see below); the FBS estimate refers to both private (households) and public (hospitals, prisons, military compounds, hotels, residences, etc) food consumption. At sub-national levels it is estimated using food consumption data, with quantities collected in national household surveys (NHS); these estimates refer to private food consumption.

DIETARY ENERGY DEFICIT
Same as Depth of Food deprivation.

DIETARY ENERGY INTAKE
The energy content of food consumed.

DIETARY ENERGY REQUIREMENT
It refers to the amount of energy required by individuals to maintain body functions, health and normal physical activity.

DIETARY ENERGY SUPPLY
Food available for human consumption, expressed in kilocalories per person per day (kcal/person/day). At country level, it is calculated as the food remaining for human use after deduction of all non-food consumption (exports, animal feed, industrial use, seed and wastage)

FOOD BALANCE SHEETS
Food Balance Sheets (FBS) are compiled every year by FAO, mainly with country-level data on the production and trade of food commodities. Using these data and the available information on seed rates, waste coefficients, stock changes and types of utilization (feed, food, processing and other utilization), a supply/utilization account is prepared for each commodity in weight terms. The food component of the commodity account, which is usually derived as a balancing item, refers to the total amount of the commodity available for human consumption during the year.

FOOD CONSUMPTION DISTRIBUTION
Food consumption distribution refers to the variation of consumption within a population. It reflects both the disparities due to socio-economic factors and differences due to biological factors, such as sex, age, body-weight and physical-activity levels.

FOOD DEPRIVATION
Food deprivation refers to the condition of people whose food consumption is continuously below its requirements. FAO's measure of food deprivation refers to the proportion of the population whose dietary energy consumption is below the minimum energy requirement (see below).

FOOD INSECURITY
Food insecurity exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. It may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level. Food insecurity, poor conditions of health and sanitation, and inappropriate care and feeding practices are the major causes of poor nutritional status. Food insecurity may be chronic, seasonal or transitory.

FOOD SECURITY
Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

GINI COEFFICIENT
The Gini coefficient measures the extent to which the distribution of income (or, in some cases, consumption expenditure, food dietary energy consumption) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini coefficient measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini coefficient index of 0 represents perfect equality, while an index of 100 implies perfect inequality.

GINI COEFFICIENT DUE TO INCOME
The Gini coefficient is a measure of inequality in food consumption when income is used as the grouping variable and ranges from 0 (when income has no effect on food consumption) to one (when food consumption depends only on income). It can refer to inequality in food consumption due to income in monetary or in energy terms.

HOUSEHOLD CONSUMPTION EXPENDITURE
Household consumption expenditure refers to all monetary expenditure by the household and individual members on goods intended for consumption and expenditure on services, plus the value of goods and services received as income in kind and consumed by the household or individual members of the household. Thus the value of items produced by the household and utilised for own consumption, as well

as the net rental value of owner-occupied housing and the gross rental value of free housing occupied by the household, each represent part of household consumption expenditure.

HOUSEHOLD FOOD CONSUMPTION EXPENDITURE

This refers to food consumed by household members during a specified period, at home and away from home, for example, at restaurants, bars, the work place, school, and so on. It includes food from all sources, purchased or from garden or farm. Further deductions should be made to allow for food given away to other households or non-household members and visitors as well as for wastage and losses occurring after acquisition.

HOUSEHOLD EXPENDITURE

Consumption plus non-consumption expenditure made by the household, both including food.

HOUSEHOLD NON CONSUMPTION EXPENDITURE

It refers to income taxes, other direct taxes, pension and social security contributions, remittances, gifts and similar transfers made by the household in monetary terms or in kind, including food such as given away, raw or ready to eat.

HOUSEHOLD INCOME

Income is the sum of all receipts, in money or in kind, which as a rule are received regularly and are of recurring nature, including food.

INCOME ELASTICITY OF FOOD DEMAND

The income elasticity of food demand measures the responsiveness of the quantity, monetary or nutrient value demanded of a good, to the change in the income of the people demanding the good. It is calculated as the ratio of the percent change in quantity demanded to the percent change in income.

INCOME INEQUALITY

Income inequality refers to disparities in the distribution of income.

INEQUALITY IN FOOD CONSUMPTION DUE TO INCOME

The inequality refers to the variation of the food consumption level within a population due to disparities in income distribution.

KILOCALORIE (Kcal)

The kilocalorie is a unit of measurement of dietary energy. In the International System of Units (ISU), the universal unit of dietary energy is the joule (J) but Kcal is still commonly used. One kilocalorie = 4.184 kilo-joules (KJ).

MACRONUTRIENTS

Used in this document to refer to the proteins, carbohydrates and fats that are required by the body in large amounts and that are available to be used for energy. They are measured in grams.

MICRONUTRIENTS

Refer to the vitamins, minerals and certain other substances that are required by the body in small amounts. They are measured in milligrams or micrograms.

MINIMUM DIETARY ENERGY REQUIREMENT

In a specified age and sex group, the amount of dietary energy per person is that considered adequate to meet the energy needs for minimum acceptable weight for attained-height maintaining a healthy life and carrying out a light physical activity. In the entire population, the minimum energy requirement is the weighted average of the minimum energy requirements of the different age and sex groups in the population.

NUTRITIONAL STATUS

The physiological status of an individual that results from the relationship between nutrient intake and requirement and from the body's ability to digest, absorb and use these nutrients. Lack of food as well as poor health and sanitation and inappropriate care and feeding practices are the major causes of poor nutritional status.

SHARE OF FOOD EXPENDITURE

The proportion of household consumption expenditure allocated to food; it is also known as the Engel ratio.

UNDERNOURISHMENT

Undernourishment refers to the condition of people whose dietary energy consumption is continuously below a minimum dietary energy requirement for minimum acceptable body weight and carrying out a light physical activity for maintaining a healthy life. The number of undernourished people refers to those in this condition.

UNDERNUTRITION

The result of undernourishment, poor absorption and/or poor biological use of nutrients consumed.

ANNEX I. Food security indicators at national and sub national level

Table 1. Prevalence of Food Deprivation and other Food Security Statistics

Population Groupings	Proportion of food deprivation in total population (%) as defined by FAO		Dietary energy consumption in food deprived population		Depth of hunger (kcal/person/day)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1	2007 HBS
Mainland Tanzania	23	23	1434	1429	257	262
Income level						
Quintile 1	42	47	1458	1436		
Quintile 2	10	8	1544	1553		
Quintile 3	3	3	1603	1602		
Quintile 4	1	1	1635	1646		
Quintile 5	0	0	1663	1724		
Area						
Dar Es Salaam	42	21	1378	1504	404	274
Other urban areas	28	23	1436	1441	290	277
Rural areas	21	23	1438	1419	241	257
Household size						
One person	6	10	1738	1805	285	243
2 to 3 people	10	13	1570	1527	214	249
4 and 5 people	15	19	1469	1444	202	230
6 and 7 people	22	24	1433	1429	224	241
8 people and over	31	27	1442	1405	236	254
Gender of Head ofHH						
Male	21	22	1465	1445	235	255
Female	24	23	1388	1392	267	263
Age of Head of HH						
Less than 35 years	13	17	1430	1395	205	226
35 to 45 years	22	22	1446	1434	235	239
46 to 60 years	26	25	1478	1479	267	275
60 years & over	31	27	1418	1403	290	299
Region						
Dodoma	7	30	1503	1412	160	259
Arusha and Manyara	36	33	1417	1437	278	278
Kilimanjaro	33	12	1396	1508	314	211
Tanga	25	10	1466	1494	255	187
Morogoro	21	10	1462	1502	254	216
Pwani	38	29	1382	1399	328	300
Dar Es Salaam	42	21	1378	1504	404	274
Lindi	21	31	1412	1387	298	356
Mtwara	23	33	1461	1449	278	304
Ruvuma	37	29	1404	1393	317	311
Iringa	18	10	1469	1462	255	212
Mbeya	14	11	1446	1479	249	211
Singida	37	26	1386	1433	330	262
Tabora	4	25	1531	1364	153	286
Rukwa	24	36	1421	1305	251	328
Kigoma	25	30	1403	1366	264	287
Shinyanga	11	14	1476	1458	186	206
Kagera	24	32	1386	1353	247	297
Mwanza	34	33	1386	1424	274	263
Mara	44	47	1254	1237	396	400

Table 2. Selected Statistics - MDER, DEC and Food Share

Population Groupings	Minimum Dietary Energy Requirement (MDER) (kcal/person/day) as defined by FAO		Average Dietary Energy Consumption (kcal/person/day)		Food Share (Ratio of Food to total consumption expenditure) (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	1691	1691	2200	2230	62.6	62.4
Income level						
Quintile 1	1652	1637	1740	1690	70.5	75.1
Quintile 2	1681	1682	2150	2210	66.4	71.6
Quintile 3	1720	1720	2500	2510	63.3	67.6
Quintile 4	1743	1759	2810	2930	59.5	62.9
Quintile 5	1792	1832	3210	3480	53.5	45.2
Area						
Dar Es Salaam	1782	1778	2070	2410	54.4	58.7
Other urban areas	1726	1717	2190	2280	59.0	57.4
Rural areas	1679	1676	2210	2190	65.1	65.3
Household size						
One person	2023	2048	3860	3030	57.2	60.3
2 to 3 people	1784	1777	2670	2650	61.4	62.3
4 and 5 people	1672	1675	2250	2240	62.2	62.4
6 and 7 people	1656	1670	2100	2120	64.1	64.5
8 people and over	1677	1659	1950	2050	63.8	61.0
Gender of Head ofHH						
Male	1700	1700	2210	2230	62.5	62.2
Female	1655	1655	2160	2210	63.4	63.4
Age of Head of HH						
Less than 35 years	1635	1621	2320	2270	61.9	61.7
35 to 45 years	1681	1673	2160	2180	61.8	63.8
46 to 60 years	1745	1754	2210	2250	62.5	60.3
60 years & over	1708	1702	2090	2200	67.0	66.4
Region						
Dodoma	1663	1672	2400	2030	62.4	65.1
Arusha and Manyara	1695	1716	1950	2020	65.4	62.7
Kilimanjaro	1710	1719	2080	2490	67.2	67.2
Tanga	1721	1682	2160	2430	68.1	67.1
Morogoro	1716	1718	2270	2620	65.7	67.1
Pwani	1710	1698	2000	2150	63.6	68.8
Dar Es Salaam	1782	1778	2070	2410	54.4	58.7
Lindi	1710	1743	2460	2260	70.9	64.8
Mtwara	1738	1752	2300	2110	66.5	62.5
Ruvuma	1721	1704	2020	2200	58.5	69.5
Iringa	1724	1674	2420	2550	63.6	55.4
Mbeya	1695	1690	2570	2540	58.9	63.5
Singida	1716	1695	2030	2150	66.7	61.4
Tabora	1684	1649	2620	2190	65.5	63.6
Rukwa	1672	1633	2160	1980	58.7	66.4
Kigoma	1667	1653	2150	2050	63.3	62.0
Shinyanga	1662	1664	2370	2310	65.1	65.4
Kagera	1633	1650	2100	2030	63.4	61.0
Mwanza	1660	1687	1950	1980	57.5	55.5
Mara	1650	1637	1890	1820	68.5	60.2

Table 3. Food Monetary Value, Energy Unit Cost, Total Consumption (TSh)

Population Groupings	Average food consumption in monetary value (Tsh 2007 Constant Price/person/day)		Average dietary energy unit value (Tsh 2007 Constant Price/1000kcals)		Average total consumption (Tsh 2007 Constant Price/person/day)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	327.8	480.55	148.8	215.85	523.2	769.92
Income level						
Quintile 1	176.6	231.99	101.4	137.61	250.4	308.81
Quintile 2	292.0	398.42	135.6	180.10	440.0	556.50
Quintile 3	402.2	561.25	161.0	223.94	635.2	830.06
Quintile 4	544.8	805.83	194.0	275.28	915.0	1280.20
Quintile 5	750.1	1481.37	233.4	426.24	1402.5	3277.91
Area						
Dar Es Salaam	587.0	891.91	283.2	369.36	1078.2	1518.68
Other urban areas	432.9	585.57	197.4	256.48	733.7	1019.91
Rural areas	291.1	411.96	131.5	187.87	447.1	631.23
Household size						
One person	784.8	1251.17	203.3	412.57	1371.9	2073.98
2 to 3 people	456.6	686.06	171.1	258.88	743.4	1101.80
4 and 5 people	351.6	490.16	156.1	218.81	565.0	785.37
6 and 7 people	294.7	411.82	140.6	194.65	459.6	638.06
8 people and over	252.7	377.72	129.5	183.91	395.8	618.81
Gender of Head ofHH						
Male	325.5	479.88	147.2	215.24	520.9	772.00
Female	337.8	483.14	156.1	218.25	533.3	761.80
Age of Head of HH						
Less than 35 years	356.3	523.15	153.9	230.89	575.6	847.78
35 to 45 years	330.4	471.79	153.1	216.54	534.5	739.60
46 to 60 years	315.9	477.18	143.1	212.21	505.7	791.84
60 years & over	294.8	438.14	141.0	198.73	440.3	660.31
Region						
Dodoma	282.1	360.10	117.4	177.74	452.3	553.32
Arusha and Manyara	351.8	466.64	180.2	230.54	537.9	744.79
Kilimanjaro	408.5	655.28	196.4	263.45	608.3	975.18
Tanga	330.0	446.56	152.6	183.67	484.4	665.55
Morogoro	341.9	586.83	150.3	224.40	520.5	874.94
Pwani	341.6	477.11	171.2	221.52	537.4	693.55
Dar Es Salaam	587.0	891.91	283.2	369.36	1078.2	1518.68
Lindi	351.1	466.47	143.0	206.15	494.9	720.40
Mtwara	414.5	364.89	179.8	173.11	623.7	583.40
Ruvuma	279.1	378.86	138.3	172.60	477.2	545.44
Iringa	368.4	551.50	152.2	216.57	578.9	995.72
Mbeya	395.0	526.57	153.7	207.36	670.1	829.82
Singida	247.6	293.98	121.7	136.71	371.1	478.62
Tabora	342.2	442.02	130.8	201.72	522.3	694.83
Rukwa	207.6	335.22	96.1	169.54	353.7	504.93
Kigoma	239.6	367.55	111.7	178.99	378.8	592.39
Shinyanga	268.2	444.94	113.1	192.22	411.6	679.89
Kagera	297.8	405.98	142.0	199.66	469.6	665.18
Mwanza	245.7	436.10	126.0	220.19	427.3	785.98
Mara	278.4	379.55	147.1	208.23	406.6	630.82

Table 4. Share Composition of Food Expenditure by Food Sources (%)

Population Groupings	Share of food purchases to total food expenditure (%)		Share of food from own production to total food expenditure (%)		Share of food eaten away from home to total food expenditure (%)		Share of food from other sources to total food expenditure (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	65.4	67.4	26.4	23.6	4.2	4.4	4.0	4.6
Income level								
Quintile 1	50.9	50.2	42.4	42.3	1.9	1.2	4.8	6.3
Quintile 2	59.4	61.1	33.8	31.6	2.5	2.1	4.3	5.2
Quintile 3	68.8	71.0	24.0	21.4	3.2	3.0	4.0	4.6
Quintile 4	74.7	76.1	17.1	14.1	5.1	5.7	3.1	4.1
Quintile 5	76.8	77.7	9.6	8.9	9.9	10.2	3.7	3.1
Area								
Dar Es Salaam	83.7	84.9	0.4	0.9	13.3	12.5	2.6	1.7
Other urban areas	85.2	83.0	7.0	7.5	5.0	6.0	2.9	3.6
Rural areas	57.7	58.1	35.1	34.2	2.7	2.0	4.5	5.7
Household size								
One person	62.3	63.9	12.6	6.3	20.6	25.2	4.6	4.7
2 to 3 people	68.2	73.7	23.3	16.2	4.2	5.1	4.4	5.0
4 and 5 people	67.5	70.7	25.1	21.7	3.7	3.1	3.7	4.5
6 and 7 people	64.9	66.0	27.2	27.2	3.4	2.5	4.5	4.3
8 people and over	61.8	59.9	31.9	33.2	2.8	2.1	3.5	4.8
Gender of Head ofHH								
Male	65.3	66.8	26.5	24.1	4.5	4.8	3.7	4.3
Female	65.8	69.4	25.9	21.7	3.1	3.1	5.1	5.7
Age of Head of HH								
Less than 35 years	66.6	69.8	23.0	18.4	6.1	7.6	4.2	4.1
35 to 45 years	68.8	70.4	23.8	21.4	4.0	4.1	3.5	4.1
46 to 60 years	63.0	66.5	30.1	26.0	3.2	3.0	3.8	4.5
60 years & over	59.5	58.9	32.1	31.7	3.1	2.3	5.3	7.1
Region								
Dodoma	56.9	66.5	35.2	25.1	3.2	3.1	4.6	5.4
Arusha and Manyara	73.1	62.8	20.6	27.6	2.9	4.7	3.3	4.8
Kilimanjaro	73.8	73.0	20.5	18.7	3.0	3.5	2.7	4.8
Tanga	63.9	63.3	31.0	27.3	1.8	3.7	3.3	5.7
Morogoro	62.4	69.3	29.4	22.1	2.9	3.9	5.2	4.7
Pwani	76.6	75.0	12.6	15.6	4.0	3.9	6.8	5.5
Dar Es Salaam	83.7	84.9	0.4	0.9	13.3	12.5	2.6	1.7
Lindi	58.8	54.8	32.5	35.4	2.5	2.9	6.2	6.9
Mtwara	56.7	70.2	31.0	21.3	6.1	3.2	6.2	5.3
Ruvuma	50.6	54.1	35.7	32.1	4.7	3.5	9.0	10.4
Iringa	63.4	68.0	29.5	25.0	2.1	2.3	5.0	4.7
Mbeya	64.2	66.3	27.9	25.8	4.8	2.8	3.1	5.1
Singida	58.7	63.9	36.3	30.3	1.9	0.9	3.1	4.9
Tabora	57.4	58.9	38.3	37.6	2.1	1.3	2.2	2.2
Rukwa	59.3	65.5	32.5	28.1	2.7	2.3	5.5	4.0
Kigoma	65.5	63.5	27.2	23.9	2.8	3.2	4.5	9.3
Shinyanga	48.7	50.4	46.6	43.1	2.1	2.5	2.5	4.0
Kagera	58.7	56.4	31.6	31.3	2.3	2.0	7.4	10.3
Mwanza	76.1	67.9	19.6	25.2	2.8	4.3	1.6	2.6
Mara	74.0	77.8	15.7	14.1	6.7	2.3	3.6	5.8

Table 5. Share Composition of Dietary Energy by Food Sources (%)

Population Groupings	Share of DEC from purchases to total DEC (%)		Share of DEC from own production to total DEC (%)		Share of DEC from eaten away from home to total DEC (%)		Share of DEC from other sources to total DEC (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	52.5	53.4	40.0	39.9	3.5	2.9	4.0	3.9
Income level								
Quintile 1	40.3	37.1	53.5	57.3	1.9	1.2	4.4	4.4
Quintile 2	48.7	49.2	44.7	44.7	2.5	1.9	4.1	4.2
Quintile 3	58.3	61.2	34.7	32.5	3.0	2.6	4.0	3.7
Quintile 4	65.1	67.9	26.2	23.9	5.0	5.0	3.7	3.3
Quintile 5	68.4	73.7	18.2	15.9	9.9	7.6	3.6	2.9
Area								
Dar Es Salaam	83.8	87.6	0.5	0.9	13.7	9.7	2.1	1.7
Other urban areas	79.2	78.5	12.5	14.0	5.3	4.3	3.0	3.2
Rural areas	45.8	43.2	47.3	50.8	2.6	1.7	4.4	4.3
Household size								
One person	53.8	61.4	18.6	16.4	22.1	16.7	5.5	5.5
2 to 3 people	55.0	59.6	36.3	31.7	3.6	4.3	5.1	4.4
4 and 5 people	53.9	56.0	39.2	37.7	3.1	2.3	3.8	4.1
6 and 7 people	52.3	51.9	40.6	42.8	2.8	1.9	4.3	3.4
8 people and over	49.6	47.2	44.7	47.1	2.4	1.9	3.3	3.7
Gender of Head ofHH								
Male	52.5	53.1	39.8	40.3	3.8	3.0	3.9	3.6
Female	52.1	54.6	40.6	38.1	2.5	2.2	4.8	5.0
Age of Head of HH								
Less than 35 years	53.5	56.3	37.6	35.6	4.8	4.4	4.1	3.6
35 to 45 years	55.8	57.2	37.2	36.7	3.4	2.7	3.6	3.4
46 to 60 years	50.4	51.7	42.9	42.4	2.8	2.3	3.9	3.7
60 years & over	47.4	45.6	44.5	46.8	2.8	1.9	5.3	5.6
Region								
Dodoma	40.9	46.0	51.2	46.0	3.0	3.1	4.9	4.9
Arusha and Manyara	66.0	50.1	26.5	44.3	2.8	2.6	4.7	3.0
Kilimanjaro	69.2	60.4	23.8	33.7	3.8	2.2	3.2	3.8
Tanga	56.2	49.5	39.1	44.1	1.6	2.7	3.1	3.7
Morogoro	49.7	56.3	42.0	36.3	2.6	2.9	5.7	4.5
Pwani	69.4	69.4	18.6	23.6	3.6	2.6	8.4	4.4
Dar Es Salaam	83.8	87.6	0.5	0.9	13.7	9.7	2.1	1.7
Lindi	46.2	43.5	44.8	47.6	2.1	2.0	7.0	6.9
Mtwara	43.2	50.1	44.7	42.0	5.8	2.6	6.2	5.4
Ruvuma	32.1	41.8	52.9	49.3	4.5	2.4	10.5	6.6
Iringa	49.6	45.4	43.5	48.0	1.9	1.9	5.0	4.8
Mbeya	54.5	51.8	37.9	41.3	4.8	2.2	2.8	4.7
Singida	41.5	43.8	52.9	52.1	2.1	0.9	3.5	3.2
Tabora	43.9	45.6	52.7	51.9	1.9	1.0	1.6	1.5
Rukwa	42.6	45.4	50.8	49.2	2.8	2.4	3.8	3.0
Kigoma	50.5	54.3	43.3	36.8	2.6	2.5	3.6	6.4
Shinyanga	34.9	41.1	60.7	54.1	1.9	2.1	2.5	2.7
Kagera	48.1	47.7	42.9	41.8	2.0	1.7	6.9	8.8
Mwanza	66.4	56.1	29.9	39.6	2.4	2.8	1.3	1.6
Mara	63.5	62.1	26.5	32.4	6.6	1.8	3.4	3.7

Table 6. Measures of Inequality of Food Access - Coefficient of variation of DEC and Food Expenditure due to Income and FAO CV parameter for estimation Food Deprivation

Population Groupings	CV of DEC DUE TO Income (%)		CV of Food Consumption Expenditure DUE TO income (%)		CV of DEC - FULL as defined by FAO (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Area						
Dar Es Salaam	34.4	25.2	50.6	55.8	39.8	32.3
Other urban areas	26.3	26.7	47.4	54.9	32.6	32.9
Rural areas	23.2	25.0	46.5	63.3	29.6	31.0
Household size						
One person	30.9	16.6	49.9	61.1	38.6	28.4
2 to 3 people	20.2	25.1	47.4	66.4	28.9	32.5
4 and 5 people	18.7	22.2	45.6	58.9	26.4	29.0
6 and 7 people	20.1	22.2	48.5	54.6	26.9	28.5
8 people and over	17.4	23.0	42.5	60.1	25.1	29.2
Gender of Head ofHH						
Male	21.4	24.2	52.0	70.1	28.3	30.5
Female	26.4	26.7	56.6	72.3	32.4	32.7
Age of Head of HH						
Less than 35 years	21.7	24.5	54.9	74.8	28.4	30.5
35 to 45 years	21.5	22.8	52.1	66.4	28.2	29.1
46 to 60 years	22.9	24.2	51.5	71.7	29.9	31.0
60 years & over	25.6	29.1	46.6	61.9	31.6	34.6
Region						
Dodoma	15.3	22.3	43.0	61.3	23.9	28.9
Arusha and Manyara	21.6	22.3	52.1	67.4	28.5	29.1
Kilimanjaro	28.1	21.3	44.3	57.5	33.8	28.6
Tanga	22.0	19.3	42.1	46.6	28.8	26.5
Morogoro	24.0	23.7	46.4	68.0	30.5	30.3
Pwani	28.0	28.3	49.3	60.9	33.7	34.0
Dar Es Salaam	34.4	25.2	50.6	55.8	39.8	32.3
Lindi	32.5	34.7	53.4	64.2	37.6	39.8
Mtwara	26.1	25.0	43.5	54.7	32.5	31.6
Ruvuma	26.3	30.4	51.6	70.7	32.5	35.6
Iringa	26.0	24.4	45.9	64.4	32.1	30.6
Mbeya	28.4	23.3	45.5	54.9	34.1	29.9
Singida	28.8	23.9	86.8	75.2	34.4	30.2
Tabora	15.8	30.0	39.6	109.6	24.4	35.0
Rukwa	23.9	32.0	41.3	58.1	30.1	36.7
Kigoma	25.2	27.4	50.3	52.6	31.3	32.8
Shinyanga	18.9	20.9	48.4	52.1	26.3	27.7
Kagera	24.2	28.3	44.4	51.3	30.1	33.6
Mwanza	23.2	20.9	53.3	57.3	29.4	27.9
Mara	37.5	37.0	53.9	69.5	41.6	41.2

Table 7. Contribution Energy-Yielding Nutrients to Total DEC

Population Groupings	Share of DEC in total DEC coming from proteins (%)		Share of DEC in total DEC coming from fats (%)		Share of DEC in total DEC coming from carbohydrates, fiber and alcohol (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	10.4	11.6	15.8	18.3	73.8	70.0
Income level						
Quintile 1	10.5	11.8	12.5	14.8	77.1	73.4
Quintile 2	10.4	11.6	15.2	16.6	74.4	71.8
Quintile 3	10.1	11.5	16.7	19.7	73.2	68.9
Quintile 4	10.4	11.6	18.7	21.8	71.0	66.7
Quintile 5	10.4	11.7	21.7	25.3	67.9	63.0
Area						
Dar Es Salaam	10.4	11.2	22.6	24.3	67.0	64.5
Other urban areas	10.2	11.6	20.1	21.0	69.6	67.3
Rural areas	10.4	11.7	14.7	17.0	75.0	71.3
Household size						
One person	10.2	11.0	18.4	22.4	71.4	66.6
2 to 3 people	10.3	11.8	17.3	21.0	72.4	67.2
4 and 5 people	10.4	11.8	16.1	18.8	73.4	69.5
6 and 7 people	10.1	11.5	15.0	17.2	74.8	71.4
8 people and over	10.5	11.6	15.1	16.9	74.4	71.5
Gender of Head ofHH						
Male	10.3	11.7	15.7	18.2	74.0	70.1
Female	10.5	11.5	16.5	18.8	73.1	69.7
Age of Head of HH						
Less than 35 years	10.4	11.9	16.3	19.1	73.3	69.0
35 to 45 years	10.3	11.7	15.9	18.3	73.8	70.0
46 to 60 years	10.4	11.3	15.8	18.2	73.8	70.5
60 years & over	10.5	11.7	14.8	17.5	74.7	70.8
Region						
Dodoma	11.5	12.6	16.4	18.4	72.1	69.0
Arusha and Manyara	10.8	11.8	18.3	22.1	70.9	66.2
Kilimanjaro	8.9	10.5	17.9	22.2	73.2	67.4
Tanga	9.3	10.1	15.6	17.1	75.1	72.8
Morogoro	10.4	11.4	15.0	17.5	74.6	71.1
Pwani	9.8	9.8	16.9	17.8	73.3	72.3
Dar Es Salaam	10.4	11.2	22.6	24.3	67.0	64.5
Lindi	9.3	12.3	15.9	16.8	74.8	70.9
Mtwara	10.5	10.5	15.8	17.0	73.7	72.5
Ruvuma	10.0	11.9	13.7	16.8	76.3	71.3
Iringa	9.6	13.8	14.2	19.7	76.2	66.5
Mbeya	9.3	11.2	15.8	20.3	74.8	68.5
Singida	12.2	12.5	16.0	19.8	71.9	67.7
Tabora	11.2	13.5	18.7	17.9	70.1	68.6
Rukwa	9.3	11.8	12.5	16.2	78.2	72.0
Kigoma	9.7	11.1	14.3	18.5	76.0	70.3
Shinyanga	12.0	11.4	16.7	15.9	71.3	72.7
Kagera	9.1	11.1	12.1	14.3	78.8	74.6
Mwanza	11.0	11.6	13.8	15.1	75.3	73.3
Mara	10.6	12.0	12.8	13.9	76.5	74.1

Table 8. Macronutrient Consumption

Population Groupings	Average food protein consumption (gm/person/day)		Average food carbohydrates consumption (gm/person/day)		Average food fat consumption (gm/person/day)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	57.1	64.7	359.5	365.5	38.8	45.4
Income level						
Quintile 1	45.5	49.8	299.9	289.0	24.2	27.7
Quintile 2	55.9	64.0	355.5	372.5	36.4	40.9
Quintile 3	63.2	71.8	400.5	406.1	46.3	54.8
Quintile 4	72.7	84.7	432.4	459.4	58.2	70.8
Quintile 5	83.9	101.8	483.7	514.3	77.4	97.6
Area						
Dar Es Salaam	53.7	67.9	329.9	371.9	52.1	65.2
Other urban areas	56.1	66.4	348.9	364.5	49.0	53.4
Rural areas	57.5	64.0	363.5	365.1	36.1	41.4
Household size						
One person	98.8	83.7	532.3	462.5	78.8	75.3
2 to 3 people	69.0	78.3	414.1	417.2	51.3	61.9
4 and 5 people	58.8	65.9	363.8	365.1	40.4	46.7
6 and 7 people	53.1	60.7	349.7	353.8	35.0	40.4
8 people and over	51.2	59.6	330.3	345.1	32.8	38.6
Gender of Head ofHH						
Male	57.2	65.0	360.0	366.1	38.6	45.2
Female	56.7	63.7	357.3	363.3	39.6	46.1
Age of Head of HH						
Less than 35 years	60.3	67.5	376.3	366.9	42.0	48.1
35 to 45 years	55.5	63.7	352.3	359.1	38.1	44.4
46 to 60 years	57.1	63.6	360.3	370.7	38.8	45.5
60 years & over	54.6	64.7	343.9	364.4	34.4	42.8
Region						
Dodoma	69.2	63.7	373.1	317.6	43.9	41.5
Arusha and Manyara	52.5	59.7	317.2	313.3	39.8	49.6
Kilimanjaro	46.3	65.2	310.8	388.2	41.3	61.2
Tanga	50.3	61.4	379.8	419.2	37.5	46.2
Morogoro	58.9	74.5	381.0	437.4	38.0	50.9
Pwani	49.0	52.9	347.5	371.7	37.5	42.7
Dar Es Salaam	53.7	67.9	329.9	371.9	52.1	65.2
Lindi	56.8	69.7	412.6	375.0	43.5	42.3
Mtwara	60.3	55.6	383.9	359.3	40.6	39.8
Ruvuma	50.7	65.3	341.5	369.2	30.7	41.0
Iringa	58.1	87.8	353.9	379.9	38.2	55.7
Mbeya	59.9	71.4	376.3	401.6	45.2	57.2
Singida	61.9	67.3	312.9	331.2	36.1	47.4
Tabora	73.2	73.8	424.1	354.7	54.4	43.6
Rukwa	50.1	58.4	327.1	331.2	30.0	35.6
Kigoma	52.1	57.1	369.0	341.1	34.0	42.3
Shinyanga	71.2	66.1	392.6	398.7	43.9	40.9
Kagera	47.8	56.4	351.5	353.4	28.2	32.2
Mwanza	53.4	57.4	345.5	345.5	29.8	33.3
Mara	50.3	54.5	342.5	324.5	27.0	28.2

Table 9. Food Consumption (Expenditure and DEC) by Food Commodity Group

Food Commodity Groups	Average expenditure (Tsh 2007 Constant Price/person/day)		Average food dietary energy consumption (kcal/person/day)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Cereals	99.98	139.73	1201	1127
Roots and Tubers	22.13	28.84	258	251
Sugars	18.87	26.92	89	94
Pulses	18.48	20.70	73	97
Tree nuts	0.21	0.27	3	3
Oil crops	7.21	13.13	79	96
Vegetables	27.58	43.81	30	73
Fruits	15.09	21.84	69	86
Stimulants	2.91	5.90	5	12
Spices	4.24	5.23	2	1
Alcoholic Beverages	11.59	17.01	114	28
Meat	34.33	51.43	71	66
Eggs	1.14	1.92	1	5
Fish	22.40	35.26	27	57
Milk and Cheese	10.64	11.29	24	46
Oils and fats (vegetables)	12.42	22.33	76	113
Oils and fats (animal)	0.46	0.07	2	0
Non Alcoholic beverages	4.21	13.65	2	6
Miscellaneous	13.88	21.21	78	63

Table 10. Micronutrients consumption by food commodity groups

Population Groupings	Average food proteins consumption (gm/person/day)		Average food carbohydrates consumption (gm/person/day)		Average food fats consumption (gm/person/day)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Cereals	29.5	24.9	230.9	222.1	12.6	11.2
Roots and Tubers	2.6	2.8	58.7	56.8	0.5	0.5
Sugars	0.0	0.0	22.3	23.5	0.0	0.0
Pulses	5.5	6.8	9.8	13.6	0.3	0.4
Tree nuts	0.1	0.1	0.0	0.0	0.2	0.3
Oil crops	2.6	3.8	1.1	2.2	6.8	7.6
Vegetables	1.7	5.4	4.0	9.3	0.3	0.7
Fruits	0.6	0.7	15.4	18.9	0.2	0.4
Stimulants	0.1	0.0	0.9	2.7	0.1	0.1
Spices	0.0	0.0	0.2	0.1	0.0	0.0
Alcoholic Beverages	0.1	0.2	1.7	2.1	0.0	0.0
Meat	5.3	5.0	0.0	0.2	5.5	5.0
Eggs	0.1	0.5	0.0	0.0	0.1	0.4
Fish	5.4	11.0	0.0	0.0	0.6	1.5
Milk and Cheese	1.3	1.8	1.8	2.3	1.3	3.3
Oils and fats (vegetables)	0.0	0.0	0.0	0.0	8.4	12.6
Oils and fats (animal)	0.0	0.0	0.0	0.0	0.2	0.0
Non Alcoholic beverages	0.0	0.0	0.5	1.5	0.0	0.0
Miscellaneous	2.0	1.7	12.2	10.1	1.5	1.5

Table 11. Share of DEC and Macronutrients of Food Commodity Groups to Totals – Mainland Tanzania

Population Groupings	Share of DEC in Total Energy Consumption (%)		Share of protein consumption in Total Protein Consumption (%)		Share of carbohydrates Consumption in Total Carbohydrates Consumption (%)		Share of Fats Consumption in Total Fats Consumption (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Cereals	54.5	50.6	51.6	38.5	64.2	60.8	32.5	24.7
Roots and Tubers	11.7	11.3	4.6	4.4	16.3	15.5	1.3	1.1
Sugars	4.0	4.2	0.0	0.0	6.2	6.4	0.0	0.0
Pulses	3.3	4.4	9.7	10.5	2.7	3.7	0.8	0.9
Tree nuts	0.1	0.1	0.2	0.2	0.0	0.0	0.6	0.6
Oil crops	3.6	4.3	4.6	5.9	0.3	0.6	17.5	16.7
Vegetables	1.3	3.3	3.0	8.3	1.1	2.6	0.8	1.5
Fruits	3.1	3.9	1.1	1.1	4.3	5.2	0.5	0.8
Stimulants	0.2	0.5	0.2	0.0	0.2	0.7	0.2	0.2
Spices	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1
Alcoholic Beverages	5.2	1.3	0.3	0.3	0.5	0.6	0.0	0.0
Meat	3.2	3.0	9.4	7.7	0.0	0.1	14.3	11.1
Eggs	0.1	0.2	0.2	0.7	0.0	0.0	0.2	0.8
Fish	1.2	2.6	9.5	16.9	0.0	0.0	1.7	3.2
Milk and Cheese	1.1	2.1	2.3	2.8	0.5	0.6	3.5	7.2
Oils and fats (vegetables)	3.4	5.1	0.0	0.0	0.0	0.0	21.8	27.7
Oils and fats (animal)	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.1
Non Alcoholic beverages	0.1	0.3	0.0	0.0	0.1	0.4	0.0	0.0
Miscellaneous	3.5	2.8	3.5	2.7	3.4	2.8	3.8	3.2

Table 12. Daily Vitamin A Consumption per person in Retinol-Activity-Equivalent and Ratios to Requirements by Population Groups

Population Groupings	Total vitamin A consumed (mcg RAE/person/day)		Vitamin A mean requirement (mcg RAE/person/day)		Ratio Vitamin A consumed / required (%)		Vitamin A recommended safe intake (mcg RAE/person/day)		Ratio Vitamin A consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	717	1088	279	279	257	390	527	527	136	206
Income level										
Quintile 1	677	1074	277	276	244	389	523	521	129	206
Quintile 2	708	1117	279	279	254	400	526	527	135	212
Quintile 3	814	1126	283	282	288	399	532	531	153	212
Quintile 4	745	1031	279	282	267	365	530	534	140	193
Quintile 5	694	1060	282	285	246	372	536	541	130	196
Area										
Dar Es Salaam	313	470	285	283	110	166	537	535	58	88
Other urban areas	581	738	283	282	205	262	531	530	109	139
Rural areas	770	1237	278	278	277	445	526	526	146	235
Region										
Dodoma	403	530	275	275	147	192	522	524	77	101
Arusha and Manyara	449	489	278	281	161	174	527	530	85	92
Kilimanjaro	376	698	285	286	132	244	535	536	70	130
Tanga	417	712	286	280	146	254	535	528	78	135
Morogoro	494	690	284	281	174	246	534	530	93	130
Pwani	295	619	283	281	104	221	534	531	55	117
Dar Es Salaam	313	470	285	283	110	166	537	535	58	88
Lindi	294	396	281	282	105	140	531	534	55	74
Mtwara	250	657	281	281	89	233	532	533	47	123
Ruvuma	796	931	282	281	283	332	530	530	150	176
Iringa	576	838	281	279	205	301	532	527	108	159
Mbeya	819	1118	280	280	292	399	527	528	155	212
Singida	381	891	286	280	133	318	534	529	71	168
Tabora	698	1451	275	275	254	528	522	521	134	279
Rukwa	361	538	280	276	129	195	527	521	68	103
Kigoma	1044	647	277	281	376	231	523	525	200	123
Shinyanga	1606	2200	277	276	579	796	523	523	307	420
Kagera	1209	1969	273	276	443	714	519	521	233	378
Mwanza	1041	2585	276	278	378	930	522	525	199	492
Mara	786	1641	274	277	287	593	519	521	151	315

Table 13. Daily Vitamin B1 Consumption per Person in mg and Ratios to Recommendations by Population Groups

Population Groupings	Total vitamin B1 consumed (mcg RAE/person/day)		Vitamin B1 recommended intakes (mcg RAE/person/day)		Ratio Vitamin B1 consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	2.13	2.45	0.98	0.98	217	249
Income level						
Quintile 1	1.96	2.95	0.96	0.95	204	310
Quintile 2	2.20	2.17	0.98	0.98	225	222
Quintile 3	2.20	2.08	1.00	1.00	219	208
Quintile 4	2.32	2.12	1.00	1.02	232	209
Quintile 5	2.30	2.12	1.02	1.05	224	202
Area						
Dar Es Salaam	1.41	1.15	1.03	1.02	137	113
Other urban areas	1.80	1.94	1.00	1.00	180	195
Rural areas	2.23	2.70	0.97	0.97	229	278
Region						
Dodoma	2.37	1.79	0.96	0.97	247	185
Arusha and Manyara	1.99	1.83	0.98	0.99	203	185
Kilimanjaro	1.48	1.57	1.01	1.02	147	155
Tanga	2.05	1.84	1.01	0.98	203	188
Morogoro	2.45	1.99	1.01	1.00	243	200
Pwani	1.64	1.30	1.00	1.00	163	130
Dar Es Salaam	1.41	1.15	1.03	1.02	137	113
Lindi	2.00	1.68	1.00	1.01	201	166
Mtwara	1.91	1.74	1.01	1.02	189	171
Ruvuma	2.33	2.94	1.00	0.99	233	298
Iringa	2.51	3.78	1.00	0.98	251	387
Mbeya	2.31	2.45	0.99	0.98	234	249
Singida	1.77	1.80	1.00	0.98	176	183
Tabora	2.37	6.84	0.97	0.95	245	718
Rukwa	2.02	2.25	0.97	0.95	208	238
Kigoma	3.35	2.70	0.96	0.96	347	280
Shinyanga	2.24	2.26	0.96	0.96	233	236
Kagera	2.70	2.98	0.94	0.95	287	313
Mwanza	1.83	1.81	0.96	0.97	191	186
Mara	1.49	2.12	0.95	0.95	157	222

Table 14. Daily Vitamin B2 Consumption per Person in mg and Ratios to Recommendations by Population Groups

Population Groupings	Total Vitamin B2 consumed (mcg RAE/person/day)		Vitamin B2 recommended intakes (mcg RAE/person/day)		Ratio Vitamin B2 consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	1.75	3.87	1.01	1.01	174	385
Income level						
Quintile 1	1.73	4.51	0.98	0.97	177	462
Quintile 2	1.71	3.96	1.00	1.00	171	395
Quintile 3	1.73	3.00	1.03	1.03	169	292
Quintile 4	1.82	3.38	1.03	1.05	176	323
Quintile 5	1.90	3.02	1.06	1.09	180	278
Area						
Dar Es Salaam	1.19	1.87	1.05	1.05	113	177
Other urban areas	1.43	3.05	1.02	1.02	139	299
Rural areas	1.85	4.28	1.00	1.00	185	429
Region						
Dodoma	1.80	5.64	0.98	0.99	183	567
Arusha and Manyara	1.41	4.35	1.00	1.02	141	428
Kilimanjaro	1.14	2.49	1.03	1.04	111	239
Tanga	1.55	3.93	1.03	1.00	150	392
Morogoro	4.60	5.44	1.03	1.02	447	531
Pwani	1.28	3.19	1.03	1.02	125	312
Dar Es Salaam	1.19	1.87	1.05	1.05	113	177
Lindi	1.52	2.73	1.03	1.04	147	263
Mtwara	1.35	4.37	1.04	1.05	130	418
Ruvuma	1.49	3.97	1.02	1.01	145	392
Iringa	1.63	7.64	1.03	1.00	158	766
Mbeya	2.23	5.07	1.01	1.01	221	503
Singida	1.94	3.72	1.03	1.01	189	368
Tabora	2.28	5.51	1.00	0.98	228	562
Rukwa	1.36	4.12	0.99	0.97	137	425
Kigoma	1.13	1.59	0.99	0.99	114	161
Shinyanga	2.21	5.23	0.98	0.98	225	531
Kagera	1.29	1.56	0.97	0.98	133	160
Mwanza	1.39	2.08	0.98	1.00	142	208
Mara	1.17	1.42	0.97	0.97	120	146

Table 15. Daily Vitamin B6 Consumption per Person and Ratios (Recommendations and Requirements respectively) by Population Groups

Population Groupings	Total Vitamin B6 consumed (mc RAE/person/day)		Vitamin B6 recommended intakes (mc RAE/person/day)		Ratio Vitamin B6 consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	2.3	2.4	1.1	1.1	207	217
Income level						
Quintile 1	2.0	2.1	1.1	1.1	185	200
Quintile 2	2.3	2.5	1.1	1.1	208	225
Quintile 3	2.5	2.5	1.1	1.1	222	223
Quintile 4	2.7	2.7	1.1	1.2	234	230
Quintile 5	2.8	2.8	1.2	1.2	242	235
Area						
Dar Es Salaam	1.5	1.6	1.2	1.2	128	140
Other urban areas	2.1	2.2	1.1	1.1	189	196
Rural areas	2.4	2.5	1.1	1.1	216	230
Region						
Dodoma	2.1	2.0	1.1	1.1	195	182
Arusha and Manyara	2.1	2.1	1.1	1.1	195	186
Kilimanjaro	1.9	2.4	1.2	1.2	166	201
Tanga	2.1	2.6	1.1	1.1	181	237
Morogoro	2.3	2.5	1.1	1.1	202	219
Pwani	1.9	1.9	1.2	1.1	161	170
Dar Es Salaam	1.5	1.6	1.2	1.2	128	140
Lindi	2.7	2.3	1.2	1.2	232	199
Mtwara	2.5	2.7	1.2	1.2	220	229
Ruvuma	2.1	2.5	1.1	1.1	187	224
Iringa	2.2	3.3	1.1	1.1	190	293
Mbeya	2.4	2.8	1.1	1.1	217	250
Singida	2.0	2.2	1.1	1.1	171	200
Tabora	2.7	2.3	1.1	1.1	245	215
Rukwa	2.3	2.3	1.1	1.1	209	221
Kigoma	2.6	2.7	1.1	1.1	238	251
Shinyanga	2.5	2.4	1.1	1.1	235	226
Kagera	2.5	2.6	1.1	1.1	235	247
Mwanza	2.6	2.6	1.1	1.1	244	237
Mara	2.5	2.6	1.1	1.1	237	244

Table 16. Daily Vitamin B12 Consumption per Person (mcg) and Ratios (to Recommendations and Requirements respectively) by Population Groups

Population Groupings	Total Vitamin B12 consumed (mcg RAE/person/day)		Vitamin B12 average requirement (mcg RAE/person/day)		Ratio Vitamin B12 consumed / recommended (%)		Vitamin B12 recommended intakes (mcg RAE/person/day)		Ratio Vitamin B12 consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	1.63	2.53	1.68	1.68	97	150	2.03	2.02	80	125
Income level										
Quintile 1	1.07	1.82	1.65	1.63	65	112	1.98	1.96	54	93
Quintile 2	1.53	2.42	1.68	1.67	91	145	2.02	2.02	76	120
Quintile 3	1.93	2.78	1.72	1.72	112	162	2.07	2.06	93	135
Quintile 4	2.49	3.59	1.72	1.75	144	206	2.07	2.10	120	171
Quintile 5	2.87	4.51	1.76	1.81	163	249	2.11	2.17	136	207
Area										
Dar Es Salaam	1.79	3.08	1.77	1.77	102	174	2.12	2.12	84	145
Other urban areas	1.76	2.78	1.72	1.71	102	162	2.07	2.06	85	135
Rural areas	1.59	2.41	1.67	1.66	95	145	2.01	2.00	79	120
Region										
Dodoma	1.12	1.19	1.64	1.65	68	72	1.98	1.99	57	60
Arusha and Manyara	1.40	1.98	1.67	1.69	84	117	2.02	2.04	69	97
Kilimanjaro	1.89	2.21	1.74	1.75	109	126	2.09	2.11	90	105
Tanga	1.49	2.17	1.73	1.67	86	129	2.08	2.02	72	108
Morogoro	1.29	2.67	1.73	1.71	75	156	2.08	2.06	62	130
Pwani	1.70	2.03	1.73	1.72	98	118	2.08	2.06	82	98
Dar Es Salaam	1.79	3.08	1.77	1.77	102	174	2.12	2.12	84	145
Lindi	1.07	2.43	1.71	1.74	63	140	2.06	2.09	52	116
Mtwara	1.65	1.89	1.74	1.75	95	108	2.09	2.10	79	90
Ruvuma	1.26	2.41	1.72	1.69	73	143	2.07	2.03	61	118
Iringa	1.19	2.68	1.72	1.68	69	159	2.07	2.02	57	132
Mbeya	1.54	2.34	1.69	1.69	91	138	2.04	2.04	76	115
Singida	1.43	2.11	1.73	1.68	83	125	2.08	2.03	69	104
Tabora	1.68	4.27	1.66	1.63	102	263	1.99	1.96	84	218
Rukwa	1.46	2.33	1.66	1.61	88	144	2.00	1.95	73	120
Kigoma	1.47	2.20	1.66	1.65	89	133	1.99	1.99	74	111
Shinyanga	1.67	2.01	1.65	1.64	101	122	1.98	1.98	84	101
Kagera	1.96	2.94	1.61	1.63	122	181	1.95	1.96	101	150
Mwanza	2.14	2.81	1.64	1.67	131	169	1.97	2.01	108	140
Mara	2.44	3.05	1.62	1.63	150	187	1.95	1.97	125	155

Table 17. Daily Vitamin C Consumption per Person (mg) and Ratios to Recommendations by Population Groups

Population Groupings	Total Vitamin C consumed (mg /person/day)		Vitamin C recommended intakes (mg /person/day)		Ratio Vitamin C consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	92.4	126.9	39.6	39.6	234	321
Income level						
Quintile 1	83.5	119.5	39.0	38.8	214	308
Quintile 2	91.2	130.5	39.5	39.5	231	330
Quintile 3	99.6	131.1	40.0	40.1	249	327
Quintile 4	103.3	121.7	40.4	40.6	256	300
Quintile 5	110.5	154.7	40.8	41.6	271	372
Area						
Dar Es Salaam	50.5	104.3	40.7	40.9	124	255
Other urban areas	66.8	112.8	40.1	40.0	167	282
Rural areas	99.8	132.7	39.4	39.4	253	337
Region						
Dodoma	49.5	76.0	39.2	39.4	126	193
Arusha and Manyara	41.5	46.0	39.5	39.7	105	116
Kilimanjaro	57.2	86.1	40.1	40.4	142	213
Tanga	95.6	144.1	39.8	39.4	240	366
Morogoro	96.9	126.7	40.1	40.0	242	317
Pwani	80.0	148.2	40.1	40.1	199	369
Dar Es Salaam	50.5	104.3	40.7	40.9	124	255
Lindi	152.8	97.6	40.1	40.5	381	241
Mtwara	145.6	215.1	40.4	40.5	360	531
Ruvuma	92.3	137.9	40.0	39.6	230	348
Iringa	63.8	214.1	40.1	39.6	159	541
Mbeya	79.3	119.0	39.8	39.7	200	300
Singida	33.5	80.6	39.9	39.6	84	204
Tabora	64.6	113.3	39.3	38.9	164	291
Rukwa	102.3	105.3	39.1	38.7	261	272
Kigoma	140.2	178.3	39.3	39.0	357	457
Shinyanga	62.6	101.4	39.1	39.1	160	259
Kagera	161.0	168.5	38.8	39.0	415	433
Mwanza	137.7	151.4	39.0	39.4	353	384
Mara	163.5	171.3	38.8	39.0	421	439

Table 18. Daily Calcium Consumption per Person (mg) and Ratios to Recommendations by Population Groups

Population Groupings	Total Calcium consumed (mg /person/day)		Calcium recommended intakes (mg /person/day)		Ratio Calcium consumed / recommended (%)	
	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS	2000/1 HBS	2007 HBS
Mainland Tanzania	296	486	747	746	40	65
Income level						
Quintile 1	237	374	743	739	32	51
Quintile 2	295	491	747	746	40	66
Quintile 3	323	541	758	754	43	72
Quintile 4	384	612	744	752	52	81
Quintile 5	410	765	750	756	55	101
Area						
Dar Es Salaam	279	518	761	754	37	69
Other urban areas	252	495	756	754	33	66
Rural areas	305	481	744	743	41	65
Region						
Dodoma	407	388	734	733	55	53
Arusha and Manyara	270	403	744	750	36	54
Kilimanjaro	322	614	767	768	42	80
Tanga	256	426	771	750	33	57
Morogoro	264	562	762	751	35	75
Pwani	269	456	760	751	35	61
Dar Es Salaam	279	518	761	754	37	69
Lindi	282	440	750	753	38	58
Mtwara	284	469	750	755	38	62
Ruvuma	226	518	752	751	30	69
Iringa	222	747	754	747	29	100
Mbeya	244	511	750	751	32	68
Singida	390	560	770	749	51	75
Tabora	373	612	734	733	51	83
Rukwa	193	425	747	734	26	58
Kigoma	220	435	740	751	30	58
Shinyanga	385	413	739	738	52	56
Kagera	299	532	727	735	41	72
Mwanza	309	341	735	743	42	46
Mara	280	382	731	741	38	52

Table 19. Share of Amino Acid in Total Amino Acid by Main Food Group

HBS 2000-01												
Item Group	Protein Consumption in Total Protein Consumption (%)	Isoleucine Consumption in Total Isoleucine Consumption (%)	Leucine Consumption in Total Leucine Consumption (%)	Phenylalanine Consumption in Total Phenylalanine Consumption (%)	Lysine Consumption in Total Lysine Consumption (%)	Methionine Consumption in Total Methionine Consumption (%)	Threonine Consumption in Total Threonine Consumption (%)	Tryptophan Consumption in Total Tryptophan Consumption (%)	Valine Consumption in Total Valine Consumption (%)	Histidine Consumption in Total Histidine Consumption (%)	Cysteine Consumption in Total Cysteine Consumption (%)	Tyrosine Consumption in Total Tyrosine Consumption (%)
Cereals and Products	51.6	40.4	49.4	46.7	27.3	39.9	41.0	23.0	45.0	40.7	50.6	45.8
Roots and Tubers, and Products	4.6	0.7	0.5	0.7	0.7	6.0	0.9	34.5	0.8	0.8	2.7	0.8
Pulses	9.7	9.5	8.6	11.7	11.8	5.5	9.5	6.2	8.8	10.2	8.4	9.0
Tree nuts	0.2	0.2	0.2	0.3	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.2
Oil Crops	4.6	5.6	4.8	6.5	3.5	2.9	5.2	5.0	5.5	5.2	7.3	5.4
Vegetables and Products	3.0	4.5	3.9	3.0	3.6	2.9	4.3	2.2	4.2	3.3	2.8	3.4
Spices	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Meat	9.4	16.6	13.6	13.0	23.0	17.1	17.0	9.1	14.2	17.8	13.2	14.4
Eggs	0.2	0.4	0.3	0.3	0.4	0.4	0.3	0.2	0.3	0.2	0.5	0.3
Fish and Products	9.5	14.7	12.5	11.4	22.2	17.3	15.1	8.2	13.2	13.8	10.8	12.9
Milk and Cheese	2.3	6.9	5.7	5.8	6.7	6.1	6.0	4.2	7.2	4.6	2.9	7.5

The data do not consider away from home consumption

HBS 2007												
Item Group	Protein Consumption in Total Protein Consumption (%)	Isoleucine Consumption in Total Isoleucine Consumption (%)	Leucine Consumption in Total Leucine Consumption (%)	Phenylalanine Consumption in Total Phenylalanine Consumption (%)	Lysine Consumption in Total Lysine Consumption (%)	Methionine Consumption in Total Methionine Consumption (%)	Threonine Consumption in Total Threonine Consumption (%)	Tryptophan Consumption in Total Tryptophan Consumption (%)	Valine Consumption in Total Valine Consumption (%)	Histidine Consumption in Total Histidine Consumption (%)	Cysteine Consumption in Total Cysteine Consumption (%)	Tyrosine Consumption in Total Tyrosine Consumption (%)
Cereals and Products	38.5	31.4	39.2	38.4	19.8	31.1	31.4	20.1	34.9	30.8	43.7	35.2
Roots and Tubers, and Products	4.4	0.7	0.6	0.8	0.7	4.8	0.8	29.8	0.7	0.8	2.2	0.7
Pulses	10.5	10.9	10.3	12.0	12.4	4.8	10.6	6.8	9.6	10.5	10.1	10.2
Tree nuts	0.2	0.2	0.2	0.3	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.2
Oil Crops	5.9	5.7	5.2	6.7	3.9	5.3	5.9	5.1	9.4	7.0	7.6	7.3
Vegetables and Products	8.3	7.6	6.4	5.7	6.0	4.9	6.6	3.3	6.7	5.3	4.6	6.1
Spices	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meat	7.7	12.5	10.8	10.3	16.2	12.8	12.8	7.7	10.6	13.5	9.9	11.1
Eggs	0.7	1.4	1.1	1.3	1.3	1.4	1.3	0.8	1.2	0.9	1.8	1.3
Fish and Products	16.9	25.2	22.6	20.6	36.0	29.7	26.1	15.3	22.3	23.8	18.0	22.9
Milk and Cheese	2.8	4.2	3.5	3.6	2.9	3.5	3.9	4.2	3.9	2.4	1.5	4.7

The data do not consider away from home consumption

Table 20. Standard errors, HBS 20000-01

Sample Based Standard Error

Region: Africa   Country: Tanzania - Mainland   Year: 2000/01

Categories and Groupings	Number of sampled households	Average food consumption in dietary energy value (kcal/person/day)	Food dietary energy consumption standard error	Food dietary energy consumption standard error within classes	Average food consumption in monetary value (LC$/person/day)	Food monetary value standard error	Food monetary value standard error within classes	Average total consumption (LC$/person/day)	Total consumption standard error	Total consumption standard error within classes	Income (LC$/person/day)	Income standard error	Income standard error within classes
Nationwide	22175	2203			220.97			352.71			544.62		
Area													
Dar es Salaam (C)	1225	2073	42	42	395.73	9.56	9.56	726.83	24.04	24.04	1095.27	214.77	214.77
Other urban areas	13382	2193	16	16	291.85	2.36	2.31	494.62	4.93	4.85	876.76	39.71	39.60
Rural areas	7568	2214	15	14	196.22	2.07	2.01	301.42	4.15	4.08	447.96	16.97	16.90
Household size													
one person	2503	3859	67	67	529.04	8.04	7.84	924.86	16.91	16.55	1762.61	153.39	152.53
two people	2431	2910	31	31	365.77	5.72	5.57	595.94	12.45	12.20	982.84	131.22	131.31
three to four people	6596	2411	14	13	262.18	2.58	2.49	423.55	5.93	5.76	655.37	35.33	35.18
five to seven people	7016	2136	11	11	208.86	2.11	2.03	329.63	4.66	4.51	499.34	30.13	30.05
More than 8	3629	1952	15	15	170.34	2.38	2.32	266.79	5.50	5.38	395.51	35.05	34.95
Gender of head of household													
MALE	16751	2212	14	13	219.40	2.02	1.96	351.14	4.42	4.31	556.06	34.83	34.74
FEMALE	5424	2165	17	16	227.75	3.35	3.26	359.49	6.31	6.16	495.09	31.81	31.73
Age of head of household													
Head <30 yrs	4913	2362	29	29	250.14	4.38	4.25	408.83	8.50	8.26	677.47	67.71	67.48
Head between 30 & 40 yrs	6544	2182	20	20	222.51	3.19	3.10	358.12	7.07	6.95	594.80	41.02	40.84
Head between 40 & 50 yrs	4717	2148	22	22	216.22	3.52	3.43	347.13	8.13	7.90	511.24	41.96	41.79
Head between 50 & 60 yrs	3120	2258	22	22	215.83	4.02	3.92	345.13	8.77	8.56	496.63	70.13	70.00
Head older than 60 yrs	2881	2091	23	23	198.75	3.61	3.51	296.83	7.19	7.03	402.30	109.95	110.04
Economic activity of head of household													
Agriculture- mining & fishing	10318	2188	13	12	193.68	1.79	1.74	296.34	3.37	3.31	441.53	13.22	13.07
Public & NGOs	4783	2299	29	29	335.17	4.66	4.56	593.81	9.36	9.16	843.91	46.83	46.63
Self employed	5884	2255	25	24	287.92	3.62	3.54	488.58	8.76	8.60	936.79	89.64	89.44
No activity	1190	2088	38	38	200.71	5.95	5.71	306.35	11.02	10.56	395.48	114.39	114.25
Region													
DODOMA	1212	2404	68	68	190.15	6.32	6.32	304.89	11.72	11.72	547.35	50.12	50.12
ARUSHA	1124	1952	32	32	237.14	7.90	7.90	362.58	17.84	17.84	598.97	60.08	60.08
KILIMANJARO	1077	2080	54	54	275.38	8.68	8.68	410.06	17.96	17.96	541.56	139.95	139.95
TANGA	1117	2163	41	41	222.48	7.06	7.06	326.58	13.35	13.35	413.92	51.65	51.65
MOROGORO	1124	2274	65	65	230.48	7.67	7.67	350.88	17.33	17.33	556.60	68.22	68.22
PWANI	987	1996	43	43	230.27	7.14	7.14	362.25	14.99	14.99	566.67	58.21	58.21
DAR ES SALAAM	1225	2073	42	42	395.73	9.56	9.56	726.83	24.04	24.04	1095.27	214.77	214.77
LINDI	1097	2455	80	80	236.69	8.37	8.37	333.61	18.48	18.48	522.11	130.66	130.66
MTWARA	1091	2305	51	51	279.43	7.68	7.68	420.45	14.24	14.24	725.54	76.79	76.79
RUVUMA	1102	2018	58	58	188.13	7.78	7.78	321.70	18.11	18.11	534.44	232.27	232.27
IRINGA	1125	2420	40	40	248.32	8.38	8.38	390.23	15.78	15.78	591.45	169.18	169.18
MBEYA	1130	2570	49	49	266.27	5.76	5.76	451.70	14.12	14.12	633.82	46.86	46.86
SINGIDA	1072	2034	39	39	166.94	6.69	6.69	250.15	12.94	12.94	309.50	242.54	242.54
TABORA	1096	2617	40	40	230.67	8.11	8.11	352.07	16.23	16.23	526.57	51.95	51.95
RUKWA	1006	2159	50	50	139.94	5.42	5.42	238.42	10.38	10.38	315.31	104.75	104.75
KIGOMA	1150	2146	37	37	161.54	7.14	7.14	255.35	17.16	17.16	394.90	86.38	86.38
SHINYANGA	1074	2371	46	46	180.78	8.17	8.17	277.48	17.27	17.27	502.05	105.17	105.17
KAGERA	1149	2098	40	40	200.75	8.36	8.36	316.56	17.27	17.27	455.70	99.89	99.89
MWANZA	1116	1949	34	34	165.64	6.40	6.40	288.06	12.21	12.21	505.73	65.12	65.12
MARA	1101	1892	32	32	187.67	5.68	5.68	274.07	10.18	10.18	400.95	28.65	28.65
Area-Income													
Dar es Salaam (C) - Quintile	245	1278	27	27	193.25	4.13	4.13	307.13	5.65	5.65	321.89	5.89	5.89
Dar es Salaam (C) - Quintile	245	1857	39	39	308.88	4.97	4.97	533.40	6.33	6.33	574.39	4.78	4.78
Dar es Salaam (C) - Quintile	245	2269	55	55	422.03	8.56	8.56	741.49	11.56	11.56	877.78	6.79	6.79
Dar es Salaam (C) - Quintile	245	2730	81	81	589.57	13.15	13.15	1131.87	19.52	19.52	1369.86	11.91	11.91
Dar es Salaam (C) - Quintile	245	3384	134	134	795.55	29.54	29.54	1650.59	88.51	88.51	4249.88	1030.74	1030.74
Other urban areas - Quintile	2676	1503	14	13	140.40	0.90	0.87	203.47	1.18	1.16	220.01	1.20	1.19
Other urban areas - Quintile	2677	1909	19	19	227.05	1.25	1.24	361.09	1.49	1.48	414.75	1.00	1.00
Other urban areas - Quintile	2676	2390	18	18	303.64	1.98	1.93	509.51	2.52	2.48	633.33	1.47	1.47
Other urban areas - Quintile	2677	2756	36	36	424.39	3.41	3.36	742.36	5.14	5.04	1017.69	3.30	3.30
Other urban areas - Quintile	2676	3212	55	54	567.89	7.57	7.47	1068.41	17.51	17.35	3618.91	186.59	186.31
Rural areas - Quintile 1	1513	1603	17	16	98.19	0.88	0.83	136.90	1.00	0.97	146.42	0.98	0.95
Rural areas - Quintile 2	1514	2084	19	18	161.86	1.08	1.06	234.54	1.11	1.11	255.99	0.77	0.76
Rural areas - Quintile 3	1514	2352	25	24	210.56	1.71	1.65	316.19	2.01	1.97	378.07	1.15	1.14
Rural areas - Quintile 4	1514	2680	33	32	281.73	2.78	2.70	439.32	3.79	3.69	581.79	2.29	2.28
Rural areas - Quintile 5	1513	3207	42	41	387.11	6.49	6.38	670.45	14.81	14.73	1659.64	74.57	74.42

Table 21. Standard errors, HBS 2007

Sample Based Standard Error

Region: Africa *Country: Tanzania* *Year: 2007*

Categories and Groupings	Number of sampled households	Average food consumption in dietary energy value (kcal/person/day)	Food dietary energy consumption standard error	Food dietary energy consumption standard error within classes	Average food consumption in monetary value (LC$/person/day)	Food monetary value standard error	Food monetary value standard error within classes	Average total consumption (LC$/person/day)	Total consumption standard error	Total consumption standard error within classes	Income (LC$/person/day)	Income standard error	Income standard error within classes
Nationwide	10421	2226			480.55			769.92			825.22		
Area													
Dar es Salaam	3436	2415	23	22	891.91	14.21	13.57	1518.68	39.94	38.70	1585.49	43.57	42.35
Other Urban	3716	2283	21	20	585.57	10.81	10.25	1019.91	29.77	28.99	1111.16	35.36	34.38
Rural	3269	2193	19	18	411.96	7.62	7.28	631.23	16.75	15.36	676.84	18.55	16.98
Household size													
One person	1447	3033	41	39	1251.17	28.05	25.36	2073.98	77.74	73.30	2219.91	88.82	83.84
Between 2 and 3 people	2931	2650	24	23	686.06	11.74	11.05	1101.80	28.99	27.62	1155.88	31.47	30.12
Between 4 and 5 people	3099	2240	21	20	490.16	9.14	8.30	785.37	31.10	28.98	837.58	34.43	32.43
Between 6 and 7 people	1784	2116	22	22	411.82	9.21	8.13	638.06	27.31	24.90	689.23	34.14	31.98
More than 7 people	1160	2054	26	25	377.72	8.92	8.20	618.81	29.18	27.77	674.44	32.42	30.97
Gender of head of household													
Male	7709	2230	14	14	479.88	8.23	7.64	772.00	21.40	20.41	831.01	23.93	22.89
Female	2712	2214	25	24	483.14	13.36	12.51	761.80	35.40	33.88	802.62	39.95	38.35
Age of head of household													
Less than 35	3513	2266	23	22	523.15	13.29	12.21	847.78	32.38	30.59	910.95	37.92	36.01
Between 35 and 45	2806	2179	22	21	471.79	13.24	12.37	739.60	30.95	29.52	789.37	35.48	33.95
Between 46 and 60	2782	2249	23	23	477.18	12.85	11.99	791.84	40.54	38.08	856.33	43.43	41.03
More than 60	1320	2205	32	32	438.14	14.10	13.27	660.31	40.16	38.83	694.62	41.59	40.21
Region													
Dodoma	291	2026	93	91	360.10	25.64	22.36	553.32	44.97	40.55	567.62	46.89	42.31
Arusha and Manyara	621	2024	45	43	466.64	26.99	24.29	744.79	72.31	65.79	797.07	90.63	82.97
Kilimanjaro	359	2487	65	62	655.28	40.80	39.13	975.18	167.44	165.55	1045.59	174.26	170.48
Tanga	430	2431	51	49	446.56	29.29	28.08	665.55	48.00	46.34	696.53	58.61	56.32
Morogoro	551	2615	49	47	586.83	32.59	29.97	874.94	56.65	49.49	914.47	61.24	53.95
Pwani	282	2154	63	60	477.11	28.80	26.84	693.55	52.99	49.11	730.79	66.74	62.58
Dar-es-salaam	3436	2415	23	22	891.91	14.21	13.57	1518.68	39.94	38.70	1585.49	43.57	42.35
Lindi	237	2263	73	67	466.47	37.64	35.07	720.40	70.11	67.21	762.99	76.44	72.79
Mtwara	379	2108	54	54	364.89	18.66	16.76	583.40	45.30	43.39	623.41	48.35	46.58
Ruvuma	260	2195	77	72	378.86	26.61	25.43	545.44	62.86	59.65	587.60	64.90	61.69
Iringa	396	2546	66	55	551.50	37.32	27.34	995.72	107.59	88.03	1102.28	129.06	107.24
Mbeya	550	2539	51	45	526.57	24.09	18.98	829.82	63.64	54.93	878.77	65.24	56.56
Singida	214	2150	66	63	293.98	18.85	17.13	478.62	47.71	47.31	506.63	48.36	47.97
Tabora	306	2191	66	62	442.02	32.40	31.45	694.83	77.23	76.95	770.81	81.90	81.39
Rukwa	260	1977	67	62	335.22	22.82	18.22	504.93	49.69	41.39	549.42	84.77	77.00
Kigoma	238	2053	103	100	367.55	29.59	27.09	592.39	60.83	54.03	630.37	66.40	59.88
Shinyanga	442	2315	52	51	444.94	29.20	27.38	679.89	46.12	41.99	731.76	48.82	44.96
Kagera	262	2033	61	59	405.98	22.59	20.97	665.18	74.76	69.80	730.33	83.09	77.16
Mwanza	598	1981	44	40	436.10	18.06	16.74	785.98	73.38	70.27	889.22	106.41	102.55
Mara	309	1823	65	60	379.55	25.66	24.66	630.82	58.73	57.50	670.23	65.02	63.61

Annex II. Methodology of measuring Deprivation

The estimate of the proportion of the population below minimum level of dietary energy consumption or food deprivation has been defined within a probability distribution framework:

$$P(U) = P(x < r_L) = \int_{x<r_L} f(x)\,dx = F_x(r_L)$$

where:

P(U) is the proportion of undernourished in total population

(x) refers to the dietary energy consumption

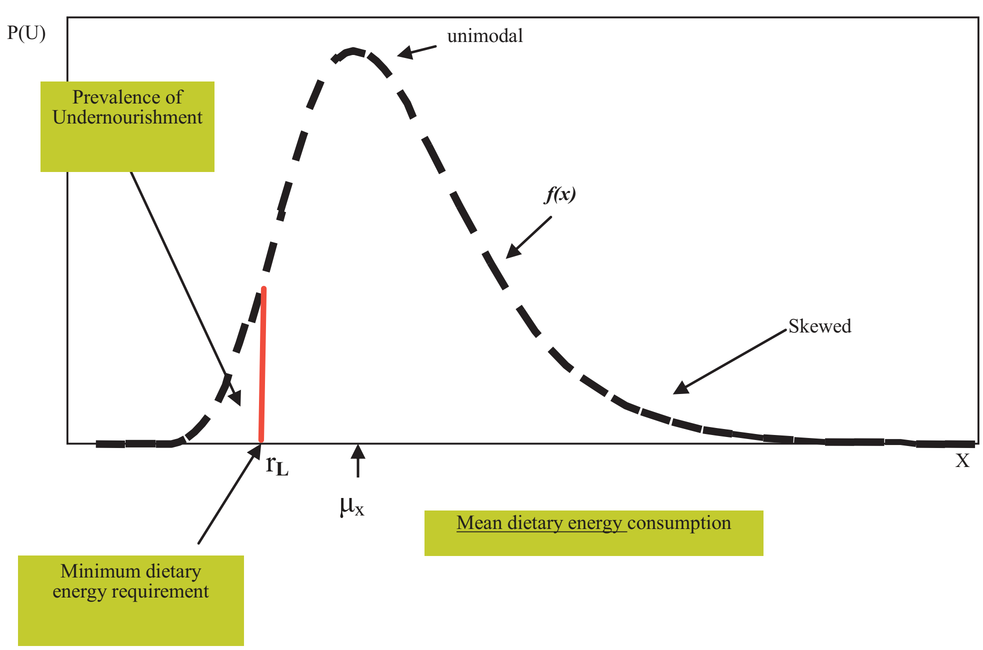
r_L is a cut-off point reflecting the minimum energy requirement

f(x) is the density function of dietary energy consumption

F_x is the cumulative distribution function of dietary energy consumption

The graph below illustrates the methodological framework for the estimation procedures of the proportion of population undernourished, i.e. prevalence of undernourishment.

Theoretical distribution of dietary energy consumption



In the graph the curve **f(x)** depicts the proportion of the population corresponding to different per caput dietary energy consumption levels **(x)** represented by the horizontal line. The area under the curve up to the minimum energy requirement which is a cut-off point in the curve,

$\mathbf{r_L}$, represents the proportion of the population undernourished, i.e. prevalence of undernourishment.

The density function, **f(x)**, **of dietary energy consumption** is assumed to be lognormal so that the parameters μ_x and σ_x^2 can be estimated on the basis of the mean, $\bar{x}$, and the coefficient of variation, **CV(x)**.

Estimation of the mean, $\bar{x}$

There are two options for estimating the mean $\bar{x}$: using Food Balance Sheet (FBS) data or Household Budget Survey (HBS) data. The first is used to prepare annual estimates for monitoring progress in food security for the country as a whole. FAO is using this FBS estimate for its global monitoring of MDG 1.9. The second one allows the derivation of both national and sub-national estimates. The latter estimates cannot be prepared on a yearly basis, as they depend on the survey frequency, in general ranging from 5 to 10 years.

Note that Prevalence of undernourishment estimated using FBS mean food consumption is always less than using the HBS mean as the former represents food supply for both private (household) and public consumption. The HBS gives private household food consumption estimates, which are more realistic and consistent in capturing food deprivation.

The National Mean computed from the Tanzania 2007 HBS is 2230 kcal/person/day.

Estimation of the coefficient of variation, CV(*x*)

The **CV(*x*)** is the coefficient of variation of the daily per person dietary energy consumption and is formulated as follows:

$$CV(x) = \sqrt{CV^2(x \mid v) + CV^2(x \mid r)}$$

Where

CV(*x*|*v*) is the coefficient of variation of the daily per person dietary energy consumption due to per person daily income **(*v*)** and **estimated** on the basis of food consumption data collected in the HBS**;**

CV(*x*|*r*) is the coefficient of variation of the daily per person dietary energy consumption due to energy requirement **(*r*)** and is considered a fixed component corresponding to about 0.20.

CV(x|v) is estimated using the following formula:

CV(x|v) = σ (x|v) / μ(x) .

Where

σ (x|v) is the standard deviation of the weighted daily per person dietary energy consumption by income deciles distribution and is derived from the formula:

$$\sigma(x|v)=\sqrt{\left[\sum_{j=1}^{k} f_j(x|v)_j^2-(\sum_{j=1}^{k} f_j(x|v)_j)^2/n\right]/(n-1)}$$

μ(x) is the weighted average daily per person dietary energy consumption by income deciles distribution and is derived from the formula:

$$\mu(x)=\sum_{j=1}^{k} f_j(x|v)_j/n$$

k is 10 - the number of income deciles;

f_j is the number of persons in the sampled households of the ***j***th income class;

$(x|v)_j$ is the average daily per person dietary energy consumption of the ***j***th income class; and ***n*** is number of persons in the household income and expenditure survey.

In many cases, total expenditure data are used as a proxy of income data because the latter is not available or wrongly reported at the collection stage.

Thus, the data required for estimating **CV(x|v)** are the averages daily per person dietary energy consumption and the number of persons of the population in each household income deciles. Note that the number of persons in the sampled households has to be expanded to the total population using the sampling and expansion weights.

The Coefficient of Variation of the daily per person dietary energy consumption computed from the Tanzania 2007 HBS is 31.72 .

Daily per person minimum dietary energy requirement

The overall daily minimum dietary energy requirement per person, which is used as the cut-off point, r_L, for estimating the prevalence of undernourishment, is derived by aggregating the sex-age requirements weighted by the proportion of each sex and age group in the total population.

Finally, a pregnancy allowance (**PA**) in per person terms for the whole population is added to the overall requirement. The PA is estimated by multiplying the birth rate by 210 kilo-calories, assuming an estimated daily requirement of 280 kilo-calories during pregnancy over 75 per cent of the year.

$$r_L = \Sigma_{ij} (MER_{ij} * P_{ij})$$

Where :

MER = daily minimum dietary energy requirement per person

P_{ij} = proportion of each sex and age group in the total population

PA = pregnancy allowance

i = age group

j = sex

The Minimum Dietary Energy Consumption per person per day computed using demographic data from the Tanzania 2007 HBS is 1691 kcal/person/day.

Estimation of the proportion and number of undernourished using HBS data

The density function of dietary energy consumption, **f(x)**, as indicated previously, is assumed to be lognormal with parameters μ_x and σ_x^2. These parameters are estimated using the derived values of the mean $\bar{x}$ and the coefficient of variation ***CV*(*x*)** of the dietary energy consumption, both estimated from HBS data as follows:

$$\sigma_x = [\log_e (CV^2(x) + 1)]^{0.5}$$

$$[\log_e (0.3172^2 + 1)]^{0.5} = 0.30963$$

and

$$\mu_x = \log_e \bar{x} - \sigma^2 / 2$$

$$\log_e 2230 - 0.30963^2 / 2 = 7.661822.$$

The proportion of population below $\mathbf{r_L}$ is then evaluated using the standard normal cumulative distribution as follows:

$$\Phi [(\log_e r_L - \mu) / \sigma)]$$

$$\Phi [(\log_e 1691 - 7.661822) / 0.30963)] = \Phi [- 0.73878] = 0.230021$$

Where:

Φ = standard normal cumulative distribution.

Thus,

the percentage of the population undernourished = 23.0 .

As the total population of Tanzania in 2007 was 37 million, the number of undernourished is obtained as follows:

Number of undernourished = 37 * 0.23 = 8.5 million.

Annex III. Estimation of micronutrient requirements and recommendations for national and sub-national population groups

The normative micronutrient requirements and recommendations are given in milligrams or micrograms per person per day for each age group and sex for the human population as shown in Tables A1.a and A1.b.

Table A1.a. Requirement and recommended intake of selected micronutrients for males

Males									
Age in years	Calcium recommended intakes based on animal protein	Vitamin C recommended intakes	Vitamin B1 recommended intakes	Vitamin B2 recommended intakes	Vitamin B6 recommended intakes	Vitamin B12 average requierement	Vitamin B12 recommended intakes	Vitamin A mean requierement	Vitamin A recommended safe intake
	mg/person/day					mcg/person/day			
Less than one	383.3	27.5	0.3	0.4	0.2	0.5	0.6	185.0	387.5
1 a 1.9	500.0	30.0	0.5	0.5	0.5	0.7	0.9	200.0	400.0
2 a 2.9	500.0	30.0	0.5	0.5	0.5	0.7	0.9	200.0	400.0
3 a 3.9	500.0	30.0	0.5	0.5	0.5	0.7	0.9	200.0	400.0
4 a 4.9	550.0	30.0	0.6	0.6	0.6	1.0	1.2	200.0	450.0
5 a 5.9	550.0	30.0	0.6	0.6	0.6	1.0	1.2	200.0	450.0
6 a 6.9	550.0	30.0	0.6	0.6	0.6	1.0	1.2	200.0	450.0
7 a 7.9	700.0	35.0	0.9	0.9	1.0	1.5	1.8	250.0	500.0
8 a 8.9	700.0	35.0	0.9	0.9	1.0	1.5	1.8	250.0	500.0
9 a 9.9	700.0	35.0	0.9	0.9	1.0	1.5	1.8	250.0	500.0
10 a 10.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
11 a 11.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
12 a 12.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
13 a 13.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
14 a 14.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
15 a 15.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
16 a 16.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
17 a 17.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
18 a 18.9	1000.0	40.0	1.2	1.3	1.3	2.0	2.4	365.0	600.0
19 a 19.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
20 a 24.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
25 a 29.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
30 a 34.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
35 a 39.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
40 a 44.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
45 a 49.9	750.0	45.0	1.2	1.3	1.3	2.0	2.4	300.0	600.0
50 a 54.9	750.0	45.0	1.2	1.3	1.7	2.0	2.4	300.0	600.0
55 a 59.9	750.0	45.0	1.2	1.3	1.7	2.0	2.4	300.0	600.0
60 a 64.9	750.0	45.0	1.2	1.3	1.7	2.0	2.4	300.0	600.0
65 a 69.9	800.0	45.0	1.2	1.3	1.7	2.0	2.4	300.0	600.0
70+	800.0	45.0	1.2	1.3	1.7	2.0	2.4	300.0	600.0

The estimate of micronutrient requirements and recommendations were weighted by sex and age population structures of the population groups under study, at national and sub-national levels.

The sex and age population structure was estimated from household member data collected in the household surveys for the different population groups at national and sub-national levels.

The daily micronutrient requirement (MREQ) or recommended intake (MREC) per person in the population group are estimated as follows:

MREQ (per person per day) = MREQij * Pij or
MREC (per person per day) = MRECij * Pij
where

MREQ is the per person per day requirement in milligram or microgram,
MREC is the per person per day recommended intake in milligram or microgram,

MREQij or MRECij are the normative micronutrient requirement or recommended intake (respectively) per person per day of the ***ith*** sex and ***jth*** age-group, and

Pij is the proportion of persons of the ***ith*** sex and ***jth*** age-group in the population studied.

Table A1.b. Requirement and recommended intake of selected micronutrients for females

Females									
Age in years	Calcium recommended intakes based on animal	Vitamin C recommended intakes	Vitamin B1 recommended intakes	Vitamin B2 recommended intakes	Vitamin B6 recommended intakes	Vitamin B12 average requierement	Vitamin B12 recommended intakes	Vitamin A mean requierement	Vitamin A recommended safe intake
	mg/person/day					mcg/person/day			
Less than one	383.3	27.5	0.3	0.4	0.2	0.5	0.6	185.0	387.5
1 a 1.9	500.0	30.0	0.5	0.5	0.5	0.7	0.9	200.0	400.0
2 a 2.9	500.0	30.0	0.5	0.5	0.5	0.7	0.9	200.0	400.0
3 a 3.9	500.0	30.0	0.5	0.5	0.5	0.7	0.9	200.0	400.0
4 a 4.9	550.0	30.0	0.6	0.6	0.6	1.0	1.2	200.0	450.0
5 a 5.9	550.0	30.0	0.6	0.6	0.6	1.0	1.2	200.0	450.0
6 a 6.9	550.0	30.0	0.6	0.6	0.6	1.0	1.2	200.0	450.0
7 a 7.9	700.0	35.0	0.9	0.9	1.0	1.5	1.8	250.0	500.0
8 a 8.9	700.0	35.0	0.9	0.9	1.0	1.5	1.8	250.0	500.0
9 a 9.9	700.0	35.0	0.9	0.9	1.0	1.5	1.8	250.0	500.0
10 a 10.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
11 a 11.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
12 a 12.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
13 a 13.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
14 a 14.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
15 a 15.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
16 a 16.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
17 a 17.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
18 a 18.9	1000.0	40.0	1.1	1.0	1.2	2.0	2.4	365.0	600.0
19 a 19.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
20 a 24.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
25 a 29.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
30 a 34.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
35 a 39.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
40 a 44.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
45 a 49.9	750.0	45.0	1.1	1.1	1.3	2.0	2.4	270.0	500.0
50 a 54.9	800.0	45.0	1.1	1.1	1.5	2.0	2.4	270.0	500.0
55 a 59.9	800.0	45.0	1.1	1.1	1.5	2.0	2.4	270.0	500.0
60 a 64.9	800.0	45.0	1.1	1.1	1.5	2.0	2.4	270.0	500.0
65 a 69.9	800.0	45.0	1.1	1.1	1.5	2.0	2.4	300.0	600.0
70+	800.0	45.0	1.1	1.1	1.5	2.0	2.4	300.0	600.0

Annex IV. Estimation of retinol activity equivalent (RAE) from retinol and pro-vitamin A carotenes for national and sub-national population groups

The vitamin A is expressed in RAE. One microgram (µg) of RAE is equivalent to one µg of all-trans-retinol, 12 µg of all-trans-β-carotene or 24 µg of other pro-vitamin A carotenes. The vitamin A is also reported in international units (IU). One IU is equivalent to 0.3 µg of retinol, 0.6 µg of β-carotene or 1.2 µg other pro-vitamin A carotenes.

All vitamin A activity from food of vegetable origin such as fruits, vegetables, legumes, nuts, cereal grains, and spices and herbs is obtained from carotenes. While all of the vitamin A activity from food of animal origin such as eggs, beef, pork, poultry, lamb, veal, game, and fish (except for some organ meats and dairy) is obtained from retinol. In food items that contain both retinol and pro-vitamin A carotenes, the amount of each of these components must be known to estimate their RAE.

The vitamin A expressed in µg RAE in single food items or in the composition of food available for human consumption is estimated as follows:

Vitamin A (µg RAE) = Retinol(µg) + [β-carotene(µg)/12] + [other pro-vitamin A(µg)/24].

Annex V. Estimation of protein digestibility corrected amino acid score (PDCAAS)

Four amino acid scoring patterns (mg/g protein) were calculated by FAO/WHO/UNU in 2002 for infants, preschool children, school children and adults. These scoring patterns were estimated using the essential amino acids requirement values (mg per Kg of body weight per day) and the mean protein required (g per Kg of body weight per day). Table B1.a

Table B1.a. Reference Scoring Patterns

mg of essential amino acid required / gram of mean protein required

Essential Amino Acid	Infants	Preschool children (1-2 years)	Children and adolescents (3-18 years)	Adults
Histidine	20	18	16	15
Isoleucine	32	31	31	30
Leucine	66	63	61	59
Lysine	57	52	48	45
Methionine and Cisteyne	28	26	24	22
Phenylalanine and Tyrosine	52	46	41	38
Threonine	31	27	25	23
Tryptophan	8.5	7.4	6.6	6
Valine	43	42	40	39

Amino Acid Score (AAS) = (mg of essential amino acid in the diet per gram of protein consumed)
(mg of essential amino acid required per gram of mean protein required)

PDCAAS(%) = Minimum AAS * protein digestibility * 100

The amino acid score was calculated from the weighted average digestible amino acid content. So, the protein digestibility was taken into consideration at food item level as for example:

Amino acid consumption (mg) = (((food item quantity in grams / 100) * mg of amino acid in 100g edible portion of food item) * (1-food item refuse factor in percentage/100))*(protein digestibility in percentage/100).

The FSSM estimated a new amino acid score pattern based on the requirements of the Tanzania's population through its age and sex structure. The data used to estimate the new pattern were amino acid requirements by age group and the protein requirement by gender and age group defined by WHO/FAO/UNU in 2002.
Data on amino acid and protein requirement are given in milligrams and grams per Kg of body mass per day respectively, so data on weights are needed to estimate quantities required per person per day. Therefore, weights are estimated using both country population heights and body mass index (50 percentile) by gender class.

- weight = bmi_50*(mheight/100)**2

  weight is estimated weight in Kg by gender and age group
  bmi_50 is body mass index (50 percentile) by gender and age group
  mheight is country's median height by gender and age group

So, amino acid and protein per person per day weighted by population are estimated as:

- aa_ppd_req = aa_req*weight*rat_pop
- pro_ppd_req = pro_req*weight*rat_pop

aa_ppd_req is mg of amino acid required per person per day in the population group
pro_ppd_req is grams of protein required per person per day in the population group
aa_req is amino acid required in mg per Kg of body mass
pro_req is protein required in grams per Kg of body mass
weight is estimated above
rat_pop is the population ratio by gender and age group in the total population group

Protein Digestibility Corrected Amino Acid Score (PDCAAS) is estimated as:

- $$PDCAAS = \frac{(\text{mg amino acid consumed / g protein consumed})}{(\text{aa\_ppd\_req of aminoacid / pro\_ppd\_req of protein})}$$

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To facilitate informed decision-making process, through provision of relevant, timely and reliable user-driven statistical information, coordinating statistical activities and promoting the adherence to statistical methodologies and standards

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