Fisheries Administration

Food and Nutrition Security Vulnerability to Mainstream Hydropower Dam Development in Cambodia

Baseline Assessment of Diet and Nutrition in Cambodia 2011

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July 2012

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AN EXECUTIVE SUMMARY

Individual and Household Food Consumption

The 2011 Cambodia household food consumption survey is the nationally representative sample survey of 1,200 household, aged 0 to 60 + years. The primary purpose of the survey is to assess the current food consumption situation and energy and nutrient intake of individual and households of Cambodian. The information is vital for policymakers and planner with data/information on food consumption and energy and nutrient intake of individuals and households by national, ecological zones, urban and rural, gender, and age group including pregnant women. The 24-hour Food Recall Method was employed to collect information on the food intake of all sample household members conducted through face to face interviews, done for one day food consumption from 14 August 2011 to 24 September 2011.

The Cambodian diet is basically rice-vegetable-fish combination in both individual and household level. The total mean one day per capita and household food consumption is 936.5 g/p/day and 3870.1 g/hh/day, in raw as purchased form, respectively. The cereal and cereal products (predominantly rice) was the highly consumed in both individual and household level at 386.07 g/p/day and 1513.2 g/hh/day, accounting for 39.3% and 39%, respectively. Fish and fish products intake was the second largest consumed by Cambodian individual and household, which estimated to be at 172.5 g/person/day and 721.8g/HH/day, with sharing nearly at 18.4% and 19%, respectively. The top 3 consumption by Cambodian individual and household was vegetables at 113.7g and 470.3g, contributing the same amount at 12% of total intake.

Inland fish which include blackfish, whitefish and grayfish, aquaculture fish and other aquatic animals (OAAs-frog, shrimp, crab, etc with mean per capita and household consumption of 124.94 g/p/day and 524 g/hh/day, were estimated to be at 13.3 % and 72.6% of the total fish consumed, respectively. While the capita and household consumption of m*arine* fish including *other marine aquatic animals founded at* 44.48 g/p/day and 184.5 g/hh/day, sharing at 25.6% and 25.7 % of the total fish intake, respectively.

Across ecological zones, per capita consumption of all food types combined was highest in coastal area at 1423 g/p/day while lowest food intake was observed in plain area at 839.8 g/p/day. Households living in the coastal area consumed the highest total food intake at 5832.8 g, followed by Phnom Penh at 3931.5 g, Tonle Sap area at 3873.7 g, and mountain & plateau area at 3724.8 g while lowest total food intake was observed among households living in the plain area at 3482.1 g/p/day. Individual and household living in coastal zone and Phnom Penh have access to foods in term of local food availability and food affordability among ecological zones. Family size and food distribution among the household members are also among the influential indicators to food consumption pattern of Cambodian individuals and households.

Consumption of inland *fish* including OAAs was higher than the marine fish across ecological zones except for the coastal area. *Blackfish* was consumed more in Tonle Sap, Coastal and Phnom Penh at 77.2 g/p/day, 60.1 g and 45.2 g/p/day, respectively while *whitefish* was consumed more in the plain, mountain and plateau at 58.5 g/p/day and 32.7 g/p/day, respectively. *Marine fish* was consumed more in the coastal area at 134.8 g/p/day followed by mountain and plateau at 51.8 g/p/day. Lowest intake of *marine fish* was in the Plain area at 25.4 g/p/day. The

marine fish consumption in mountain or plateau area was relatively high; it is possibly due to food items imported from Thailand such in provinces located along the Cambodia-Thai border. And again purchasing power is one of the influential indicators to have access to these kind of food items especially in the larger town such as Phnom Penh, Battambang and Seam Reap. The urban area consumes marine fish and marine OAAs higher than its counterpart rural area because they have higher purchasing power and market demand for the marine fish products

The national per capita and household blackfish consumption in urban areas across the country is relatively higher than other fish categories-white fish and grey fish. It is because household in urban area have relatively high purchasing power than rural areas. Households living in Tonle Sap zone also have high consumption in blackfish since it is very available in their area. On the other hand, black fish are eaten fresh or whole whereas white fish are often processed e.g. Prohoc, and other processed forms especially in Mountain areas or areas away from water body. If we are only looking at purchase weight then we may be biasing towards black fish as they are more often eaten fresh as opposed to white fish that are more likely eaten processed.

The total mean food intake per capita per day, in urban and rural areas was 962.3 g/p/day and 909 g/p/day, respectively. While daily household food consumption was estimated at 4037.7 g/hh/day in rural and 3701.8 g/hh/day in urban, in raw as purchased form. Consumption of *fish* in the urban area was slightly higher at 180 g/p/day in the rural area at 164.05 g/p/day. Male consumed more *fish* at 180.4 g/p/day than female at 166.0 g/p/day. *Inland fish* was eaten more than the *marine fish* with the male eating more at 131.09 g/p/day while the female eating at 119.9 g/p/day.

Individual and Household Energy and Nutrient Intake

The mean total intake for *energy* of Cambodians and Cambodian households were estimated about 1798 Kcal/p/day and 7918.7 Kcal/hh/day, only about 25.2 % and 29.4% of Cambodians and Cambodians had energy intake meeting 100 % of their recommended daily allowance. The number of individuals meeting adequacy for *energy* in the coastal area was at 52.2 %, about one-fourth in Tonle Sap and plains and near 30 % in Phnom Penh, mountains and plateaus. Highest adequacy for energy at close to one-third (29.7 %) was met by the adults (20-50 years old) and lowest by the school children (6 to 12 years old) at only about one-sixth (15.8 %). Among the age groups, the *school-children* could then be considered as the most food insecure while the *adults* were the most food secured. Energy-giving foods specifically cereals and their products as well as fish and fish products were consumed more by the adults than other age groups

The individual and Cambodian household means intakes of *Protein* of 72.9 g/day and 330.07 g/day were able to meet more than 89 % and 95% of Recommended Dietary Allowance (RDA). Protein was the highest meeting RDA by ecological zones, urbanity, gender and age. Regardless of ecological zones, adequacy for protein was met high. Highest proportion the met adequacy for *protein* was in Tonle Sap at 94.1 and lowest in plains at 85 %. The proportion of female individuals meeting their adequacies was generally lower than the males for all nutrients. Nearly 90 to 95 % of both male and female individuals met their adequacies at 80 % for *protein*. Across age groups including pregnant women protein adequacies were high from 80 to 90 % with highest proportion meeting adequacies in preschool children and the adults for protein.

The individual mean intake of iron at 12.8 mg was only able to meet the RDA iron adequacy at 19.1 %. The households mean intake of iron at 38.9 mg was estimated to meet at 14.3% at least 80% of the recommended. *Iron* adequacy was higher in Phnom Penh, Mountains and Plateaus and Tonle Sap at about 25 % individuals in the Plains and coastal areas. Iron Adequacy was met by about one-fifth of the individuals in the urban and rural areas and the lower proportions of individuals meet their adequacies in the rural areas. Proportion meeting adequacies for iron was highest among the elderly but lowest among the preschool children.

Role of Fish in Food and Nutrition Security

Combined results of the dietary survey of the household and the individual show that at the national and sub-national levels, the Cambodian diet is basically *rice-fish-vegetable* combination with largest consumption of rice, followed by fish and vegetables. In the Cambodian diet, *rice* and *fish* were the most frequently eaten food groups with rice at almost three times a day and fish at about two to three times a day. *Vegetables* were consumed at one and a half (1 ½) times a day.

Cereal and cereal products (major rice) are major energy contributors in the Cambodian diet contributing about 1095 kcals (60.1%). It is also the second contributor of protein at 34.83 %, fats at 17.03, and iron at 32.07 %. Fish and fish products are the major contributors of protein at 36.59 %, fats at 27.81 %, iron at 37.3 %. Meat and meat products follows fish and fish products in their contribution to the total nutrient intake. Vegetables, on the other hand, are the major contributors of iron at 9.20 %.

Fish was the major contributor of the *animal intake* among Cambodian households sharing more than three-fourths (75 %) to the total animal intake. Meat and meat products together with poultry contributed less than one-fourth to the total animal intake contributing about 20 % and 4 %, respectively. The inland fishes contributed the most at 55 % with the blackfish providing the highest percentage (about 23 %) followed by whitefish (18.5%) while the aquaculture fish contributed the least with only about 2 %. The marine fish together with other aquatic animals from marine source contributed almost 21%.

Fish shared about 12.0 % to the total *energy intake* in a day with the highest contributing from whitefish at 4.0 %; protein at 36.0 % of the total daily household *protein* intake, with the highest sharing by blackfish at 11.73%; fat at 27.0 % of the total household fat intake with the highest contributing from whitefish at 11.79%. Fish being not a carbohydrate source had minimal contribution (0.89%) to the total carbohydrate intake among households.

The significant contribution of fish to nutrition adequacy in meeting protein adequacy is its greater than contribution to iron density of the Cambodian diet than any other food groups. Fish contributed to the total iron intake by the individual at nearly one-third (19.1%) and the household at about one-third (34%) of the total daily household *iron* intake, with the major shared by whitefish at 20.92 %. Thus, fish other that its significant contribution in meeting primarily protein and energy adequacy plays a significant role in meeting adequacy in iron in the households and by the individuals

The Cambodian diet has a total energy of 1798 Kcal. The sources of calories generated the largest amount from carbohydrates at 66%, moderate from proteins at 21% and very low from fats and oils at 2% and miscellaneous food at 11%. The dietary energy supply from carbohydrate at 66% to total dietary energy per capita is consistent with the desirable contribution

carbohydrate of recommended by RENI, The Cambodian households were able to meet the energy adequacy bout 29.4 %, while individuals met the energy adequacy only about 25.2 %. Protein adequacy was highly exhibited both in the households and the individuals at close to 97 and at 89 %, respectively. The households and individuals were able to meet the iron adequacy at close to 20% and 14.3%, respectively. Consumption of protein-rich food was next to the energy-giving food with fish consumed largely than any other protein-rich food. The contribution of fish of more than half (55 %) to the total animal protein intake of the individual.

The greater role of fish in meeting adequacy for food in terms of energy is the fact that when energy need by the body cannot be supplied by rice and other carbohydrate-rich foods, the body metabolizes the protein from fish to sustain the caloric need of the human body for the proper functioning of the various physiological and biochemical processes such as digestion and metabolism of foods to sustain life.

Fish was also the source of fats. The fats and the protein contributed by fish significantly played in mitigating caloric deficiency in the Cambodian diet and perhaps the protein-energy malnutrition which is the form of malnutrition that exists in developing countries like Cambodia. Fish contribute some fat but overall intake of fat was very low (2%), it is much far lower than the desirable contribution of fats to total dietary energy recommended by RENI for 30-40% for infants and 20-30% for all others. The low fat intake is the reason for low calorie intake. Fish provides protein, which the body uses for optimal growth, but in the context of low calorie intake the body must turn to protein to satisfy energy needs. This is the form of protein-calories malnutrition (Marasmus) and the major reason for stunted growth and development in Cambodia. Another form of protein-calorie malnutrition (Kwashiorkor) is simple protein deficiency. This type is not common in Cambodia and rarity can be attributed to availability of protein from fish. It can be noted that the contribution of dietary energy from 21% to total dietary energy per capita is much higher than the desirable contribution of protein recommended 10-15% by RENI.

The contribution of fish to total fat intake although low as compared with other food groups must also be emphasized. Aside from contributing to the total energy intake, fat of fish contains essential fatty acids namely, linoleic acid (omega 6), the precursor of arachidonic acid (ARA) and linoleic acid (omega 3), the precursor of DHA. These nutrients are not synthesized by the body. It must be obtained from food and it is known to be benefit to health DHA is a key component of the phospholipids membranes of the eyes and brain. It is essential for brain and eye development infants and children; reduce the risks of heart disease and stroke- prevents blood clots, lowers blood pressure, protects against irregular heartbeats, reduces inflammation; strengthens the immune system; and essential for normal growth and development -for healthy skin, normal growth and reproduction. A diet that is deficient in DHA is associated with poor growth skin lesions, reproductive failure and fatty liver.

Furthermore, it can be observed that generally among households and individuals found in ecological zones eating more fish than any other animal meat and other food groups were generally more nutrient secured. Fish other that its significant contribution in meeting primarily protein and energy adequacy plays a significant role in meeting adequacy in iron in the households and by the individuals. Iron has function as part of hemoglobin, which transports oxygen in blood to cells to produce energy and part of myoglobin in muscles, which makes oxygen available for muscle contraction. Iron is part of an enzyme in the immune system helps

protect against infections and involved in making amino acids, collagen, hormones or normal brain functions-for synthesis of neurotransmitters & brain growth in human.

I. INTRODUCTION

Cambodia is one of the poorest countries in the South East Asia region with an estimation of total population of around 14.2 millions, a growth rate of about 1.75% per annum in 2007 and 35% of the population was below the poverty line in 2004 (UNDP, 2007). The gross domestic product (GDP) per capita estimated at approximately USD 805 in 2010 (IMF, 2011) and the GDP per capita purchasing power parity (PPP) was US$ 2,170 in 2011 (FAO, 2012). The GDP was shared by the agriculture sector (31%), industry sector (26%) and service sector (43%) in 2007 (World Bank, 2008). Agriculture is the major occupation of around 85-90% of the total population. The human development index (HDI), a human welfare indicator, was rising from 5.33 in 1995 to 5.71 in 2003. This is attributed to the peace and order in place and considerable foreign assistance (UNDP Cambodia, 2006).

Cambodia is comprised of a wide basin surrounded by highlands and its geography is dominated by the Mekong River. The natural resources provide a foundation for food security, income and employment for most of the population in Cambodia. More than 10 million people live in rural areas in which about 85% depend on agriculture, fisheries, and forest resources to support their livelihoods. Agricultural sector contributes some 31 % to GDP in which the contribution of agriculture, fisheries, livestock and forestry is 47, 31, 15 and 7%, respectively (MAFF, 2004).

1.1. Food and Nutrition Security Status in Cambodia

Food and nutrition security is an important cross-cutting issue for Cambodia. Based on the definition of the World Food Submit plan of action in 1996 "Food security exits when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food, enabling them to meet their dietary needs and food preferences for an active and healthy life". In 2000, Helen Keller International (HKI) conducted the first Cambodia National Micronutrient Survey (CNMS) to assess the magnitude and key determinants of micronutrient deficiencies in the country.

Protein energy malnutrition and micronutrient deficiencies are still critical problems in Cambodia and in the Asia-Pacific region. Malnutrition, especially in rural areas, is widespread, particularly among preschool-aged children and lactating women. The malnutrition rates in Cambodia are among the highest in the Asia-Pacific region. However, the infant mortality rates a remarkable decline in childhood mortality. In 2010, there were 45 infants deaths for every 1,000 live births and 54 under-five deaths for every 1,000 live birth. In 2005, infant mortality was 66 and under-five mortality was 83. The nutritional status of children has not changed much in the last five years. Protein-energy malnutrition, vitamin A deficiency (VAD), and especially, iron deficiency anemia (IDA) are widespread among the under 5 year- aged children. IDA among children under-five years of age it is over 55% (CDHS, 2010). Women also suffered from nutritional deficiencies. Forty-four percent of women faced anemia deficiencies. Nineteen percent of Cambodian women age 15-49 were considered thin, while 11 percent were overweight or obese. The percentage of underweight women has remained stable over the last 10 years, while the percentage of overweight women has increased since 2000 (CDHS, 2010).

Undernutrition in Cambodia is evidenced in the high prevalence of stunting and underweight among children among 5-year Table 1. While progress was made in reducing undernutrition in

the early part of the last decade, reduction slowed between 2005 and 2010. Stunting, low height for age is the result of chronic undernutrition was still unchanged.

Table 1 Trend in the prevalence of child malnutrition, Cambodia 2010

	CDHS 2005[1] n=3101	CAS 2008[2] n=7019	CDHS 2010[3] n=3,975
Wt for Ht < -2SD	7.1%	8.9%	10.9%
Wt for Age <-2SD	35.7%	28.8%	28.3%
Ht for Age <-2SD	38.3%	39.5%	39.8%

[1]Cambodian Demographic and Health Survey
[2]Cambodian Anthropometric Survey
[3]Cambodian Demographic and Health Survey

Food distribution remains a problem for a larger part of the population in Cambodia, resulting in structural food insecurity at the national level, and acute or chronic food insecurity particularly in rural areas. This problem of availability, together with problems of access to and utilization of food as well as the lack of diversity in the diet of most people result in high levels of child and adult malnutrition, even though national food supplies are adequate. Several survey (FAO, 1999a) confirm that the food consumption of the typical Cambodian consists primarily of rice with some fish or fish products.

The contribution of total energy from carbohydrate (mainly rice) was 76%, while the share of protein and fat to the overall energy supply was 10% and 14%, respectively (FAO, 2010). The main source of protein in rural areas is Prahoc, which is the paste fermented fish. A United Nation Children's Emergency Fund (UNICEF)/Worl Food Program (WFP) survey shows that fish is part of the daily diet of 74-80% of all children of over 11 months old, while nearly all (95%) reported to have eaten rice the previous day (Kenefick, 1999).

Insufficient animal protein consumption and associated forms of malnutrition are linked to the degree of poverty. Apart from rice, fish was found to be by far the most common food item consumed in all regions of the country (FAO, 1999a). According to UNICEF/WFP survey the average number of meals consumed by children is 2.4 meals/day. The composition showed a
According to the most recent NIS/FAO data (2012), 22% of Cambodians suffer from undernourishment, which refers to the condition when “dietary energy consumption is continuously below a minimum dietary energy requirement for maintaining a healthy life and carrying out a light physical activity with an acceptable minimum body-weight for attained-height”.

Table 2 indicates the distribution of food energy in the Cambodian diet in relation to current recommendations. The minimum fat intake is too low as the recommended intake for women of childbearing age is 20% of total energy in order to meet their requirements for essential fatty acids. Absorption of fat-soluble vitamins is also limited when fat intake is low. The nutritional status of women is directly related to that of their children as low energy intake and micronutrient deficiencies can lead to increased morbidity and mortality of both mother and child.

For young children, fat should exceed 30% of energy intake. While adequate energy and macronutrient intake is essential for fetal and child growth. Poor growth in childhood has far

reaching effects ranging from lower productivity to an increased risk of obstructed labor related to stunting.

Table 2 Macronutrient distribution in the Cambodian diet vs. recommendations (as a % of total energy intake)

Macronutrient	Cambodia	Recommended Range: Women	Recommended Range: Children
Carbohydrates	76%	45-65%	45-65%
Protein	10%	10-35%	10-30%
Fat	14%	20-35%	30-40%

Source: FAO, 2012

1.2. Study Scope

The 2011 Cambodia household food consumption survey focuses on household food consumption and other indicators of food security undertaken in each ecological zone covering all provinces of Cambodia. The nationally representative sample survey of 1,200 households aged 0 to 60+ years. The primary purpose of the survey is to access the current food consumption situation and energy and nutrient intake of individuals and households of Cambodian. The secondary purpose is to assess the relative contribution made by each major category of fish species (*blackfish, greyfish, and whitefish*) and OAA to food and nutrition security in Cambodia-this survey meant to contritbute to an overall analysis of the impact of main stream dams on nutrition in Cambodia, especially the likely scenario of reduced access to white fish species.

The information is vital for policymakers and planner with data/information on food consumption and energy and nutrient intake of individuals and households by national, ecological zones, urban and rural, gender, and age group including pregnant women.

The limitation of the study

The study was conducted in rainy season from 14 August to 24 September 2011, it should be influenced to the result of the fish consumption in dry season due to most of the inland fishing occurs in the dry season and this is when fish is most available. Thus, the further study is needed.

Cambodia does not have own Food Composition Table, the Vietnam, Thai, ASEAN and Philippine Food Composition Table were utilized to determine the nutrient content of food items consumed and the Recommended Energy and Nutrient Intakes (RENI) to determine the level of nutritional adequacy of food intakes.

Cambodia also does not have own Mixed Dishes Food Composition Table, thus in this survey all mixed dishes food items that household bought from outside (restaurant/market, etc.) we combined in miscellaneous food.

1.3. Sampling design

The national survey concerns Cambodian food consumption and nutrition survey 2011, based on a random sample of 1,200 households selected from the population of Cambodia. The data collection was done using face-to-face interview method.

The survey was done taking into consideration the five zones of the country namely Phnom Penh, Coastal, Plain, Plateau/Mountain, Tonle Sap. Villages in each zone were classified as either urban or rural.

The provinces composing each of the ecological zones as below:

- Phnom Penh (Phnom Penh);
- Plains (Kandal, Kampong Cham, Prey Veng, Svay Rieng, Takeo Provinces);
- Tonle Sap (Banteay Meanchey, Battambang, Pursat, Kampong Chhnang, Kampong Thom, and Siem Reap Provinces);
- Plateau/Mountains (Kampong Speu, Kratie, Pailin, Mondul Kiri, Otdor Meanchey, Preah Vihear, Ratanak Kiri, and Stung Treng Provinces); and
- Coastal (Kep, Preah Sihanuk, Koh Kong, and Kampot Provinces).

Survey was employed the 2 stage cluster sampling design. Representative samples were selected in two stages with villages in the first stage and households in the second stage. In the first stage, villages (also known as clusters or enumeration areas) were selected with probability proportional to the village size. The village size represents the number of households residing in the village. Complete mapping and listing of all households existing in the selected villages were obtained from the villages before the start of the actual survey.

The resulting lists of household served as the sampling frame for the second stage of sample selection. Households were systematically selected from the lists for participation in the survey. (See detail in Appendix A and B)

1.4. Training and Survey Organization

The overall objective of the training aimed to educate the 18 of survey experts and enumerators of data collection for the 2011 Cambodia food consumption survey. The Training was held from 3-9 August, 2011 at Inland Fisheries Research and Development Institute, Fisheries Administration, Ministry of Agriculture, Forestry and Fisheries.

The specific objectives of the training course are:

- Educate the interviewers how to conduct dietary assessment by using the 24 hour food recall questionnaire and food frequency questionnaire, and food insecurity questionnaire;
- Educate the interviewers to get familiar with fish species;
- Reinforce the recall interviewers with exercise practices and pilot testing; and
- Educate the interviewers to be familiar with questionnaire before data entry was employed

Pretest Questionnaire

The objective of pilot pretest questionnaire was to identify the potential problems which were impossible to encounter and check such as:

- The respondents are willing and able to answer the question in the way interviewers ask
- No questions are difficult to answer
- The questions are understood by respondents
- The respondents have the same understanding of the questions that interviewers have,
- Questions and recall form are designed with adequate space for responses, etc.

The pretest questionnaire was conducted in day 5 of training workload at outskirts of Phnom Penh City. The individual interviewer was assigned to carry out one household to be interview. Before actual filed work, letters to the village authorities informing them of the conduct of the survey were sent at least 1 week before the actual survey. The survey staff (2 food and nutrition experts, 2 logistics coordinator from NIS, and 18 field enumerators) were fielded 1 day before the first day of the interview to tend to preparatory tasks like discussing with village authorities, filling in the household listing form and thereafter sample those households to be interviewed.

A total of 18 trained interviewers recruited from the Fisheries Administration and National Institute of Statistics of Cambodia made up the survey teams. They were divided into six teams of three members. One member (preferably from NIS) in each team acted as survey team leader.

Each team worked in the field with a daily workload of three households per interviewer. Questionnaires were cross-checked by the members of the team for any missing pieces of information followed by data entry. Per ecological zone, the field work for all teams was completed within 7 days. One day travel was allotted to travel to the next ecological zone.

For the household, a face-to-face interview with the mother (who usually prepares the food) was interviewed using the food frequency and the food security questionnaires. All individual members of the household were also interviewed (face-to-face) using the 24-hour food recall questionnaire. Data collection started from 14 August 2011 to 24 September, 2011.(Appendix C).

1.5. Data Processing

The 18 interviewers were assigned for data entry by their own personal computers. They were trained two weeks after all interviews were conducted. Questionnaires were collected by the team leader and submit them to the food and nutrition experts. The training was trained by national database expert and began on 15 October, 2012. Data processing included one national database expert, one national nutrition expert, one field coordinator, 18 data entry. Questionnaires data were entered at IFReDI, FiA by using ACCESS database program. Data entry was completed on 15 November 2012. Data entry was also cross-checked by members of the team. The secondary checking and editing by national database expert; international and national nutrition expert; and project leader were completed on 6 February, 2012.

OPERATIONAL DEFINITION OF TREMS

Nutrition- The science of food and the nutrient and other substances they contain, and of their actions within the body (including digestion, absorption, transport, metabolism, and excretion).

Nutrients- Chemical substances obtained from food and used in the body to provide energy, structural materials, and regulating agents to support growth, maintenance, and repair's the body's tissue. Nutrients may also reduce the risk of some diseases.

Diet- Foods and beverages a people eat and drink.

Energy-yielding food/nutrients- the nutrients that breakdown to yield energy the body can use: Carbohydrate, Fat and Protein.

As Purchased (AP) - is the form of food as sold in the market or picked from garden, and includes peelings, bones, shells and other inedible parts.

Per Capita Food/Nutrient Intake - is the average amount of food and nutrient eaten by each member of the sample population, without consideration of age, sex, and physiological status.

miscellaneouse foods including spices, condiments, dessert, beverage and mixed dishes.

Mixed Sishes: all mixed dishes food items that household or individuals bought or ate from outside the house (restuarant, market, relative house, etc) for example fish porride, pork porride, soup,..and so on.

Estimated Average Requirement (EAR) - is used to estimate the prevalence of inadequate intake within a population group.

Recommended Energy and Nutrient Intakes for Filipinos (RENI, 2002)- the revised edition from the Recommented Dietary Allowance (RDA) of the Philippines)- is a nutrient-based dietary standard recognized in the nutrition and health community as the source of information on recommended intakes of energy and nutrient for the maintenance of good health. It aims to maintain health and prevent deficiency in 97.5% of apparently healthy Filipinos. (The survey used RENI because Cambodia does not have RDA for Cambodian)

Table A. The Recommended Energy and Nutrient Intake per day by age group

Population Group	Weight (kg)	Energy (Kcal)	Protein (g)	Iron (mg)
Infants, months				
Birth-< 6	6	560	9	0.38
6-<12	9	720	14	10
Children, years				
1-3	13	1070	28	8
4-6	19	1410	38	9
7-9	24	1600	43	11
Males, years				
10-12	34	2140	54	13
13-15	50	2800	71	20
16-18	58	2840	73	14
19-29	59	2490	67	12
30-49	59	2442	67	12
50-64	59	2170	67	12
65+	59	1890	67	12

Females, year				
10-12	35	1920	49	19
13-15	49	2250	63	21
16-18	50	2050	59	27
19-29	51	1860	58	27
30-49	51	1810	58	27
50-64	51	1820	58	27
65+	51	1410	58	10
Pregnant women				
Trimester				
First		66		27
Second	+300	66		34
Third	+300	66		38
Lactating Women				
1st 6 months	+500	105		27
2nd 6 months	+500	105		30

Desirable Contribution of Carbohydrate, Fats and Protein to Total Dietary Energy

Carbohydrate	55-70%
Fats and fatty acids	30-40 for infants
	20-30% for all others
Protein 10-15	10-15 %

Population Groupings- The population groups essentially follow the (FAO/WHO, 200) groupings, and consistent with the international Reference Standard (IRS) for growth.

Recommended Dietary Allowances (RDA) - The average daily amount of a nutrient considered adequate to meet the known nutrient needs of the practically all healthy people; a goal for dietary intake by the individual.

Dietary Evaluation- Vietnam, Thai, ASEAN and Philippine Food Composition Table were utilized to determine the nutrient content of food items consumed and the Recommended Energy and Nutrient Intakes (RENI) to determine the level of nutritional adequacy of food intakes. This will be computed using this formula:

$$\textbf{Adequacy} = \frac{\text{total energy/nutrient intake}}{\text{RENI values for energy/nutrient}} \times 100\%$$

White fish species- The River fish (long distant migratory fish). These species include *Pangasius pangasius, Pseudolais micronemus, Pangasianodon hypophthalmus, Puntioplites waandersi, Henicorhynchus siamensis, etc.*

Grey fish species- Short distant migratory fish. These species include *Puntioplites falcifer, Barbonymus gonionotus, Hampala dispar, Hampala macrolepidota, etc.*

Black fish species- The resident and floodplain fish. These species include *Channa strata* , *Clarias batrachus* , *Clarias macrocephalus, Trichogaster trichopterus, Trichogaster pectoralis, Anabas testudineus, etc*

OAAs (inland)- including crab, shrimp, clams, etc.
OAAs (marine)- including crab, shrimp, clams, etc
Aquaculture fish: Tilapia, pangasuis

II. SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTIC

A. Household Characteristics

Table 3 Percentage Distribution of Households by House Ownership, Type, and Land Ownership

Characteristics	Percent
House Ownership	
Owned	95.4
Rented	2.9
Others	1.7
Total	**100**
Type of House	
Wooden	71.24
Concrete	22.06
Leaf	5.5
Other	1.2
Total	**100**
Type of House	
One-Story	88.4
Two-Story	9.8
Three-Story	0.4
Other	1.4
Total	**100**
Residence	
Permanent	97.8
Migrant	2.2
Total	100.0
Land Ownership	
Owned	93.2
leased	6.8
Total	100.0

The type of the material used for the house is one of indicators for the impression of the wealth at the first glance. Nearly all (95.4%), table 3, of the sample households owned the house. Majority (71%) of the respondents made up their houses from wooden, while about one-fourth (22%) made up from concrete and only 5.5% used leaf as materials to made up their house. Majority (88%) of the respondents, have one-story houses, while around 10% has two-story houses. Nearly all (98%) of the respondents lives as permanent houses, only few (2%) lives as temporary houses. This is as indication of the poor economic condition of the Cambodian people as a result of the civil war. Nearly all 93% of the respondents owned land for housing. While only about 7 percent leased.

Table 4 Percentage Distribution of Households by Household Size

Number of Household Members	Percent
1	1.02
2	11.1
3	20.8
4	28.2
5	20.9
>5	17.8
Total	100.0
Min	1
Max	10
Mean	4.2
Median	4
Mode	4
Standard Deviation	1.5

The average family size of respondent was more than 4 members. About 28 percent of the interviewed households have 4 members, while households have 3 and 5 member were founded to be at 21% (table 4).

Table 5 Percentage Distribution of Households by Assets

Household Assets	Percent
Radio	56.7
Television	80.2
Cell phone	78.2
Bicycle	72.4
Motorbike	68.0
Car, Taxi	5.7
Sewing Machine	8.0
Battery of Lighting	26.2
Cart	10.9
Plough	14.2
Hand Tractor	6.6
Thresher	0.3
Rice Mill	2.8
Water Pump	7.3
Cash Savings	34.3
Jewelry	54.1
Others (Computer, Cows, Ship fishing)	1.9

Among the appliances that are most acquired by households television ranked highest (80%), followed cell phone (78%) and bicycle and motorbike accounted for 72% and 68%, respectively. The last priority appliance was thresher (0.3%) (table 5).

Table 6 Percentage Distribution of Household by Food Source by Residency

Food Source	Percent
Purchased (Market)	96.8
Traded (Market)	0.3
Own Production	21.6
Fishing/Hunting	15.4
Others	0.3

Up to 97% of households purchased food from market as food, while own food production and fishing/hunting accounted for about 22% and 15%, respectively (table 6).

Table 7 Percentage Distribution of Households In terms of whether there are pregnant and lactating 15%, mothers in the family

	Percent
Pregnant	
Yes	5.8
No	94.2
Total	100.0
Pregnancy (month)	
1-3	39.8
4-5	41.3
6-9	18.9
Total	100.0
Lactating in the Family	
Yes	91.3
No	8.7
Total	100.0

Nearly all 94% of households had no pregnant women. Only few households (6%) had pregnant women in family, of which pregnancy from 4 to 5 months founded to be at 41%, 1-3 months at 40% and 6-9 months at 19% (Table 7).

B. Household Member Characteristics

Table 8 Percentage Distribution of Household Members by Educational Attainment

Educational Attainment	Percent
Did not attend school	18.3
Finished primary school	28.9
Finished secondary school	24.5
Finished high school	9.2
Finished college/university	2.7
Finished vocational/technical	0.5
Attended any of the above but did not finish	14.7
Other	1.2
Total	100.0

The Cambodian educational system, grades seven to nine are classified as secondary level, while grades 10 to 12 are classified as high school. Nearly (29%) of the respondents of the household members completed primary school and secondary level of education around (25%). Only 9

percent and 3% reached high school and college/university, respectively. While about 18% had no formal schooling (Table 8).

Table 9 Percentage Distribution of Household Members by Source of income

Source Income	Percent
No source of income	12.9
Agricultural	22.7
Professional	21.5
Service and Sales Workers	25.7
Craft and related works	9.3
Other	7.9
Total	100.0

More than one-fourth (26%) of the household members derived income from service and sale workers, followed by agricultural field (farming, forest and fishery) accounted for about 23% and around 22% generated income from professional worker (salary). Up to around 13% had no income (Table 9).

Table 10 Percentage Distribution of Household Members by Age group

Age (in year)	Percent
<5	2.1
6-10	3.2
11-19	10.3
20-30	24.9
31-40	17.0
41-50	21.4
51-60	13.8
61-70	5.9
71-80	1.3
81-90	0.1
Total	100.0
Mix	0
Max	85
Mean	36.57
Median	36
Mode	32
Standard Deviation	16.27

About one-fourth (25%) of the household members belonged to the young age category (20 - 30 years old). A small percentage (6%) was more than 65 years old. The average age was 37 years. This shows that the manpower resource in the country is relatively younger. They are the new generation as a result of the effects of war. The social structure in terms of age is similar to a pyramid in which the base is made up of young, active, and responsible population where majority are women (Table 10).

III. AN INDIVIDUAL FOOD CONSUMPTION

3.1 Food Consumption

3.1.1. National Food Consumption

The 2011 Food Consumption Survey revealed that the average Cambodian diet is basically rice-vegetable-fish combination (Figure 1.) In term of weight, the total mean one day per capita food consumption is 936.5 grams per day, in raw as purchased form (Table 11). The highly consumed food was *cereal and cereal products* at 386.07 grams (39.30 % of the total food intake), contributing to more than 1/3 of the total food intake. Intake of *fish and fish products was* at 172.53 grams (18. 42 % of the total food intake). *Vegetables* were the third top food items commonly consumed by Cambodian people at 113.78 grams (12.15 % of the total food intake) per capita per day. There was also a high consumption of miscellaneous food which included spices, condiments, beverages and mixed dishes at 125.94 grams (13.45 % of the total food intake). Among all food groups, *fats and oils* were the least consumed at 5.03 grams, included mostly vegetable oil or cooking oil, which comprising 0.54 % of the total food intake. The rest of food groups are meat and meat products; Poultry; Egg; Fruits; Fats and Oils; Sugar and Syrups; Dried Beans, Nuts, and Seeds; and Starch Roots and Tubers were also consumed by Cambodian people as shown in (Figure 1 and Table 11).

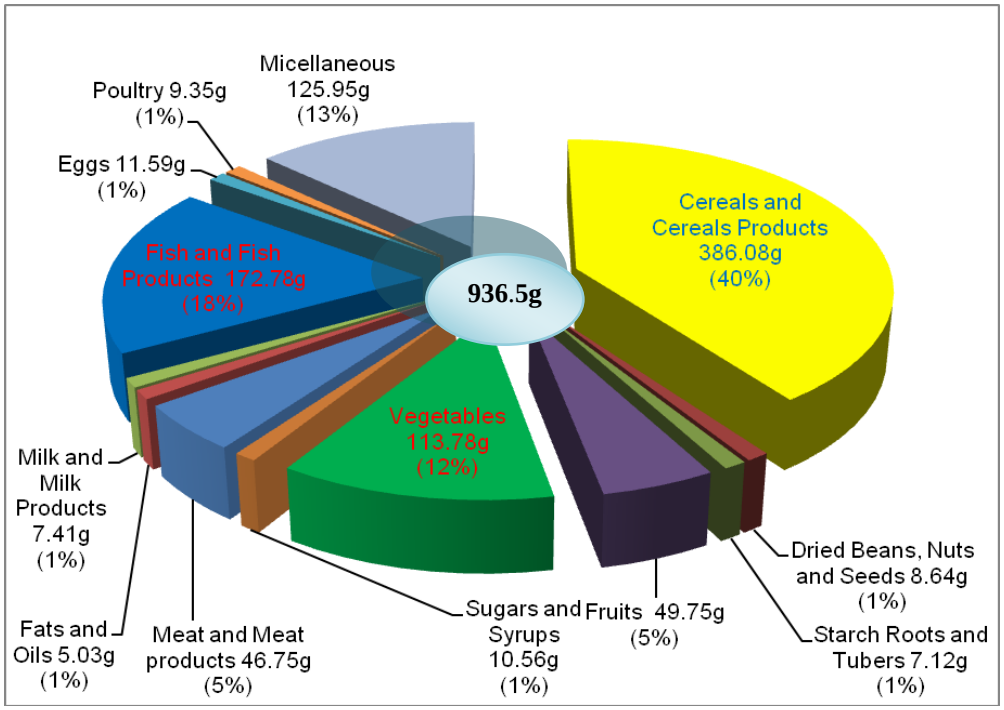


Figure 1 Mean one-day per capita food intake by food groups: Cambodia, 2011

Table 11 Mean one-day per capita food consumption, standard error, confidence interval, coefficient of variation and percent of total intake: Cambodia, 2011†

Food Group/Sub-group	Mean	Std. Error	95% Confidence Interval		%CV	% of Total Food Intake
			Lower Limit	Upper Limit		
ENERGY-GIVING FOODS						
Cereals and Cereal Products	386.07	0.062	367.94	368.19	0.02	39.30
Sugars and Syrups	10.56	0.011	10.53	10.58	0.11	1.13
Fats and Oils	5.03	0.006	5.01	5.04	0.12	0.54
BODY-BUILDING FOODS						
Meat and Meat Products	191.55	0.202	191.15	191.94	0.11	4.95
Poultry	9.35	0.012	9.32	9.37	0.13	1.00
Eggs	11.59	0.008	11.57	11.61	0.07	1.24
Milk and Milk Products	29.97	0.077	29.81	30.12	0.26	0.77
Dried Beans, Nuts and Seeds	8.64	0.015	8.61	8.66	0.17	0.92
REGULATING FOOD						
Vegetables	113.78	0.034	113.71	113.85	0.03	12.15
Fruits	49.75	0.034	49.68	49.82	0.07	5.31
Miscellaneous‡	125.94	0.069	125.80	126.07	0.05	13.45
All Foods	936.50					100.0

†*Numbers may not add up to totals as these are rounded off.*
‡*Includes spices, condiments, dessert, beverages and mixed dishes.*

3.1.2. National Fish Consumption

Total fish consumption per capita consumed by Cambodian people founded 172.5 grams per day, in raw as purchased, accounting for 16.32 % of the total food intake and was consumed more, next to rice, than any other food items (Table 12). *Inland fish* was consumed more than the marine fish. *Inland fish* which included blackfish, whitefish and grayfish, aquaculture fish and other inland aquatic animals (OAAs) was consumed at 124.94 g or 13.34 % of the total food intake and three-fourth (72.42 %) of the total fish consumed while m*arine* and *other marine aquatic animals (OAAs)* were consumed at 44.48 grams or 4.75 % of the total food intake and only one-fourth (25.78 %) of the total fish intake (Table 12).

Of the inland fish, *blackfish* was consumed more at 51.50 grams which was 5.50 % of the food intake and 29.85 % of the total fish intake followed by *whitefish* (42.51 g), *grayfish* (16.45 grams) and *aquaculture fish* (3.67 grams). *Blackfish* was even consumed more than marine fish. *Aquaculture fish* was the least consumed at 3.67grams which is 0.39% of the food intake and 2.13% of the total fish intake. Intake of inland OAAs was even higher than intake of aquaculture fish at 10.81 grams. *Other aquatic animals* both marine and inland which includes edible insects, shrimps, clams, water birds and frogs were consumed at 13.92 grams or 1.48 % of the total food intake and 8.07 % of the total fish intake. The overall per capita consumption of blackfish was relatively higher than other fish categories- white fish and grey fish due to availability and affordability of individual by ecological zone and areas. The Tonle Sap showed the highest consumption of black fish due to near or located in fish sources (availability). Phnom Penh zone and urban area also showed the high per capita consummation of this particular this species due to the high income population group which they can afford to their preferences (acceptability). Another possibility they consume white fish as processed form like fish sauce, fish paste, fermented fish or/and smoked fish.

Table 12 Mean one-day per capita fish consumption, standard error, and confidence interval, coefficient of variation and percent of total intake: Cambodia, 2011

Food Group/ Sub-group	Mean	Std. Error	95% Confidence Interval		%CV	% of Total Food Intake	% of Total Fish Intake
			Lower Limit	Upper Limit			
Fish and Fish Products	172.53	0.040	172.45	172.61	0.02	18.42	
Inland	124.94	0.036	123.93	12.01	0.03	13.34	72.42
Blackfish	*51.50*	0.034	51.44	51.57	0.07	*5.50*	*29.85*
Whitefish	*42.51*	0.030	42.45	42.57	0.07	*4.54*	*24.64*
Greyfish	*16.45*	0.016	16.41	16.48	0.10	*1.76*	*9.53*
Aquaculture	*3.67*	0.007	3.67	3.70	0.20	*0.39*	*2.13*
OAAs Inland	*10.81*	0.011	10.78	10.83	0.10	*1.15*	*6.27*
Marine	44.48	0.032	44.42	44.55	0.07	4.75	*25.78*
OAAs Marine	*3.11*	0.009	3.09	3.12	0.28	*0.33*	*1.80*

3.1.3. Individual Food Consumption by Ecological Zone

Across ecological zones, rice-fish-vegetable combination remained as the typical diet among the Cambodian population. Coastal area showed highest food intake at1423 grams, followed by Phnom Penh at 1008.5 grams, Tonle Sap area at 930.5 grams, Mountain and Plateau area at 922.6 grams while lowest food intake was observed in plain area at 839.8 grams per day. Intake of cereals and cereal products, predominantly rice, was high in the coastal area at 465.9 grams followed by mountain and plateau area at 388.2 grams per day. Phnom Penh, Plain and Tonle Sap areas showed almost similar consumption within the range of 353.9 to 354.3 grams per day. Starch roots and tubers which was one of the least consumed food groups was eaten high in the coastal area at 17.3 grams while the Tonle Sap and Phnom Penh areas showed lowest consumption at 4.8 and 4.9 grams per day, respectively (Table 3). It reflects to access to food in term of local food availability, food affordability among ecological zones. Family size, food distribution among the household members are also among the indicator influence to food consumption pattern of individuals.

Table 13 Mean one-day per capita food consumption, standard error and % of food to total intake by ecological zone: Cambodia, 2011†

Food Group/ Sub-group	Ecological Zone														
	PHN			Mountains and Plateaus			Plains			Coastal			Tonle Sap		
	g/day‡	SE	%	g/day‡	SE	%	g/day‡	SE	%	g/day‡	SE	%	g/day‡	SE	%
ENERGY-GIVING FOODS															
Cereals and Cereal Products	354.2	0.232	35.1	388.2	0.128	42.1	353.8	0.084	42.1	465.9	0.394	32.7	353.9	0.110	38.0
Starchy Roots and Tubers	4.8	0.024	0.5	9.5	0.027	1.0	6.2	0.013	0.7	17.3	0.084	1.2	4.9	0.015	0.5
Sugars and Syrups	11.5	0.037	1.1	14.3	0.033	1.5	8.4	0.013	1.0	15.3	0.065	1.1	9.5	0.020	1.0
Fats and Oils	4.7	0.009	0.5	3.8	0.007	0.4	3.6	0.005	0.4	16.9	0.059	1.2	4.8	0.014	0.5
BODY-BUILDING FOODS															
Meat and Meat Products	60.0	0.083	6.0	49.6	0.064	5.4	34.6	0.033	4.1	53.0	0.107	3.7	56.3	0.057	6.1
Poultry	19.8	0.054	2.0	11.7	0.031	1.3	6.4	0.016	0.8	20.9	0.082	1.5	4.9	0.014	0.5
Eggs	20.6	0.049	2.0	10.0	0.015	1.1	10.3	0.010	1.2	11.5	0.036	0.8	11.3	0.014	1.2
Milk and Milk Products	10.7	0.083	1.1	9.6	0.041	1.0	3.5	0.014	0.4	9.8	0.057	0.7	9.9	0.033	1.1
Dried Beans, Nuts and Seeds	5.5	0.019	0.5	13.7	0.047	1.5	7.1	0.021	0.8	6.5	0.050	0.5	9.2	0.029	1.0
REGULATING FOODS															
Vegetables	132.1	0.142	13.1	103.5	0.066	11.2	109.9	0.051	13.1	134.6	0.166	9.5	114.1	0.062	12.3
Fruits	61.8	0.145	6.1	48.5	0.071	5.3	35.1	0.037	4.2	70.9	0.148	5.0	62.4	0.084	6.7
Miscellaneous††	165.5	0.261	16.4	117.2	0.136	12.7	99.4	0.081	11.8	352.8	0.548	24.8	94.3	0.099	10.1
All Foods	1008.5		100	922.6		100	839.8		100	1423		100	930.5		100

†*Numbers may not add up to totals as these are rounded off; SE – Standard Error*
††*Includes spices, condiments, dessert, beverages and mixed dishes*
‡ *As purchased weight*

Phnom Penh and Coastal areas showed almost similar high intake of *vegetables* 132.1 and 134.6 grams per day, respectively. Lower intake of vegetables was observed in the plain, mountain and plateau areas. The lowest intake of *vegetables* was in the mountain and plateau areas at 103.5 grams per day. Coastal, Tonle Sap and Phnom Penh had relatively higher consumption of *fruits* at 70.9, 62.4 and 61.8 grams per capita per day, respectively. Lower intakes of *fruits* were in plain, mountain and plateau ecological zones at 35.1 and 48.5 grams per capita per day, respectively. National knowledge, education attainment level, income generation of individuals and again local food availability are of among the best indicator reflecting to food intake.

Fish and fish products were generally eaten more than either any of the body building foods such as meat or poultry in all ecological zones. Higher consumption of *fi*sh was observed in the coastal area at 247.5 grams and Tonle Sap area at 194.5 grams per day possibly due to near proximity to fish sources. Lower *fish* consumption was observed in Phnom Penh and Plain areas at 157.2 and 161.5 grams per capita per day, respectively. Lowest consumption was observed in the mountain and plateau at 143. 2 g per day being more a land lock area than coastal and Tonle Sap ecological zones (table 14).

Poultry was consumed higher in Phnom Penh at 19.8 and coastal at 20.9 grams per capita per day. Lower intake was in mountain and plateau at 11.7 grams per capita per day. *Poultry* was consumed least in Tonle Sap at 4.9 grams per capita per day. *Eggs* were highly consumed in Phnom Penh at 20.6 g per capita per day while the rest of the ecological zones similarly consumed eggs at a lesser amount from 11.3 to 10 grams per capita per day. *Meat and meat products* were also consumed high in Phnom Penh followed by Tonle Sap at 60 and 56.3 grams per capita per day, respectively. Meat intake in the coastal at 53.0 g did not vary much from meat intake in Tonle Sap. Lowest intake was in the plain at 34.6 g per capita per day.

Regardless of ecological zones, *sugars and syrups* remained to be consumed in lower amounts from 15.3 in the coastal area to 8.4 grams per capita per day in plain area. Coastal, mountain and plateau and Phnom Penh ecological zones had almost similar intakes as well as that of plain and Tonle Sap. *Milk and milk products* were consumed in the same amount in Tonle Sap, coastal, Phnom Penh, mountain and plateau at 9.6 to 10.7 grams per capita per day. *Milk* was least consumed in the plain area at 3.5 g per capita per day.

Dried beans, nuts, seeds, fats and oils continued to be consumed least. Higher intake of *fats and oils* was in the coastal area at 16.9 g per capita per day while Phnom Penh, mountain and plateau, plain and Tonle Sap had almost similar intakes from 4.8 to 3.6 grams per capita per day. *Dried beans, nuts and seeds* were consumed more in the mountain and plateau at 13.7 grams per capita per day while consumption in the rest of the ecological zones was from 9.2 to 5.5 grams per capita per day.

3.1.4. Individual Fish Consumption by Ecological Zones

Consumption of inland *fish* including OAAs remained higher than consumption of marine fish across ecological zones except for the coastal area. Highest consumption founded in Tonle Sap at 147.9 grams while lowest was in the mountain and plateau at 89.4 grams per capita per day. The lower consumption in the mountain and plateau could be due to the fact that it is relatively far from Tonle Sap Lake which is the main source of inland fish. Consumption was similar in

Phnom Penh and coastal at 104 and 105.1 g per capita per day, respectively. High consumption was also observed in plains at 134.6 grams per capita per day.

Blackfish was consumed more in Tonle Sap, Coastal and Phnom Penh at 77.2, 60.1 and 45.2 grams per capita per day, respectively than either whitefish or grayfish while *whitefish* was consumed more in the plain, mountain and plateau at 58.5 and 32.7 grams per capita per day, respectively, than either blackfish or grayfish. Aquaculture fish remained to be consumed least across ecological zones. Consumption of OAAs was even higher than the consumption of aquaculture except in Phnom Penh. Is this because black fish are eaten fresh or whole whereas white fish are often processed. It can be said that Mountain areas or areas away from water bodies; and instead they consumed processed fish such as dried fish, prahoc or other forms of processed fish. If we are only looking at purchase weight then we may be biasing more towards black fish as they are more often eaten fresh as opposed to white fish that are more likely eaten processed.

Marine fish was consumed more in the coastal area at 134.8 grams followed by mountain and plateau at 51.8 grams per capita per day. Phnom Penh and Tonle Sap showed almost similar consumption at 48.4 grams and 41.8 grams per capita peer day, respectively. Lowest intake of *marine fish* is the plain at 25.4 grams per capita per day. The marine fish consummation in mountain or plateau area was relatively high; it is possibility due to such food items imported from Thailand in such provinces located along the Cambodia-Thai border. And again purchasing power is one of the influence indicator accesses to this kind of food items especially in the larger town in such Phnom Penh, Battambeng and Seam Reap.

Table 14 Mean one-day per capita fish consumption, standard error and % of food to total intake by ecozone: Cambodia, 2011

Food Group/ Sub-group	Ecological Zone														
	PHN			Mountains and Plateaus			Plains			Coastal			Tonle Sap		
	g/day†	SE	%	g/day†	SE	%	g/day†	SE	%	g/day†	SE	%	g/day†	SE	%
Fish and Fish Products	157.2	0.910	15.6	143.2	0.075	15.4	161.5	0.060	19.3	247.5	0.300	17.39	194.2	0.091	20.9
Inland	104	0.900	10.3	89.4	0.071	9.6	134.6	0.058	16.1	105.1	0.250	73.9	147.9	0.090	15.9
Blackfish	45.2	0.083	4.5	30.3	0.041	3.3	44.3	0.053	5.3	60.1	0.113	4.22	77.2	0.089	8.3
Whitefish	33.0	0.072	3.3	32.7	0.061	3.5	58.5	0.057	7.0	20.0	0.142	1.41	35.0	0.045	3.8
Greyfish	13.0	0.046	1.3	9.5	0.029	1.0	14.3	0.021	1.7	11.3	0.045	0.79	27.3	0.042	2.9
Aquaculture	7.4	0.041	0.7	2.2	0.015	0.2	6.1	0.013	0.7	1.1	0.011	0.08	0.4	0.004	0.04
OAAs Inland	5.4	0.035	0.5	14.7	0.027	1.6	11.4	0.015	1.4	12.6	0.065	0.89	8.7	0.021	0.9
Marine	48.4	0.089	4.8	51.8	0.070	5.6	25.4	0.023	3.0	134.8	0.208	9.47	41.8	0.082	4.5
OAAs Marine	4.8	0.057	0.5	2.0	0.016	0.2	1.5	0.005	0.2	7.6	0.037	0.53	4.5	0.020	0.5

†*As Purchased Weight*

3.1.5. INDIVIDUAL FOOD CONSUMPTION by Urbanity

The total mean food intake per capita per day, as purchased, in the urban and rural areas are 962.27 grams and 909 grams, respectively (Table 15). The rice-fish-vegetable combination remained as the typical diet among Cambodians in the urban and rural areas. Energy giving foods such as *cereal and cereal products, starchy roots and tubers* were eaten more in the rural area at 398.5 grams than in the urban area at 352.82 grams while *sugars, syrups, fats and oil* were eaten more in the urban area at 13.33 grams than in the rural area at 17.75 grams per capita per day. Body building foods such as *fish, fish products, meat, meat products, eggs, milk and milk products, dried beans, nuts and seeds* were eaten more in the urban area at 284.24 grams than in the rural area at 227.05 grams per capita per day. Body regulating foods which are good sources of vitamins and minerals such as *fruits* were consumed higher in the rural area at 51.57 grams than in the urban area at 48.01 grams per capita per day while *vegetables* were similarly consumed at 114.31 grams in the rural area and 113.27 grams in the urban area. It can draw that the affordability and availability to food items are the best indicator to food intake among the two areas rural and urban.

Table 15 Mean one-day per capita food consumption, standard error and % of food to total intake by urbanity: Cambodia, 2011†

Food Group/Sub-group	Urbanity					
	Rural			Urban		
	g/day‡	Std Error	%	g/day‡	Std Error	%
ENERGY-GIVING FOODS						
Cereal and Cereal Products	391.31	0.092	43.02	345.76	0.082	35.93
Starchy Roots and Tubers	7.19	0.013	0.79	7.06	0.016	0.73
Sugars and Syrups	8.72	0.013	0.96	12.32	0.018	1.28
Fats and Oils	4.61	0.009	0.51	5.43	0.009	0.56
BODY-BUILDING FOODS						
Meat and Meat Products	31.26	0.027	3.44	61.61	0.041	6.40
Poultry	9.80	0.017	1.08	8.91	0.017	0.93
Eggs	9.03	0.009	0.99	14.04	0.014	1.46
Milk and Milk Products	3.01	0.011	0.33	11.64	0.028	1.21
Dried Beans, Nuts and Seeds	9.90	0.023	1.09	7.42	0.018	0.77
REGULATING FOODS						
Vegetables	114.31	0.048	12.57	113.27	0.047	11.77
Fruits	51.57	0.048	5.67	48.01	0.048	4.99
Miscellaneous††	104.88	0.094	11.53	146.15	0.101	15.19
All Foods	909.65		100.00	962.27		100.00

†*Numbers may not add up to totals as these are rounded off; SE – standard error*
††*Includes spices, condiments, dessert, beverages and mixed dishes.*
‡ *As Purchased Weight*

3.1.6. Individual Fish Consumption by Ecological Zone

Consumption of *fish* in the urban area is 180.66 grams and in the rural area is 164.05 grams per capita per day. Consumption of *inland fish* including *aquaculture fish* and *OAAs* was slightly higher in the rural area at 127.24 grams than in the urban area at 122.73 grams per capita per day. Consumption of *marine fish* in the urban area was high at 52.96 grams while marine fish in the rural area was much lower at 35.65 grams per capita per day. The people living in urban can

meet their demand at market while people living in rural area can access to marine fish by fishing Consumption of blackfish was higher between and within urbanity. *Aquaculture fish* was the least consumed among inland fish in either the rural or urban areas at 2.87 grams and 4.47 grams per capita per day, respectively. More aquaculture fish was consumed in the urban area than in the rural area. It can also be observed that inland *OAAs* were eaten more than aquaculture fish and more were eaten in rural area at 13.79 grams than in the urban area at 7.93 grams per capita per day. The food preferences, perception of people are the factors reflected to food consumption pattern of individual among or within the ecological zones. This suggests that the whole concept of replacing locally caught native fish species with aquaculture species grown in artificial reservoirs behind dams is not going to work unless there is a major change in attitude and practice.

Table 16 Mean one-day per capita fish consumption, standard error and % of fish to total intake by urbanity: Cambodia, 2011

Food Group/ Sub-group	Urbanity					
	Rural			Urban		
	g/day†	Std Error	%	g/day†	Std Error	%
Fish and Fish Products	164.05	0.060	18.04	180.66	0.070	18.76
Inland	127.24	0.050	13.99	122.73	0.060	12.74
Blackfish	*49.13*	*0.046*	*5.40*	*53.78*	*0.051*	*5.59*
Whitefish	*44.95*	*0.045*	*4.94*	*40.16*	*0.041*	*4.17*
Greyfish	*16.50*	*0.023*	*1.81*	*16.39*	*0.021*	*1.70*
Aquaculture	*2.87*	*0.010*	*0.32*	*4.47*	*0.010*	*0.46*
OAAs Inland	*13.79*	*0.019*	*1.52*	*7.93*	*0.012*	*0.82*
Marine	35.65	0.034	3.92	52.96	0.054	5.50
OAAs Marine	*1.16*	0.005	0.13	*4.97*	0.016	0.52

† *As Purchased Weight*

3.1.8. Individual Food Consumption by Gender

Total mean food intake of male at 1004.05 grams is higher than that of the female population at 880.69 grams per capita per day, as purchased The differences in body mass between man and woman make man needs caloric more than woman in order to meet their body requirement to satisfy and maintain life (Table 7). Energy giving foods such as *cereals, cereal products, starchy roots and tubers, sugars and syrups, fats and oils* were consumed more by the male population at 425.64 grams than by the female population at 361.95 grams per capita per day. *Cereals*, predominantly is rice, was highly consumed by male at 403.61 grams than by the female at 338.69 grams per capita per day. However, energy giving foods such as *sugars and syrups* were consumed slightly higher by female at 11.40 grams than by the male population at 9.53 grams per capita per day.

Body building foods such as *fish, fish products, milk, milk product, meat and meat products, dried beans, nuts and seeds* were also consumed higher by the male at 266.48 grams than by female at 247.82 male grams per capita per day. Almost similar consumption of *egg and poultry* was observed for both and female population at about 21grams per day. For the body regulating foods which contain vitamins and minerals, the male consumed more *vegetables* at 117.51grams

while the female population consumed 110.70 grams per capita per day. The female consumed more *fruits* at 63.38 grams than male population at 51.93 grams per capita per day.

Table 17 Mean one-day per capita food consumption and % of food to total intake by gender: Cambodia, 2011†

Food Group/ Sub-group	Gender					
	Male			Female		
	g/day‡	Std Error	%	g/day‡	Std Error	%
ENERGY-GIVING FOODS						
Cereals and Cereal Products	403.61	0.098	40.20	338.69	0.076	38.46
Starchy Roots and Tubers	7.30	0.017	0.73	6.98	0.013	0.79
Sugars and Syrups	9.53	0.016	0.95	11.40	0.016	1.29
Fats and Oils	5.20	0.009	0.52	4.88	0.008	0.55
BODY-BUILDING FOODS						
Meat and Meat Products	49.89	0.040	4.97	44.15	0.032	5.01
Poultry	9.33	0.018	0.93	9.36	0.0160	1.06
Eggs	11.60	0.013	1.16	11.58	0.011	1.32
Milk and Milk Products	8.46	0.023	0.84	6.54	0.021	0.74
Dried Beans, Nuts and Seeds	6.76	0.015	0.67	10.19	0.023	1.16
REGULATING FOODS						
Vegetables	117.51	0.050	11.70	110.70	0.046	12.57
Fruits	45.47	0.048	4.53	53.29	0.048	6.05
Miscellaneous††	148.95	0.120	14.83	106.92	0.078	12.14
All Foods	1004.05		100.00	880.69		100.00

†*Numbers may not add up to totals as these are rounded off.*
††*Includes spices, condiments, dessert, beverages and mixed dishes.*
‡ *As Purchased Weight*

3.1.9. Individual Fish Consumption by Gender

Male consumed more *fish* at 180.44 grams than female at 166.0 grams per capita per day. *Inland fish* was eaten more than the *marine fish* with the male eating more at 131.09 grams while the female eating at 119.87 grams per day. Among the inland fish, *blackfish* was slightly eaten more by both gender but male was more slightly eaten at 52.24 grams than female at 50.90 grams per capita per day. Regardless of gender, aquaculture fish remained to be eaten low. Consumption of OAAs although low was still higher than the consumption of aquaculture fish (Table 18).

Table 18 Mean one-day per capita fish consumption and % of fish to total intake by gender: Cambodia, 2011

Food Group/ Sub-group	Gender					
	Male			Female		
	g/day†	Std Error	%	g/day†	Std Error	%
Fish and Fish Products	180.44	0.070	17.98	166.0	0.060	18.84
Inland	131.09	0.055	13.06	119.87	0.050	13.61
Blackfish	*52.24*	*0.048*	*5.20*	*50.90*	*0.048*	*5.78*
Whitefish	*46.34*	*0.047*	*4.62*	*39.33*	*0.039*	*4.47*
Greyfish	*17.47*	*0.025*	*1.74*	*15.60*	*0.020*	*1.77*
Aquaculture	*4.10*	*0.012*	*0.41*	*3.34*	*0.009*	*0.38*

OAAs Inland	*10.94*	*0.016*	*1.09*	*10.70*	*0.015*	*1.21*
Marine	46.68	0.052	4.65	42.67	0.040	4.84
OAAs Marine	2.67	0.013	0.27	3.46	0.012	0.39

† *As Purchased Weight*

3.1.10. By Age Group including pregnant women

3.1.10.1. Pre-school Children: 6 months- 5 years old

The mean one-day total food intake of children 6 months to 5 years old weighed 593.6 grams, as purchased (Table 19) consisting largely of 215.1g of *cereal and cereal products* of which rice and rice products were the predominant forms, 97 grams of *fish* and 60.6 g of *vegetables*. Energy giving foods such as rice and body building foods such as milk, fish, meat poultry and egg are food items that are needed most importantly in preschool children's diet to support the fast rate of growth and development. Rice consumed contributed more than one-third of the total food intake. Nearly all (95%) of children over 11 months old reported to have eaten rice (UNICEF/WFP, 1999). This age group's intake of *fish and fish products* was about16 % *while meat and meat products a*t 4.5 %, *poultry and eggs* at 2.4 % of the total food intake. *Milk and milk products* were at 3.5 % of the total food intake. *Fruits and vegetables* amounted to 34.4 and 160.6 grams, respectively, which shared about 5.8 -10.2 % of total food intake. The intake of fats and oils, at 3.1 grams or 0.5% of the total food intake, although low, is important for the transport of fat soluble vitamins especially vitamin A found in animal tissues or beta-carotene, the precursor of vitamin A from the plant tissues.

Preschool children consumed and *fish and fish products* at 97 grams per day with inland *fish* eaten largely at 70.6 grams than *marine fish* at 24.2 grams per day. Among the inland fish, *blackfish* was eaten more by them at 30.8 grams followed by *whitefish* at 23.9 grams. The survey by UNICEF and World Food Program (WFP), 1999 showed that fish is part of daily diet of 74-80% of all children of over 11 months. This strongly evidence could be concluded that fish are play crucial role for daily diet of all age group of Cambodian.

3.1.10.2. School-children: 6-12 years old

The mean one-day total food intake of school-age children 6- 12 years old was 708.7grams in raw as purchased form (Table 19). Energy giving foods such as *cereal and cereal products, starchy roots and tubers, sugars and syrups* were consumed at 301grams which is about 42 % of the total daily food intake.

The foods consumed in greatest amounts among the energy giving foods were *cereals and cereal products,* which amounted to 280.8 grams which was predominantly rice contributing almost 40% to the total food intake in a day.

Total mean intake for body building foods was 183.2 grams contributing to almost one-fourth of the total food intake. *Fish and fish products* were largely consumed at 122.4 grams and sharing almost 17% of the total food intake followed by *poultry, eggs, milk and milk products, dried beans, nuts and seeds* at 67.8 grams. *Poultry* was consumed low at 6.1 grams or 0.9 of the total daily food intake. Drinking of *milk* was not popular for this age group, contributing only about

3% of the total diet. *Dried beans, nuts and seeds* were consumed at 7.0 grams per day which was only 1 % of the daily food intake.

For fish consumption, inland fish was eaten least by the school children at 91.3 grams per day than by other older age groups. *Blackfish and whitefish* consumed at about 34 grams were higher the intake of marine fish at 30.1 grams per day. *Aquaculture* was eaten minimally at 1grams.

Regulating foods were consumed by this group at 127.8 grams or about one-fifth of the total daily food intake. *Vegetables* were consumed at 78.3 grams or about 11 % while *fruits* at 49.5 grams or 7 %.

Table 19 Mean one-day per capita food consumption and % of food to total intake by age group with pregnant women: Cambodia, 2011†

Food Group/ Sub-group	Age Group (years)											
	0-5		6-12		13-19		20-59		60 and above		Pregnant	
	g/day‡	%	g/day‡	%	g/day‡	%	g/day‡	%	g/day‡	%	g/day‡	%
ENERGY-GIVING FOODS												
Cereals and Cereal Products	215.1	36.2	280.8	39.6	378.2	40.6	416.3	39.3	342.9	38.1	413.8	41
Starchy Roots and Tubers	5.8	1	6.3	0.9	7.7	0.8	7.4	0.7	6.6	0.7	14.2	1.4
Sugars and Syrups	17.2	2.9	10	1.4	13.8	1.5	9.6	0.9	5	0.6	8.5	0.8
Fats and Oils	3.1	0.5	3.9	0.6	5.5	0.6	5.7	0.5	3.5	0.4	3	0.3
BODY-BUILDING FOODS												
Fish and Fish Products	97	16.4	122.4	17.1	178.7	19.2	196.2	18.5	171.2	19	190.7	18.9
Inland	70.6	11.9	91.3	12.8	125.7	13.5	142.3	13.4	125.3	13.9	160.9	15.9
Blackfish	*30.8*	*5.2*	*34.3*	*4.8*	*48.5*	*5.2*	*59.7*	*5.6*	*55.8*	*6.2*	*26.4*	*2.6*
Whitefish	*23.9*	*4*	*34.8*	*4.9*	*43.4*	*4.7*	*47.4*	*4.5*	*41.2*	*4.6*	*120.4*	*11.9*
Greyfish	*11.2*	*1.9*	*13.1*	*1.8*	*17.5*	*1.9*	*18.2*	*1.7*	*14.5*	*1.6*	*2*	*0.2*
Aquaculture	*0.6*	*0.1*	*1*	*0.2*	*3.8*	*0.4*	*4.9*	*0.5*	*3.6*	*0.4*	*0*	*0*
OAAs(Inland)	*4.1*	*0.7*	*8.1*	*1.1*	*12.5*	*1.3*	*12.1*	*1.1*	*10.2*	*1.1*	*12.1*	*1.2*
Marine	24.2	4.1	30.1	4.2	47.2	5.1	50.8	4.8	43.9	4.9	29.8	3
OAAs (Marine)	2.2	0.4	1	0.1	5.8	0.6	3.1	0.3	2	0.2	0	0
Meat and Meat Products	26.5	4.5	33.5	4.7	51.6	5.5	52.9	5	40.7	4.5	50.4	5
Poultry	3.6	0.6	6.1	0.9	7.6	0.8	11.4	1.1	11	1.2	19.5	1.9
Eggs	10.4	1.8	9.6	1.4	11.9	1.3	11.8	1.1	14	1.6	6.2	0.6
Milk and Milk Products	20.8	3.5	11.6	1.6	3.6	0.4	4.9	0.5	11.4	1.3	6.6	0.7
Dried Beans, Nuts and Seeds	9.1	1.5	7	1	7.6	0.8	9.9	0.9	5.9	0.7	13.6	1.3
REGULATING FOODS												
Vegetables	60.6	10.2	78.3	11.1	115.9	12.4	131.8	12.4	109	12.1	103.4	10.3
Fruits	34.4	5.8	49.5	7	48.4	5.2	51.6	4.9	54.8	6.1	112.2	11.1
Miscellaneous††	90.2	15.2	89.5	12.6	101.5	10.9	150.1	14.2	124.5	13.8	66.3	6.6
All Foods	593.6	100	708.7	100	931.9	100	1059.5	100	900.5	100	1008	100

†*Numbers may not add up to totals as these are rounded off.*
††*Includes spices, condiments, dessert, beverages and mixed dishes.*
‡ *As Purchased Weight*

3.1.10.3. Adolescent: 13-19 years old

The mean one-day total food intake of adolescence 13-19 years old weighed 931.9 grams in raw as purchased from (Table 19). *Energy-giving foods* were consumed more at 405.2 grams or 43.5 % of the total daily food intake. Nearly one-half of the foods consumed by this group in a day consisted of cereals and cereal products of which more than 40% was contributed by rice and rice products. Other energy giving foods were consumed at 27 grams or 2.9 of the total daily food intake. *Fats and oils were* the least consumed among the energy giving foods eaten by this group.

For body building foods, almost one-fourth of the diet was shared by *fish and fish products, meat and meat products, and poultry* but *fish and fish products* were largely eaten at 178.7 grams more than the combined intakes of *poultry, egg, milk, milk products, meat and meat products, dried beans, nuts and seeds* at 82.3 grams or 8 % of the total daily food intake. *Dried beans, nuts and seeds* were eaten least at 7.6 grams per capita per day. *Inland fish* was also eaten in greater amount at 125.7 grams than *marine fish* at 2 grams per day. From among the inland fish, *blackfish and whitefish* were consumed in almost the same amounts at about 47 grams. Consumption of inland fish by this age group at 125.7 g was similar than that of the elderly.

For the regulating foods, consumption of *vegetables and fruits* was at 171.9 grams contributing about 18.4 % of the daily food intake. Consumption of *vegetables* was highest among the regulating foods at 115.9 grams or 12.4 % of the daily food intake. *Fruits* were only eaten at 48.4 grams per day.

3.1.10.4. Adults: 20-59 years old

The mean one day food intake of adults, 20-59 years old was 1059.5 grams in raw as purchased form, and was the highest intake across age/population groups (Table 19). For the energy giving foods, consumption of *cereals and cereal products* contributed nearly 40 % of the total daily intake.

For the body building foods, *fish and fish products* at 196.2 grams and *meat and meat products* at 52.9 g contributed almost 19 % and 5 % to the adult's diet, respectively while for the regulating foods, *vegetables* shared almost 12% while *fruits* contributed about 5% to their daily intake. *Fish* was consumed at 196.2 grams per day. The adults consumed fish more than any other age groups. Inland fish was again consumed largely at 142 grams followed by whitefish at about 60 grams and grayfish at about 47 grams per day. *Other aquatic animals* were eaten more at 12 grams which was three times than of the aquaculture fish at about 4 grams.

3.1.10.5. Elderly: 60 years old and over

The overall mean one-day food intake of the elderly 60 years old and over weighed 900 grams in raw as purchased form (Table 9). *Cereals and cereal products* still constitute the main bulk of the elderly' s diet at 342.9 grams contributing more 38% to their total daily food intake. The major source of protein was fish and fish products at 171.2 grams contributing 19 % to elderly's diet. Across population groups, the elderly had the highest intake of fruits with almost 6 % of

their total intake but had lower intake of vegetables at 109 g contributing 12 % to total daily food intake compared with the adolescent and adult age groups at 115.9 grams and 131.8 grams, respectively. Mean intake of milk and milk products among elderly was greater compared to adolescents and adults. The least consumed food groups for this age group include starchy roots and tubers, sugar and syrups, fats and oil, eggs, and dried beans, nuts and seeds.

The elderly consumed the lesser amount of fish than the adults and pregnant women. Blackfish and whitefish were also eaten more than any fish types. The elderly consumed high amount of *marine* fish next to the intake of marine fish by the adolescents at about 44 grams and 47 grams, respectively. *Aquaculture fish* was eaten least at about 4 grams per day.

3.1.10.6. Pregnant Women

The overall mean daily intake of pregnant women amounted to 1008 grams per capita per day in raw as purchased weight (Table 19). Cereal and cereal products comprised 41 % of total daily food intake at about 414 grams per day. Daily intake of *fish and fish products* was at 190.7 grams, meat and meat products at 50.4 grams, and poultry at 19.5 grams. These contributed almost 19 % (fish and products) and about 7 % (meat and product, including poultry) to the overall daily food consumption of the pregnant women. Pregnant women showed highest consumption of *poultry* across age groups at 19.5 grams. Intake of *vegetables and fruit* made up 10.3% and 11.1% of the total daily food intake. Consumed in less significant amounts in a day or about 1-7 % of the total intake were starchy *roots and tubers, sugars and syrups, fats and oils, egg, and dried beans, nuts, and seeds*.

Consumption of fish by the pregnant women was relatively high than the intakes of fish by the elderly, adolescents and school children but had the highest intake of *inland fish* at about 161 g. The consumption of whitefish by the pregnant women was the highest at 120 g per day.

3.2. Individual Energy and Nutrient Intake

3.2.1. Individual Energy and Nutrient Intake by National Estimate

At a mean total intake for *energy* of about 1798 grams per capita per day, only about 25.2 % of the Cambodian population had energy intake meeting 100 % or more of their recommended daily allowance (RDA) (Table 20). For the rest of the nutrients, adequacy was assessed by meeting only 80 % or more of the RDA (Figure 2). Based on this, for *protein*, about 89 % of the Cambodian population at mean intake of 72.9 g were able to meet 80 % of the recommended protein intake. Cambodians were able to meet the RDA of 19.1 % for *iron* at mean intake of 12.8 mg per day. Meeting the recommended daily allowances (RDAs) were highest for protein and relatively lower in energy and iron.

Table 20 Mean one-day per capita energy and nutrient intake, standard error, 95% confidence interval, coefficient of variation, and the proportion that met the RDA: Cambodia, 2011†

Energy and Nutrient Intake	Mean Intake	Standard Error	95% Confidence Interval		CV (%)	Number of individuals meeting adequacy (%)
			Lower Limit	Upper Limit		
Energy (Kcal)	1798.29	0.325	1797.65	1798.92	0.02	25.2
Carbohydrates (g) ‡	299.02	0.091	298.85	299.20	0.03	
Fats (g) ††	36.85	0.015	36.82	36.88	0.04	
Protein (g)	72.88	0.020	72.84	72.92	0.03	89.0
Iron (mg)	12.79	0.004	12.78	12.80	0.03	19.1

†*Meeting 100% of RENI for energy intake and 80% of RENI for other nutrients*

‡ *Recommended Daily Intake/Allowance are not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Fats, carbohydrates and fiber are expressed as energy (Kcal).*

3.2.2. Energy and Nutrient Intake by Ecozone

The amount of nutrients consumed followed almost the same trend as food groups consumed across ecological zones (Figure 1). Generally, when food consumption intake is high, energy and nutrient intakes are also high, consequently results in high number of individuals meeting adequacy. Consumption of almost food groups including that of fish was found to be high in the coastal area and therefore, the number of individuals meeting adequacy for energy was higher than the rest of the other ecological zones.

The number of individuals meeting adequacy for *energy* in the coastal area was at 52.2 % was almost twice than that of either Phnom Phen at 28.3, Mountains and Plateaus at 27.1, Plains at 21.5, and Tonle Sap at 20.9 %. It was even higher than the national estimate for energy at 25.2 %. Tonle Sap showed the lowest proportion of individuals that met RDA. The number of individuals meeting adequacy for protein in Phnom Phen and Mountains and Plains was comparable at 88.2 and 89.5 %, respectively. Highest proportion the met adequacy for *protein* was in Tonle Sap at 94.1 but was comparable with that in coastal area at 93.3 %.

Iron adequacy founded to be higher in Phnom Penh, Mountains and Plateaus and Tonle Sap where about one-fourth of the individuals meeting their adequacies while only about one-sixth of the individuals in the Plains and coastal met their adequacies for iron.

Table 21 Mean one-day per capita energy and nutrient intake, standard error, 95% confidence interval, coefficient of variation, and the proportion that met the RDA by ecological zone: Cambodia, 2011

Energy and Nutrient Intake	Ecological Zone														
	PHN			Mountains and Plateaus			Plains			Coastal			Tonle Sap		
	Mean	SE	%†	Mean	SE	%†	Mean	SE	%†	Mean	SE	%†	Mean	SE	%†
Energy (Kcal)	1871.7	1.240	28.3	1802.1	0.653	27.1	1654	0.424	21.5	2705.4	1.964	52.6	1735	0.604	20.9
Carbohydrates (g) ‡	297.6	0.264		312.7	0.127		279.7	0.109		458.3	0.895		275.3	0.124	
Fats (g) ††	41.0	0.062		32.7	0.031		33.4	0.019		62.5	0.080		36.3	0.029	
Protein (g)	72.7	0.052	88.2	64.9	0.036	89.5	66.8	0.028	84.9	105.2	0.096	93.3	78.8	0.050	94.1
Iron (mg)	11.9	0.009	19.0	11.0	0.008	22.9	12.3	0.007	15.8	14.8	0.014	14.7	14.5	0.009	18.3

†*Meeting 100% of RENI for Energy Intake and 80% of RENI for other nutrients*

‡ *Recommended Daily Intake/Allowance are not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Fats, carbohydrates and fiber are expressed as energy (Kcal).*

3.2.3. Energy and Nutrient Consumption by Urbanity

Protein was met by individuals at more than 80 % adequacy in the urban and rural areas. There was only about one-fourth of the individuals meeting 100 % adequacy for *energy*.

Adequacy for *iron* was met by about one-fifth of the individuals in the urban and rural areas. Generally, lower proportions of individuals meet their adequacies in the rural areas (Table 22)

Table 22 Mean one-day per capita energy and nutrient intake, standard error, 95% confidence interval, coefficient of variation, and the proportion that met the RDA by urbanity: Cambodia, 2011

Energy and Nutrient Intake	Urbanity					
	Urban			Rural		
	Mean Intake	Standard Error	Percent Adequacy†	Mean Intake	Standard Error	Percent Adequacy†
Energy (Kcal)	1810.80	0.461	26.4	1785.25	0.457	24.1
Carbohydrates (g)‡	283.30	0.133		315.41	0.124	
Fats (g)‡	42.11	0.023		31.37	0.018	
Protein (g)	77.79	0.031	90.6	67.76	0.026	87.4
Iron (mg)	13.35	0.007	18.7	12.21	0.005	19.6

†*Meeting 100% of RENI for Energy Intake and 80% of RENI for other nutrients*

‡*Recommended Daily Intake/Allowance are not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Fats, carbohydrates and fiber are expressed as energy (Kcal).*

3.2.4. Energy and Nutrient Consumption by Gender

Nearly 90 to 95 % of both male and female individuals met their adequacies at 80 % for *protein*. Only about one-fifth of them met their adequacies for *iron* by male and female individuals (Table 23). The proportion of female individuals meeting their adequacies was generally lower than the males for all nutrients considered.

Table 23 Mean one-day per capita energy and nutrient intake, standard error and proportion that met RDA by gender: Cambodia, 2011

Energy and Nutrient	Gender

Intake	Male			Female		
	Mean Intake	Standard Error	Percent Adequacy†	Mean Intake	Standard Error	Percent Adequacy†
Energy (Kcal)	1973.01	0.506	25.4	1653.90	0.414	25.1
Carbohydrates (g)†	326.71	0.115		276.14	0.136	
Fats (g)‡	40.65	0.023		33.71	0.019	
Protein (g)	76.79	0.027	89.6	69.65	0.029	88.5
Iron (mg)	13.53	0.006	22.1	12.18	0.006	16.7

†*Meeting 100% of RENI for Energy Intake and 80% of RENI for other nutrients*

‡*Recommended Daily Intake/Allowance are not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Fats, carbohydrates and fiber are expressed as energy (Kcal).*

3.2.5. Energy and Nutrient Intake by Age Group with pregnant Women

Table 24 Mean one-day per capita energy and nutrient intake and proportion that met the RDA by age group including pregnant women: Cambodia, 2011

Energy and Nutrient Intake	Age Group (in years)					Pregnant
	0-5	6-12	13-19	20-59	60-above	
Energy (Kcal)	1,089	1,353.4	1,825.6	2,040.4	1,679.1	2,115.9
Meeting 100% of RENI	*27.6*	*15.8*	*17.8*	*29.7*	*27.9*	*23.4*
Carbohydrates (g)†	208.64	243.30	313.38	330.69	266.37	308.17
Fats (g)†	24.76	27.78	36.78	41.77	33.74	53.71
Protein (g)	44.82	54.08	75.64	81.50	72.46	93.63
Meeting 80% of RENI	*91.3*	*87.3*	*89.0*	*90.5*	*81.6*	*80.4*
Iron (mg)	7.52	9.77	13.59	14.09	13.14	14.13
Meeting 80% of RENI	*12.9*	*19.1*	*19.4*	*18.6*	*27.1*	*15.7*

†*Recommended Daily Intake/Allowance is not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Carbohydrate, fats and fiber are expressed as energy (Kcal).*

3.2.5.1. Preschool children: 0 to 5 years old

Among the preschool children, only about one-fourth met the recommended dietary intake for *energy*; more than 90 % met at least 80% of *protein* requirements; while *iron* was met by more than one-half of the preschool children (Table 24).

3.2.5.2. School-age children, 6 to 12 years old

Only about one-sixth of the school children met the recommended daily intake for *energy*, but almost 90 % met at least 80% of the recommended dietary intake for *protein*; and about one-fifth met at least 80 % of the recommended intake for *iron* (Table 24).

3.2.5.3. Adolescents 13-19 years old

Only about 18 % or less than one-fifth of the adolescents met at least 80 % of their recommended energy intake and the same was observed for *iron*. About 90 to 95 % of the adolescents met at least 80% of their *protein* requirements (Table 24).

3.2.5.4. Adults 20-50 years old

Close to 1/3 of the adults met at least 100 % of their recommended intake for *energy*. About 90 % of the adults met at least 80% of the recommended intake of protein. Less than one-fifth of the adults met at least 80% of recommended intakes for *iron* (Table 24).

3.2.5.5. Elderly 60 years old and over

Less than one-third of the elderly met the recommended intake for *energy* but close to fourth-fifth (80%) met the *recommended intake for protein*. *Iron* was met by about one-tenth (11 %) of the elderly (Table 24)

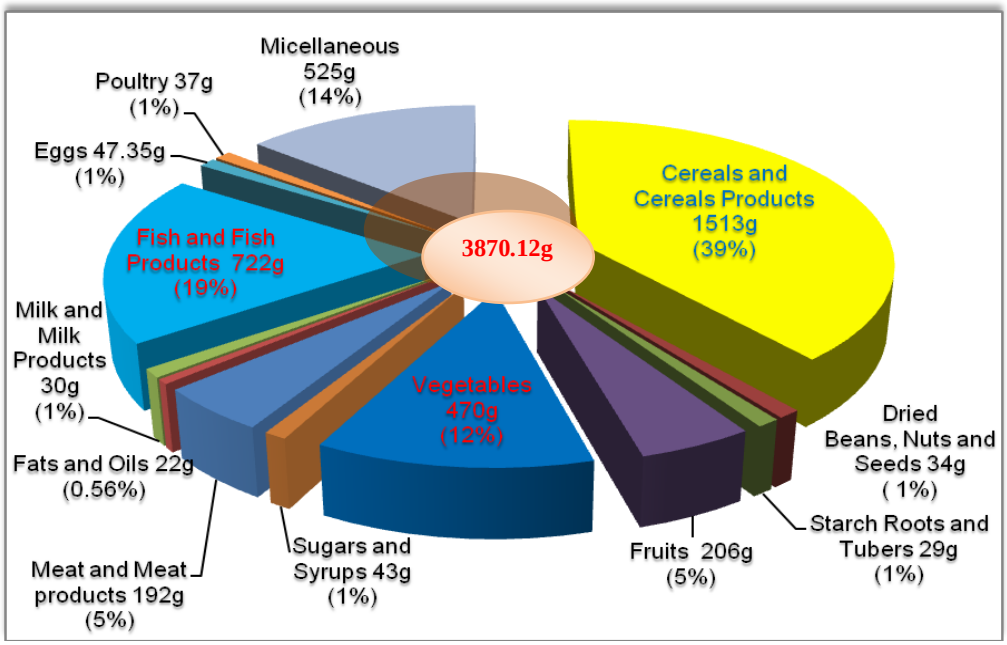
3.2.5.6. Pregnant women

Requirement for *protein* was met by 80 % of the pregnant women. Energy was met by a little over one-fifth (23 %). A low proportion of the pregnant women met their RDA for *iron* at about 16 %. (Table 24).

IV. HOUSEHOLD FOOD CONSUMPTION

4.1. Food Consumption

4.1.1. Household Food Consumption by National



The Cambodian diet at the household level remained a rice-fish-vegetable combination. The largest share of the total food intake of the household was contributed by cereals, fish and vegetable. The total average food intake in a day among Cambodian households is equivalent to 3870.12 grams in raw as purchased form (Table 25). C*ereal and cereal products* to where rice, the staple food belongs, was consumed in greatest amount at 1513.22 grams, contributing around 39% to the total food intake. This was followed by *fish and fish products* at 721.8 grams sharing nearly 19% to the total daily intake. Next was the intake of *miscellaneous foods* such as condiments, spices, and beverages at 525.19 grams with about 14% contribution to the total food intake. Consumption of vegetables at 470.28 grams contributed around 12% to the total intake in a day. *Fruits* consumed at 206.02 grams and *meat and meat products* at 191.55 grams, both contributed around 5% to the total intake per day. The other food groups were consumed in lesser amounts ranging from almost 22 to 47 grams daily (Figure 2.)

Table 25 Mean one-day household food consumption, standard error, confidence interval, coefficient of variation and percent of total food intake: Cambodia†

Food Group/ Sub-group	Mean	Std. Error	95% Confidence Interval		%CV	% of Total Food Intake
			Lower Limit	Upper Limit		
ENERGY-GIVING FOODS						
Cereals and Cereal Products	1513.22	0.531	1512.18	1514.26	0.04	39.10
Starchy Roots and Tubers	29.15	0.078	29.00	29.31	0.27	0.75
Sugars and Syrups	42.49	0.065	42.36	42.61	0.15	1.10
Fats and Oils	21.55	0.047	21.45	21.64	0.22	0.56
BODY-BUILDING FOODS						
Meat and Meat Products	191.55	0.202	191.15	191.94	0.11	4.95
Poultry	37.18	0.096	36.99	37.36	0.26	0.96
Eggs	47.35	0.060	47.23	47.47	0.13	1.22
Milk and Milk Products	29.97	0.077	29.81	30.12	0.26	0.77
Dried Beans, Nuts and Seeds	34.38	0.086	34.21	34.55	0.25	0.89
REGULATING FOODS						
Vegetables	470.28	0.284	469.72	470.84	0.06	12.15
Fruits	206.02	0.240	205.55	206.49	0.12	5.32
Miscellaneous‡	525.19	0.484	524.24	526.14	0.09	13.57
All Foods	3870.12	1.359	3867.46	3872.78	0.04	100.00

†*Numbers may not add up to totals as these are rounded off. SE –standard error*
‡*Includes spices, condiments, dessert, beverages and mixed dishes.*

4.1.1.1. Household Fish Consumption by National

Among Cambodian households, fish, next to rice, was consumed more than any other food groups at 721.8 grams in raw as purchased form, sharing almost 19% to the total daily food intake (Table 26). *Inland fish* which included blackfish, whitefish and greyfish, aquaculture fish and other inland aquatic animals (OAAs) was consumed in greater amount compared to *marine fish*. Consumption of inland fish at 524.03 grams contributed almost three-fourths to the total fish intake (72.59%) while *marine fish* consumed at 184.50 grams and *other marine aquatic animals (OAAs)* consumed at 13.27 grams shared only about one-fourth to the total fish intake (25.59% and 1.82%, respectively).

Of the inland fishes, blackfish was consumed the most at 219.06 grams contributing around 30% to the total fish intake followed by whitefish consumed at 176.18 grams with 24.41% contribution. Consumed in lesser amounts were greyfish at 70.16 grams (9.71% contribution) and inland OAAs at 43.75 grams (6.06% contribution). The least consumed among the inland fishes was those from aquaculture with only 14.88 grams consumption sharing only about 2% to the total fish consumption. The national household fish consumption was consumed blackfish relatively higher than other fish categories- white fish and grey fish due to because the household at urban areas was consumed more backfish. It indicated that household in urban areas are relatively high purchasing power which influenced by access to food. On the other hand, the household living in Tonle Sap zone also consumed high in blackfish where are available to this fish category.

Other aquatic animals such as edible insects, shrimps, clams, water birds, frogs and the like coming from marine sources were consumed the least at 13.27 grams sharing only about 2% to the total fish intake. The reason behind this finding, the OAAs consumption of household at

rural areas and mountain ecological zone were relatively high. It could be local available and probably cheap. And these are generally consumed as snack foods especially in urban area and Phnom Penh.

Table 26 Mean one-day household fish consumption, standard error, confidence interval, coefficient of variation, percent of total food intake, and percent of total fish intake: Cambodia†

Food Group/ Sub-group	Mean	Std. Error	95% Confidence Interval		CV%	% of Total Food Intake	% of Total Fish Intake
			Lower Limit	Upper Limit			
Fish and Fish Products	721.8	0.350	721.11	722.49	0.05	18.64	
Inland	524.03	0.290	523.46	524.60	0.06	13.53	72.59
Blackfish	219.06	0.265	218.54	219.58	0.12	5.66	30.36
Whitefish	176.18	0.273	175.64	176.71	0.16	4.55	24.41
Greyfish	70.16	0.132	69.90	70.42	0.19	1.81	9.71
Aquaculture	14.88	0.058	14.76	14.99	0.39	0.38	2.04
OAAs Inland	43.75	0.089	43.58	43.93	0.20	1.13	6.06
Marine	184.50	0.268	183.98	185.03	0.15	4.77	25.59
OAAs Marine	13.27	0.064	13.15	13.40	0.48	0.34	1.82

†*Numbers may not add up to totals as these are rounded off. SE –standard error*

4.1.2. Household Consumption by Ecological Zone

Across ecological zones, households living in the coastal area consumed the highest total food intake at 5832.8 grams per day, followed by Phnom Penh at 3931.5 grams, Tonle Sap area at 3873.7 grams, mountain & plateau area at 3724.8 grams while lowest total food intake was observed among households living in the plain area at 3482.1 grams per day (Table 26).

Daily consumption of *cereals and cereal products*, primarily rice, was highest among households living in the coastal area at 1910.2 grams followed by the households living in the mountain & plateau area at 1567.4 grams. Households living in the Plain and Tonle Sap areas showed almost similar consumption ranging from 1468.3 to 1473.2 grams per day. Household in the Phnom Phen area had the lowest intake of cereals and cereal product at 1383.7 grams.

Among the body-building foods, *fish and fish products* were consumed more than meat or poultry in all ecological zones. Highest consumption of fish was observed among households in the coastal area at 1013 grams followed by Tonle Sap area at 811.6 grams per day. Next were the households living in the Plain and Phnom Penh areas at 667 grams and 605.4 grams, respectively. Lowest consumption was observed in the mountain & plateau area at 577.5 grams per day. The food preferences, locally available and affordable to food are the key influences to the food intake of the overall population among ecological zones.

Poultry was consumed highest among households in the coastal area at 85.9 grams followed by Phnom Phen at 77.4 grams in a day. Next was in mountain & plateau area at 47.2 grams per day. Poultry was consumed minimally in Plain and Tonle Sap areas at 26.6 grams and 20.6 grams, respectively. *Eggs* were highly consumed in Phnom Penh at 80.6 grams per day while Tonle Sap and coastal areas had similar consumption at around 47%. Egg was consumed the least among households in the plain area and in the mountain & plateau area ranging from 40 to 43%. *Meat and meat products* were consumed the highest in Phnom Penh and Tonle Sap areas, both at 234.5 grams per day. Meat intake among households in the mountain & plateau area at 200.1 grams did

not vary much from meat intake in the coastal area at 217.3 grams per day. Households in the plain area had the lowest meat intake at 143.6 grams per day.

Coastal and Phnom Penh areas showed almost similar high intake of *vegetables* at 552.1 grams and 516.1 grams per day, respectively. Lower intake of vegetables was observed in Tonle Sap (475.0 grams) and Plain areas (455.9 grams). The lowest intake of vegetables was in the mountain & plateau area at 418.0 grams per day. Coastal, Tonle Sap, Phnom Penh, and mountain & plateau areas had relatively high consumption of *fruits* at 290.6, 259.6, 241.4 and 195.7 grams per day, respectively. Low intake of fruits was seen in the plain area at 145.6 grams per day.

Households in the coastal and mountain & plateau areas showed almost similar high intake of *sugars and syrups* at 62.5 and 57.7 grams, respectively. Lower intake was seen in Phnom Penh at 44.9 grams per day. Lowest intake of sugars and syrups was observed among households in Tonle Sap (39.6 grams) and Plain areas (34.9 grams). *Milk and milk products* were consumed in almost similar amounts in Phnom Penh (41.9 grams), Tonle Sap (41.1 grams), coastal (40.2 grams), and mountain & plateau areas (38.6grams). Milk was least consumed in the plain area at 14.6 grams per day.

Dried beans, nuts and seeds were consumed the highest in the mountain & plateau area at 55.3 grams followed by Tonle Sap area at 38.2 grams per day. Minimal consumption of this food group was seen in plains, coastal and Phnom Penh areas.

Fats & oils and *starchy roots & tubers* were the least consumed among the food groups. Households in the coastal areas consumed high of the fats and oils (69.5 grams) while Phnom Phen, mountain & plateau, plain, and Tonle Sap areas had almost similar intakes from 15.1 to 19.9 grams per day. Starchy roots and tubers were consumed in high amounts in the coastal area at 71.1 grams per day while Tonle Sap and Phnom Penh areas showed lowest consumption at 20.5 and 18.9 grams per day, respectively.

Table 27 Mean one-day household food consumption, standard error and % of food to total intake by ecological zone: Cambodia†

Food Group/ Sub-group	Ecological Zone														
	PHN			Mountains and Plateaus			Plains			Coastal			Tonle Sap		
	g/day‡	SE	%††	g/day‡	SE	%††	g/day‡	SE	%††	g/day‡	SE	%	g/day‡	SE	%
ENERGY-GIVING FOODS															
Cereals and Cereal Products	1383.7	2.007	35.2	1567.4	1.174	42.1	1468.3	0.714	42.2	1910.2	3.221	32.7	1473.2	0.838	38.0
Starchy Roots and Tubers	18.9	0.185	0.5	38.2	0.232	1.0	25.7	0.099	0.7	71.1	0.596	1.2	20.5	0.085	0.5
Sugars and Syrups	44.9	0.184	1.1	57.7	0.223	1.5	34.9	0.082	1.0	62.5	0.377	1.1	39.6	0.104	1.0
Fats and Oils	18.5	0.061	0.5	15.5	0.058	0.4	15.1	0.041	0.4	69.5	0.431	1.2	19.9	0.065	0.5
BODY-BUILDING FOODS															
Fish and Fish Products	605.4	0.705	15.6	577.5	0.720	15.4	667	0.555	19.3	1013	1.820	17.39	811.6	0.777	20.9
Inland	398	0.650	10.3	360.6	0.700	9.6	555.8	0.510	16.1	430.4	1.750	73.9	618.8	0.705	15.9
Blackfish	*170.9*	*0.610*	*4.5*	*122.3*	*0.375*	*3.3*	*181.7*	*0.361*	*5.3*	*246*	*0.838*	*4.22*	*321.6*	*0.661*	8.3
Whitefish	*126.6*	*0.579*	*3.3*	*131.9*	*0.680*	*3.5*	*242.6*	*0.492*	*7.0*	*82.1*	*1.237*	*1.41*	*145.6*	*0.371*	3.8
Greyfish	*50.6*	*0.387*	*1.3*	*38.4*	*0.231*	*1.0*	*58.7*	*0.177*	*1.7*	*46.2*	*0.339*	*0.79*	*113.7*	*0.330*	2.9
Aquaculture	*28.7*	*0.348*	*0.7*	*8.8*	*0.111*	*0.2*	*25.4*	*0.112*	*0.7*	*4.4*	*0.072*	*0.08*	*1.5*	*0.026*	0.04
OAAs Inland	*21.1*	*0.235*	*0.5*	*59.2*	*0.245*	*1.6*	*47.4*	*0.122*	*1.4*	*51.7*	*0.542*	*0.89*	*36.4*	*0.148*	0.9
Marine	188.8	0.681	4.8	209	0.684	5.6	105.2	0.189	3.0	551.3	1.688	9.47	174	0.581	4.5
OAAs Marine	18.7	0.289	0.5	7.9	0.157	0.2	6.0	0.043	0.2	31.2	0.305	0.53	18.8	0.157	0.5
Meat and Meat Products	234.5	0.619	6.0	200.1	0.651	5.4	143.6	0.268	4.1	217.3	0.784	3.7	234.5	0.403	6.1
Poultry	77.4	0.465	2.0	47.2	0.285	1.3	26.6	0.115	0.8	85.9	0.646	1.5	20.6	0.095	0.5
Eggs	80.6	0.331	2.1	40.3	0.149	1.1	42.6	0.082	1.2	47.0	0.206	0.8	47.1	0.104	1.2
Milk and Milk Products	41.9	0.373	1.1	38.6	0.279	1.0	14.6	0.062	0.4	40.2	0.309	0.7	41.1	0.162	1.1
Dried Beans, Nuts and Seeds	21.4	0.134	0.5	55.3	0.341	1.5	29.6	0.115	0.8	26.8	0.322	0.5	38.2	0.169	1.0
REGULATING FOODS															
Vegetables	516.1	1.165	13.1	418.0	0.630	11.2	455.9	0.438	13.1	552.1	1.300	9.5	475.0	0.472	12.3
Fruits	241.4	0.894	6.1	195.7	0.606	5.3	145.6	0.273	4.2	290.6	0.900	5.0	259.6	0.555	6.7
Miscellaneous††	646.8	1.601	16.5	473.3	1.098	12.7	412.6	0.537	11.8	1446.7	3.371	24.8	392.7	0.604	10.1
All Foods	*3931.5*	*5.147*	*100.0*	*3724.8*	*3.110*	*100.0*	*3482.1*	*1.655*	*100*	*5832.8*	*8.531*	*100.0*	*3873.7*	*2.002*	*100.0*

†*Numbers may not add up to totals as these are rounded off; SE – standard error*
††*Includes spices, condiments, dessert, beverages and mixed dishes.*
‡ As *purchased weight*

4.1.3. Household Food Consumption By Urbanity

Disaggregating by urbanity, the total daily food intake among rural households at 4037.75 grams, in raw as purchased form, was higher compared with that of the urban households at 3701.83 grams (Table 28). The daily intake in both areas remained to be a rice-fish-vegetable combination. *Cereals and cereal products* to where rice belongs contributed the highest to the total food intake in both areas. Urban households consumed more of this food group at 1580.66 grams in a day than their counterparts in the rural areas at 1446.05 grams, contributing almost 43% and 36%, respectively.

Table 28 Mean one-day household food consumption, standard error and % of food to total intake by urbanity: Cambodia, 2011†

Food Group/ Sub-group	Urbanity					
	Rural			Urban		
	g/day‡	Std Error	%	g/day‡	Std Error	%
ENERGY-GIVING FOODS						
Cereals and Cereal Products	1580.66	0.770	42.70	1446.05	0.726	35.81
Starchy Roots and Tubers	27.66	0.091	0.75	30.64	0.127	0.76
Sugars and Syrups	33.96	0.073	0.92	50.98	0.107	1.26
Fats and Oils	19.24	0.049	0.52	23.85	0.079	0.59
BODY-BUILDING FOODS						
Fish and Fish Products	677.25	0.456	18.27	766.18	0.550	18.98
Inland	527.09	0.410	14.21	521.00	0.450	12.91
Blackfish	*205.92*	0.346	*5.56*	*232.14*	*0.402*	*5.75*
Whitefish	*185.65*	0.406	*5.00*	*166.74*	*0.366*	*4.13*
Greyfish	*70.25*	0.191	*1.89*	*70.08*	*0.183*	*1.74*
Aquaculture	*11.27*	0.073	*0.30*	*18.48*	*0.091*	*0.46*
OAAs Inland	*54.0*	0.141	*1.46*	*33.55*	*0.108*	*0.83*
Marine	145.12	0.278	3.92	223.73	0.455	5.54
OAAs Marine	5.04	0.042	0.14	21.46	0.121	0.53
Meat and Meat Products	127.05	0.230	3.43	255.79	0.322	6.33
Poultry	37.73	0.128	1.02	36.62	0.144	0.91
Eggs	35.76	0.071	0.97	58.90	0.096	1.46
Milk and Milk Products	12.70	0.053	0.34	47.17	0.143	1.17
Dried Beans, Nuts and Seeds	36.71	0.129	0.99	32.07	0.114	0.79
REGULATING FOODS						
Vegetables	465.82	0.410	12.58	474.72	0.394	11.76
Fruits	209.23	0.317	5.65	202.83	0.359	5.02
Miscellaneous††	438.08	0.650	11.83	611.96	0.710	15.16
All Foods	*3701.83*	*1.827*	*100.00*	*4037.75*	*2.001*	*100.00*

†*Numbers may not add up to totals as these are rounded off. SE – standard error*
††*Includes spices, condiments, dessert, beverages and mixed dishes.*
‡ As *purchased weight*

Fish and fish products was the second largest contributor to the total food intake in both areas, however, consumption among households in the urban areas at 766.18 grams (18.98% contribution to total intake) was higher compared to that of the households living in the rural areas at 677.25 grams (18.27% contribution to total intake) per day.

Consumption of *vegetables* among households in the rural areas was the third largest contributor to the total daily intake at 465.82 grams followed by *miscellaneous food items* such as spices, condiments and beverages at 438.08 grams, sharing nearly 13% and 12%, respectively. On the other hand, the opposite was seen among households living in the urban areas with miscellaneous food items consumed at 611.96 grams (15.16% contribution) being the third largest contributor to the total intake in a day followed by the vegetable food group consumed at 474.72 grams per day sharing almost 12% to the total daily intake.

Meat and meat products were consumed in greater amounts among households in the urban areas at 255.79 grams per day (6.33% contribution to total intake) compared with the rural households at 127.05 grams (3.43% contribution to total food intake). Other food groups consumed in greater amounts among urban households than their counterparts in the rural areas include *sugars and syrups* (50.98 grams vs. 33.98 grams), *eggs* (58.90 grams vs. 35.76 grams), and *milk & milk products* (47.17 grams vs. 12.70 grams). Consumption of *starchy roots & tubers, fats & oils, poultry*, and *dried beans, nuts & seeds* did not differ much between the two areas.

4.1.4. Household Fish Consumption by Urbanity

Majority of the fish consumed by Cambodian households regardless of urbanity were from inland source than from marine source (Table 29). In the rural areas, households consumed *inland fishes* at 527.09 grams in raw as purchased form per day which contributed around 14 % to the total food intake or 77.6 % to the total fish consumption while marine fishes were consumed at 145.12 grams and other aquatic animals from marine source at 5.04 grams sharing almost 22 % and nearly 1 %, respectively, to the total daily fish consumption.

In the urban areas, similarly, households consumed more of the inland fishes, but a little lesser than their counterparts in the rural areas, at 521 grams contributing almost 13% to total food intake or 68.02 % to the total fish intake in a day. Consumption of marine fishes and OAAs from marine source among urban households were higher compared to their counterparts in the rural areas at 223.73 grams and 21.46 grams, respectively, contributing around 30% to the total fish consumption in a day. The urban consumed marine fish and marine OAAs higher than its counterpart rural area, reflecting to market demand for the products and higher purchasing power among the urban households. Another possibility is that marine fish was imported from Thailand especially the provinces along Cambodia-Thai border, it also relatively cheap compared to marine fish transport from Cambodia coastal area.

Table 29 Mean one-day household fish consumption, standard error, confidence interval, coefficient of variation, percent of total food intake, and percent of total fish intake: Cambodia

Food Group/ Sub-group	Urbanity							
	Rural				Urban			
	g/day†	Std Error	% to total Food Intake	% to total Fish Intake	g/day†	Std Error	% to total Food Intake	% to total Fish Intake
Fish and Fish Products	677.25	0.456	18.27		766.18	0.550	18.98	
Inland	527.09	0.410	14.21	77.60	521.00	0.450	12.91	68.02
Blackfish	205.92	0.346	5.56	30.82	232.14	0.402	5.75	30.30
Whitefish	185.65	0.406	5.00	27.71	166.74	0.366	4.13	21.76

Greyfish	70.25	0.191	1.89	10.47	70.08	0.183	1.74	9.17
Aquaculture	11.27	0.073	0.30	1.66	18.48	0.091	0.46	2.42
OAAs Inland	54.00	0.141	1.46	8.09	33.55	0.108	0.83	4.37
Marine	145.12	0.278	3.92	21.73	223.73	0.455	5.54	29.19
OAAs Marine	5.04	0.042	0.14	0.77	21.46	0.121	0.53	2.79

† As *purchased weight*

Among the inland fishes, the whitefish and OAAs from inland the source were consumed more by rural households than their counterparts in the urban areas. It can be noted that locally available and affordable to the food items among rural and urban areas. White fishes were consumed in the rural households at 185.65 grams and contributed almost 28 % to their total daily fish consumption while the OAAs from inland sources were consumed at 54 grams and shared around 8% to total daily fish intake. Consumption of the other inland fishes which include blackfish, greyfish, and aquacultured fish did not differ much between the two areas.

4.2.Household Energy and Nutrient Intake

4.2.1.Household Energy and Nutrient Intake by National Estimate

The total mean energy intake in a day among Cambodian households is 7918.72 kilocalories (Table 30). Less than one-third of the households (29.4 %) had met 100 % or more of their energy intake. Among the nutrients, protein had more than 95 % of households meeting at least 80 % of the recommended intake. Less than 20 % of the households met at least 80 % of the recommended intake for iron (14.3% with the mean intake of 38.97 milligrams.

Table 30 Household mean one-day energy and nutrient intake, standard error, 95% confidence interval, coefficient of variation, and the proportion met the RENI: Cambodia

Energy and Nutrient Intake	Mean Intake	Standard Error	95% Confidence Interval		CV (%)	Percent Meeting RENI†
			Lower Limit	Upper Limit		
Energy (Kcal)	7918.72	2.872	7913.09	7924.35	0.04	29.4
Carbohydrates (g)‡	1280.57	0.575	1279.44	1281.69	0.04	
Fats (g)‡	171.75	0.121	171.51	171.98	0.07	
Protein (g)	330.07	0.174	329.73	330.41	0.05	96.7
Iron (mg)	38.97	0.037	38.90	39.05	0.10	14.3

†*Meeting 100% of RENI for Energy Intake and 80% of RENI for other nutrients*

‡*Recommended Dail y Intake/Allowance is not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Fats, carbohydrates and fiber are expressed as energy (Kcal).*

4.2.2. Household Energy and Nutrient Intake by Ecological Zone

Disaggregating by ecological zone, households living in the coastal areas had the highest mean intake at 11737 kilocalories and more than one-half of them met 100 % or more of their energy requirement (Table 31), followed by the households living in the mountain & plateau areas wherein about one-third (34.6%) met at least 100% of their energy requirement. While about one-fourth of the households living in the plain area met the energy requirement while less than one-fourth of the households in Tonle Sap met 100 % of the energy requirement, the lowest among the ecozones.

For protein, more than 95 % of the households in Phnom Penh (98.3 %), mountains and plateaus (97.9 %), Tonle Sap (97.5 %), coastal (97.1 %) and plain (95.4 %) areas, met at least 80% of the recommended intake for this macronutrient. *Iron* intake of households from the 5 ecozones founded the lowest percentage of meeting at least 80 % of the recommended intake for this nutrient ranging from 10.8 % to 20.1%.

Table 31 Household Mean one-day energy and nutrient intake, standard error and % of food to total intake by Ecological Zone: Cambodia, 2011

Energy and Nutrient Intake	Ecological Zone														
	PHN			Mountains and Plateaus			Plains			Coastal			Tonle Sap		
	Mean	SE	%†	Mean	SE	%†	Mean	SE	%†	Mean	SE	%†	Mean	SE	%†
Energy (Kcal)	7818.5	10.314	30.4	7899.5	6.624	34.6	7295	3.610	25.4	11737	17.599	58.2	7691.6	4.485	23.8
Carbohydrates (g)‡	1238.5	2.010		1322.8	1.280		1199	0.680		1944.3	4.205		1190.8	0.747	
Fats (g)‡	181.8	0.447		157.3	0.325		154.8	0.153		279.9	0.694		166.5	0.199	
Protein (g)	315.9	0.429	98.3	291.8	0.383	97.9	302.6	0.238	95.4	467.2	0.871	97.1	349.0	0.353	97.5
Iron (mg)	33.4	0.068	16.9	30.5	0.080	10.8	37.0	0.067	11.7	43.5	0.098	20.1	45.8	0.072	17.2

†*Meeting 100% of RENI for Energy Intake and 80% of RENI for other nutrients; SE-standard error*

‡ Recommended Daily Intake/Allowance is not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008). Fats, carbohydrates and fiber are expressed as energy (Kcal).

4.2.3. Household Energy and Nutrient Intake by Urbanity

Mean *energy* intake of households living in the urban areas at 8114.55 kilocalories per day was higher compared with their counterparts in the rural areas at 7722.11 kilocalories (Table 32). This resulted to the higher percentage of households meeting 100% or more of their energy requirements in the urban areas (30.5 %) than in the rural areas (28.4 %)

In both areas, more than 95 % of the households met at least 80% of the recommended intake for *protein.*
Iron intake was seen to be the lowest among Cambodian households with only about 13% of the households in the rural areas and around 15 % in the urban areas meeting at least 80% of the daily recommendation for this nutrient.

Table 32 Household Mean one-day food consumption, standard error and % of food to total intake by urbanity: Cambodia, 2011

Energy and Nutrient Intake	Urbanity					
	Urban			Rural		
	Mean Intake	Standard Error	% Meeting RENI†	Mean Intake	Standard Error	%Meeting RENI†
Energy (Kcal)	8114.55	4.140	30.5	7722.11	3.973	28.4
Carbohydrates (g)‡	1236.83	0.860		1324.48	0.762	
Fats (g)‡	197.17	0.189		146.22	0.147	
Protein (g)	355.43	0.261	97.8	304.60	0.226	95.7
Iron (mg)	42.73	0.063	15.3	35.20	0.040	13.3

†*Meeting 100% of RENI for Energy Intake and 80% of RENI for other nutrients*
‡*Recommended Daily Intake/Allowance are not available in Recommended Allowances for Southeast Asia (SEA-RDAs) (Barba and Cabrera, 2008. Fats, carbohydrates and fiber are expressed as energy (Kcal).*

V. THE ROLE OF FISH IN FOOD AND NUTRITION SECURITY

5.1. Cambodian diet

Combined results of the dietary survey of the household and the individual show that at the national and subnational levels (Figures 1, table 11, table 19) the Cambodian diet is basically *rice-fish-vegetable* combination with largest consumption of rice, followed by fish and vegetables. In the Cambodian diet, *rice* and *fish* were the most frequently eaten food groups with rice at almost three times a day and fish at about two to three times a day. *Vegetables* were consumed at one and a half (1 ½) times a day. *Rice* was eaten by almost 100 % (99.7%) of the household members while *fish* and *vegetables* were eaten by 100 and almost by 92 %, respectively. Rice and fish are then the major staples in Cambodia. Rice-fish-vegetable is the dietary pattern of the Cambodian household and its members (Table 33).

Table 33 Number of households and individuals consuming rice, fish and vegetables: Cambodia, 2011

Food Groups	% Consuming Households	Mean Weight (g)†	% Consuming Individuals	Mean Weight (g)†
Rice	100	1410	99.7	386
Fish	100	721.8	100	172.5
Vegetables	100	470.8	91.4	113.8

†*As purchased form*

5.2. Fish Consumption

5.2.1. Percentage Contribution of Different Food Groups to Total Energy and Nutrient Intakes of the Households and Members

a. Individual

The contribution of food groups to total nutrient intake as shows in table 34, cereal and cereal products (mainly rice) are major energy contributors in the Cambodian diet contributing about 1095 kcals (60.91 %). Because of the large bulk that this food group was eaten, it is also the major contributor of carbohydrates at 80%.

It is also the second contributor of protein at 34.83 %, fats at 17.03, iron at 32.07 %. *Fish and fish products* are the major contributors of protein at 36.59 %, fats at 27.81 %, iron at 37.3 %. *Meat and meat products* follows fish and fish products in their contribution to the total nutrient intake. *Vegetables*, on the other hand, are the major contributors of iron at 9.20 % and the second contributor of carbohydrate *at 5.38%*.

Table 34 Percentage Contribution of Particular Food Group to Total Nutrient of the Individuals. Cambodia

Energy and Nutrients	Cereals and Products(%)	Starchy Roots and Tuber(%)	Sugar and Syrups(%)	Fats and Oils(%)	Fish and Fish Products(%)	Poultry(%)	Egg(%)	Milk and Milk Products(%)	Dried Beans, nuts and seeds(%)	Vegetables(%)	Fruits(%)	Meat and Meat Products(%)	Miscellaneous(%)
Energy (Kcal)	60.91†	0.44	1.07	1.85	12.49‡	0.89	1.05	1.19	0.96	2.17	1.72	4.29	10.98
Carbohydrates (g)	80.00†	0.59	1.30	0.07	0.99	0.05	0.03	0.49	0.79	5.38‡	3.64	0.10	6.56
Fats (g)	17.03‡	0.14	0.92	9.17	27.81†	2.79	2.96	1.60	1.38	2.08	1.49	12.77	19.87
Protein (g)	34.83‡	0.15	0.29	0.14	36.59†	1.89	2.74	0.76	1.09	2.78	0.80	10.49	7.44
Iron (mg)	32.07‡	0.52	0.39	0.19	37.3†	0.41	1.26	0.43	2.02	9.20	3.19	5.31	7.70

†*First largely shared by rice, fish and vegetables in the Cambodian diet*
‡*Second largely shared by rice, fish and vegetables in the Cambodian diet*

b. Household

Cereals & cereal products were the highest consumed food group in the Cambodian diet (Table 35). It supplied more than three-fourths (78.67%) of the carbohydrate intake and consequently was the major energy contributor sharing almost 61% to the total energy intake among households. *Fish & fish products* and *miscellaneous* food group also contributed more than 10% to the total household energy consumption.

Fish & fish products together with the *cereals & cereal products* were the major contributors of protein intake, both providing more than one-third of the total household protein intake. Household consumption of *meat & meat products*, *poultry*, *eggs*, *milk & milk products*, and *dried beans, nuts & seeds* were minimal thus contributing less percentage to the total household protein intake.

Similarly, the *fish & fish products* was the highest contributor of household fat intake at 25.32% followed by the *miscellaneous* food group at 23.9%. Consumption of *fats & oils* and *meat & meat products* shared less than 10% of the total household fat intake in a day.

Fish & fish products contributed almost one-third (31.46 %) to the total household iron intake. Table 35 further shows that fish is largely primarily contributing to protein, fats, and iron than the rest of the food groups while only secondarily contributing to energy, and iron.

Table 35 Percentage Contribution of Particular Food Group to Total Nutrient of the Households: Cambodia, 2011

Energy and Nutrients	Cereals and Products (%)	Starchy Roots and Tuber (%)	Sugar and Syrups (%)	Fats and Oils (%)	Meat and Meat Products (%)	Fish and Fish Products (%)	Poultry (%)	Egg (%)	Milk and Milk Products (%)	Dried Beans, nuts and seeds(%)	Vegetables (%)	Fruits (%)	Miscellaneous (%)
Energy (Kcal)	60.86†	0.49	1.05	2.14	3.41	11.57‡	1.12	0.90	0.98	0.79	2.38	1.57	12.76
Carbohydrates (g)	78.67†	0.66	1.24	0.19	0.08	0.89	0.06	0.05	0.52	0.60	6.54‡	2.75	7.76
Fats (g)	18.26‡	0.12	0.88	9.95	9.19	25.32†	3.45	2.46	1.24	1.27	2.83	1.12	23.90
Protein (g)	35.61‡	0.21	0.36	0.30	9.53	35.33†	2.49	2.35	0.61	0.95	2.78	0.76	8.72
Iron (mg)	35.20†	0.69	0.54	0.43	5.21	31.46‡	0.57	1.23	0.40	1.94	9.67	3.47	9.20

†*First largely shared by rice, fish and vegetable in the Cambodian diet*
‡*Second largely shared by rice, fish and vegetable in the Cambodian diet*

5.2.2. Percentage Contribution of Fish to Total Animal Intake

a. Individual

Table 36 Percentage Contribution of Fish to Total Animal Intake of the individuals and households: Cambodia, 2011

Animal Food Group	HOUSEHOLD		INDIVIDUAL	
	Percent to Total Animal Intake			
Fish	75.94		75.47	
Inland Fish	55.13		54.65	
Blackfish		23.05		*22.53*
Whitefish		18.53		*18.59*
Grayfish		7.38		*7.19*
Aquaculture		1.57		*1.61*
OAAs Inland		4.6		*4.73*
Marine Fish	19.41		19.46	
OAAs Marine	1.4		*1.36*	
Poultry	3.91		4.09	
Meat and Meat Products	20.15		20.45	
Total	100		100	

In the household and among the individuals, fish was the major contributor of the animal intake among Cambodian households sharing more than three-fourths (75 %) to the total animal intake (Table 36). Meat and meat products together with poultry contributed less than one-fourth to the total animal intake contributing about 20 % and 4 %, respectively.

Among the fish sources, the inland fishes contributed the most at 55 % with the blackfish providing the highest percentage (about 23 %) followed by whitefish (18.5%) while the aquaculture fish contributed the least with only about 2 %. The marine fish together with other aquatic animals from marine source contributed almost 21 %. Thus, fish the main contributor of energy , protein, fats and the micronutrients especially iron (Tables 34 and 35).

In the coastal area, contribution of fish consumption to the total animal intake was almost 77% and only about 23% were contributed by meat and meat products and poultry.

In Tonle Sap, fish consumption shared about 76% to the total animal intake while nearly 24% for poultry and meat & meat products. Consumption of inland fish (58.0%) was also higher in this area than intake of fish from marine sources (18.0 %). Blackfish was consumed in greater amount (30.14%) than other inland fishes.

Those living in mountains & plateaus likewise had higher consumption of fish (70 %) than meat and meat products (24 %) and poultry (6 %). Marine fish was consumed more in this ecological zone (25 %) than white fish (16 %) and blackfish (15 %) from inland source.

In Phnom Pen, fish consumption was least compared with their counterparts in the other ecozones at nearly 66 % fish contribution. This was compensated by their relatively high intake of meat and meat products (26 %) and poultry (8 %) compared with those living in the other ecozones.

5.2.3. Percentage Contribution of Fish to Total Energy and Nutrient Intakes

Fish consumption among households shared almost 12.0 % to the total *energy* intake in a day with whitefish sharing the highest percentage at 4.01% (Table 29). Protein, more than one-third (36.0 %) of the total daily household *protein* intake was shared by fish with blackfish contributing the highest at 11.73%. About one-fourth (27.0 %) of the total household fat intake was shared by fish consumption with whitefish sharing the highest (11.79%) among other fishes. Fish being not a carbohydrate source had minimal contribution (0.89%) to the total carbohydrate intake among households. For iron, almost one-third of the total household iron intake (34.0 %) was shared by fish intake with whitefish sharing the highest at 20.92 %.

Table 37 Percentage Contribution of Fish to Total Energy and Nutrient of the Households: Cambodia, 2011

Energy and Nutrient Intake	Fish Type (%)							Total
	Inland					Marine		
	Blackfish	Whitefish	Grayfish	Aquaculture	OAAs Inland	Marine	OAAs Marine	
Energy (Kcal)	3.34	4.01	1.00	0.16	0.82	2.04	0.20	12.03
Carbohydrates (g)	0.11	0.13	0.12	0.00	0.13	0.32	0.08	0.94
Fats (g)	6.20	11.79	1.90	0.11	2.48	2.67	0.17	26.57
Protein (g)	11.73	9.45	3.17	0.80	1.38	7.98	0.82	35.96
Iron (mg)	6.63	13.55	3.23	0.27	1.41	4.01	2.36	34.38

5.2. Food Adequacy

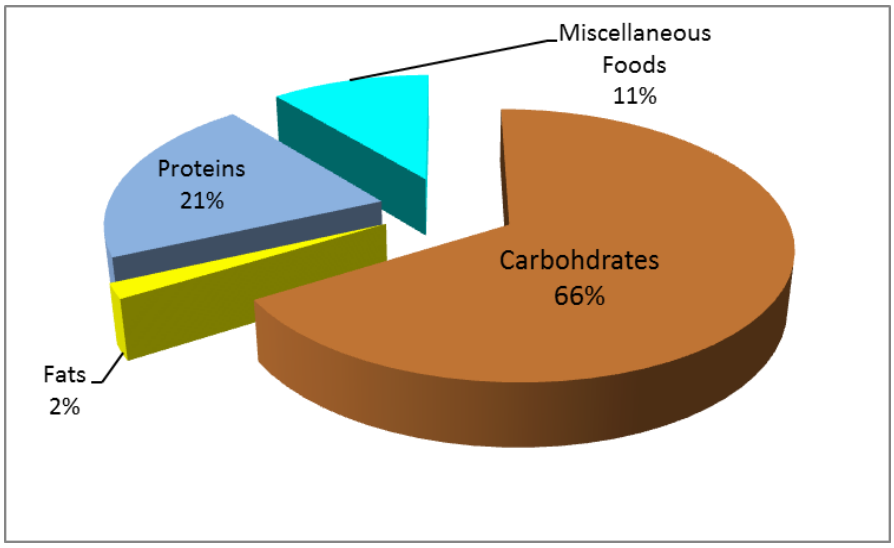


Figure 2 Percent distribution of calories from carbohydrates, fats and proteins

All major food groups contribute to the caloric intake of individuals and households and therefore, adequacy in the caloric and protein intakes measured against the recommended daily allowance is a good indicator of food adequacy. An intake of 1 gram of carbohydrate-rich foods such as cereal and its products, starchy tubers and roots, sugar and syrups, fruits and vegetables will generate 4 Kcal as well as an intake of 1 gram of protein-rich foods such as fish, meat, milk, poultry, eggs, dried beans, nuts and seeds and their products. An intake of 1 gram fats and oils including butter margarine will give 9 Kcal. The Cambodian diet has a total energy of 1798 Kcal. The sources of calories in a diet namely, carbohydrates, proteins and fats is an indicator of the quality of the diet. As in the case of the Cambodian diet, largest amount of energy comes from carbohydrates at 66 %, moderate from proteins at 21 % and very low from fats and oils (2%) and miceleneous food 11% (Figure 12). Compared to the study by FAO, 2010 founded that the contribution of total energy intake of Cambodian from carbohydrate was 76%; from protein was 10% of which the main source of protein in rural areas is Prahoc-which is fermented fish; and from fat was 14%.

Only about one- third (29.4 %) of households at 100% met the adequacy for energy while about one-fourth (25.2 %) by the individuals implying that at both the household and individual levels, the diet of the Cambodians is very low intake of fats. Fish is the major contributor more than cereals and their products to protein close to 37 % and fat intakes at nearly 28 % of the Cambodians (Table 23 and 25). Of the total energy intake, about 13 % was shared by fish.

The greater role of fish in meeting adequacy for food in terms of energy is the fact that when energy need by the body cannot be supplied by rice and other carbohydrate-rich foods, the body metabolizes the protein from fish to sustain the caloric need of the human body for the proper functioning of the various physiological and biochemical processes such as digestion and metabolism of foods to sustain life.

Fish was also the source of fats. The fats and the protein contributed by fish significantly played in mitigating caloric deficiency in the Cambodian diet and perhaps the protein-energy malnutrition which is the form of malnutrition that exists in developing countries like Cambodia. Fish contribute some fat but overall intake of fat was very low. The low fat intake is the reason for low calorie intake. Fish provides protein, which the body uses for optimal growth, but in the context of low calorie intake the body must turn to protein to satisfy energy needs. This is the form of protein-calories malnutrition (Marasmus) and the major reason for stunted growth and development in Cambodia. Another form of protein-calorie malnutrition (Kwashiorkor) is simple protein deficiency. This type is not common in Cambodia and rarity can be attributed to availability of protein from fish.

Adequacy for protein at the national level was highly exhibited both in the households and by the individuals at close to 97 and at 89 %, respectively. Consumption of protein-rich food was next to the energy-giving food with fish consumed largely than any other protein-rich food. The contribution of fish of more than half (55 %) to the total animal protein intake of the individual. (Tables 23 and 25).

Disaggregating by ecological zones, adequacy for energy was highest when intake of energy-giving foods, body-building food and fish was also high as in the case of coastal where adequacy was met by about one-half (52 %) of the households and therefore can be said as the most food secured. Lower adequacy was met by households in other ecological areas with lower intakes of energy-giving foods and fish ranging from one-fifth (21 %) to about more than one-fourth (27.5 %). The least food secured was Tonle Sap and plain at nearly one-fifth (21 %) of the households and individuals meeting adequacy for energy.

Adequacy for energy was met by individuals at about one-fourth (24 to 26 %) and by the households at about one-third (28 to 30 %) in both the urban and rural areas (Reference table here). The urban area seemingly was the more food secured than the rural areas. Fish was consumed in almost the same amounts by either the households or the individuals with also the same intakes of energy-giving foods. The same trend was observed in male and female individuals meeting adequacy for energy by one-fourth (25 %). With respect to energy intakes, the male was more food secured than the females.

Highest adequacy for energy at close to one-third (29.7 %) was met by the adults (20-50 years old) and lowest by the school children (6 to 12 years old) at only about one-sixth (15.8 %). Among the age groups, the *school-children* could then be considered as the most food insecure while the *adults* were the most food secured. Energy-giving foods specifically cereals and their products as well as fish and fish products were consumed more by the adults than other age groups.

5.3. Nutrient Adequacy

Table 38 summarizes the proportions of households and individuals meeting their adequacies for the nutrients considered at the national level. Iron's proportion meeting adequacy at the household and individual levels met by the individual close to 20 % and lowest in the household at about one-sixth (14.3 %).

Table 38 Mean intake and proportion of household and individual that met the recommended daily allowances (RDA): Cambodia, 2011

Energy and Nutrients	Household		Individual	
	Intake, g as purchased	Proportion meeting adequacy (%)	Intake, g as purchased	Proportion meeting adequacy (%)
Energy (Kcal)	**7918.72**	29.4	1798.29	**25.2**
Protein (g)	**330.07**	96.7	72.88	**89**
Iron (mg)	**38.97**	14.3	12.79	**19.1**

The significant contribution of fish to nutrition adequacy in meeting protein adequacy is its greater than contribution to iron density of the Cambodian diet than any other food groups (Table 37). Fish contributed to the total iron intake by the individual at nearly one-third (19.1%) and the household at about one-sixth. Thus, fish other that its significant contribution in meeting primarily protein and energy adequacy plays a significant role in meeting adequacy in iron in the households and by the individuals.

Table 39 Proportion contribution of fish to energy and nutrient intake: Cambodia, 2011

Energy and Nutrients	Individual	Household
Energy (Kcal)	11.57%	12.49%
Carbohydrate (g)	0.89%	0.99%
Fats (g)	8%	27.81%
Protein (g)	35.33%	36.59%
Iron (g)	31.46%	37.30%

The contribution of fish to total fat intake although low as compared with other food groups must also be emphasized. Aside from contributing to the total energy intake, fat of fish contains essential fatty acids namely, linoleic acid (omega 6), the precursor of arachidonic acid (ARA) and linoleic acid (omega 3), the precursor of DHA. These nutrients are not synthesized by the body. It must be obtained from food and it is known to be benefit to health DHA ("Smat" fat) is a key component of the phospholipids membranes of the eyes and brain. It is essential for brain and eye development infants and children; reduce the risks of heart disease and stroke- prevents blood clots, lowers blood pressure, protects against irregular heartbeats, reduces inflammation; strengthens the immune system; and essential for normal growth and development -for healthy skin, normal growth and reproduction. A diet that is deficient in DHA is associated with poor growth skin lesions, reproductive failure and fatty liver. (Eleanor N. Whitney,2005).

At the sub-national level, iron highest adequacy was met at one-fifth (20.1%) at coastal area, while Mountain and Plateau area was lowest adequacy only more than one-tenth (10.8%). Tonle Sap, Phnom Penh and Plain were met the iron adequacy more than one-tenth at 17.2%, 19.7%, and 11.7, respectively (Figure 4)

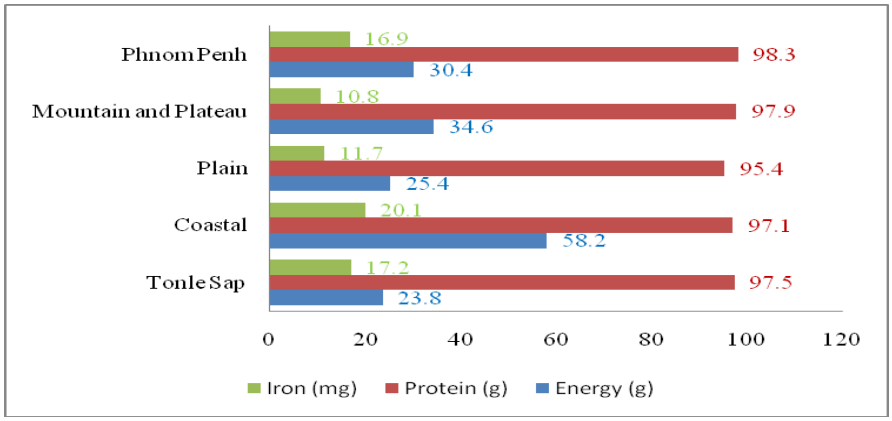


Figure 3 Proportion meeting daily allowances (RDAs) by Ecological Zone: Cambodia, 2011

Generally, among household, the most nutrient secured was the coastal area, followed by the Tonle Sap and Phnom Penh while the least nutrient secured were the plain, mountain and plateau areas. The same can be said of individuals across ecological zones. Furthermore, it can be observed that generally among households and individuals found in ecological zones eating more fish than any other animal meat and other food groups were generally more nutrient secured. Fish still remained as the major contributor of iron in the households and by the individuals across ecological zones.

Disaggregating by urbanity, consumption of fish in the urban area was higher than the rural with marine fish eaten largely than the inland fish. Generally, household and household members in the rural area were more nutrient insecure in the urban area. Almost less than 20 % of the individuals in the rural areas met their adequacies for iron while also about the same number households met their adequacies in iron (Figure 5).

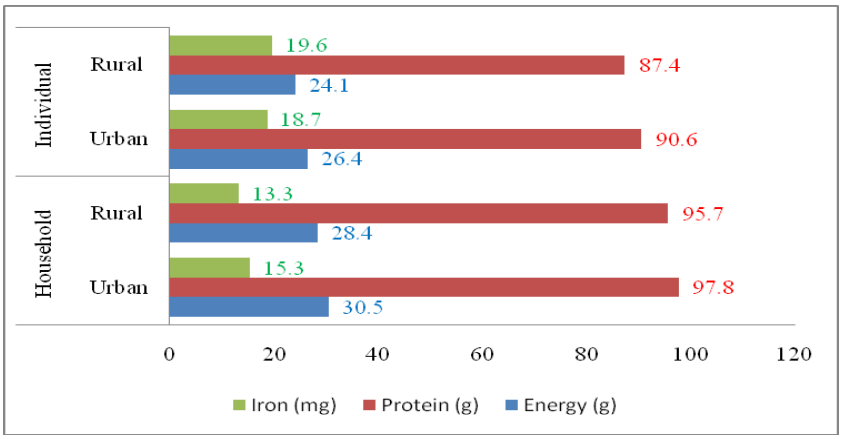


Figure 4 Proportion meeting daily allowances (RDAs) by urbanity: Cambodia, 2011

More male were eating fish than the female individuals and thus the proportion of the latter meeting nutrient adequacies were lower than the male (Tables 18).

By age groups including pregnant women, the most nutrient secured were the adults, 20 to 59 years of age, followed by the preschool children, aged 6 months to 5 years; the elderly, 60 years old and over; adolescents, 13 to 19 years old; school children 6 to 12 years old and the pregnant women, in decreasing order of meeting nutrient adequacy (Figure 6).

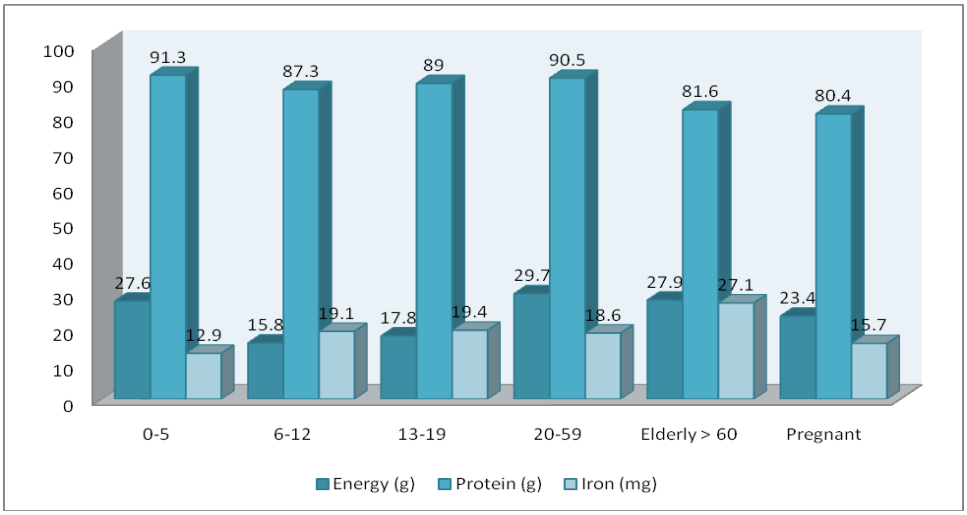


Figure 5 Proportion meeting recommended daily allowances by age groups and pregnant women (RDAs): Cambodia, 2011

Associating the nutrient intakes with the food consumption show that across age groups including pregnant women the Cambodian diet remained a rice-fish-vegetable combination. Fish remained their greater source for most of their nutrient. All age groups including pregnant women consumed large amount of fish next to rice but greater amount of fish was consumed by the adults. This age group consumed more rice, fish and vegetables than any other age groups including that of the pregnant women intakes (Figure 7).

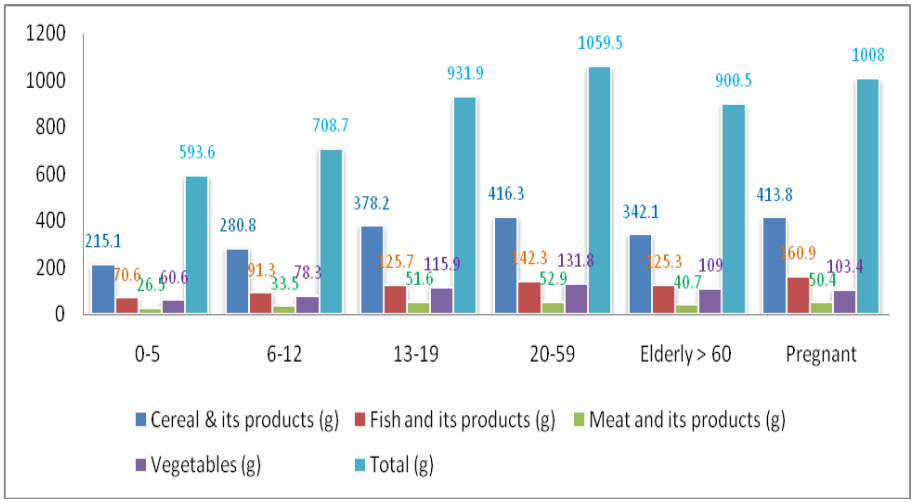


Figure 6 Rice-fish-vegetables across age groups and pregnant women: Cambodia, 2011

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APPENDIX A:

SAMPLING PLAN

FOOD CONSUMPTION AND NUTRITION SURVEYED 2011

I. INTRODUCTION

The national survey concerns Cambodian food consumption and nutrition survey 2011, based on a random sample of 1,200 households selected from the population of Cambodia. The data collection was done using face-to-face interview method. The survey was done taking into consideration the five zones of the country namely Phnom Penh, Coastal, Plain, Plateau/Mountain, Tonle Sap. Villages in each zone were classified as either urban or rural.

II. SAMPLE SIZE DETERMINATION

The total population in Cambodia by 2011, based on the Population Projection (2008-2050) is about **14,317,101** of which **6,976,915** are male and **7,340,186** are female. Using a 95% level of confidence and further adjusted using a 10% non-response rate and 1.5 design effects the total number of sample households in this survey is 1,200.

III. SAMPLING FRAME AND COVERAGE

The latest frame of the general population census of Cambodia, 2008 conducted by the National Institute of Statistics (NIS) was used as the sampling frame in this survey. This frame consists of province code and name, district code and name, commune and name, village code and name. It also has the national map that shows boundaries between villages. The total number of households, with villages classified as urban or rural based on the Reclassification of Urban and Rural Area in Cambodia, is also in the frame.

IV. THE SAMPLE'S CHARACTERISTICS OF SURVEY 2011

The Food Consumption and Nutrition Survey 2011 employed two stage stratified sampling with villages as the primary sampling units (PSUs) and households as secondary sampling units (SSUs). The population was stratified by zone and by urbanity.

Primary Sampling Units selection (PSUs) or Villages

One hundred fifty villages (PSUs) were randomly selected from the entire population of Cambodia. This number was equally allocated among the five zones and further allocated between urban and rural villages. The selection of villages was done using the latest list of villages generated from the updated 2008 census of Cambodia.

Linear Systematic Sampling with Probability Proportional to its Size (LSS-PPS) was employed in selecting the PSUs, with the number of households in a village as the measure of size.

The frame was divided into Phnom Penh and others 23 provinces classified as urban and rural. For notation purposed, the total number of villages will be denoted by **N** and the measure of size of ith village in the stratum denoted by **S**i, for i = 1, 2, 3,....., **N**.
The following procedure explains the Linear Systematic Sampling with Probability Proportional to its Size (LSS-PPS) method

Step 1: Arrange a table format using seven columns and ***N*** rows - one for each in the domain. The seven columns are:

Column (1) is serial number of village (*i*).
Column (2) is Identification of the village consisting of province, district,
Column (3) is name of village.
Column (4) is size of village (Si).
Column (5) is lower limit of selection probability interval (L_i): Lo=1 and $L_i = S_1+S_2+.....+S_{(i-1)} +1$.
Column (6) upper limit of selection probability interval (U_i): $U_i = S_1+S_2+.....+S_i$
the cumulative size, for ***i*** *=1, 2,....., N.*
Column (7) is order of selection.

Step 2: Calculate the sampling interval as $\boldsymbol{I=U_N/n}$, round off to the nearest integer. Here $\boldsymbol{U_N}$ is the last cumulative value in column (6), ***n*** as the total number of sample villages (PSUs) in the domain.

Step 3: Choose the integer of random number *R* in the range *1* to *I* from the supplied table of random numbers or computer calculation as *=int (randbetween(1,I)).*

Step 4: Take R_1= random number R, and generate a sequence of *n* selector number R_1, R_2, R_3,….....,R_n in the following way: Get the next selector number from previous selector number by adding (*I*) in to it. The sample villages will select by using the computer program, the number of households in the village will be used as the measure of size.

Step 2- For the secondary sampling unit's selection (SSUs), 8 households were randomly selected within the selected village from sector urban and rural. The random selection was done with equal probability

V. THE ALLOCATION OF SAMPLE

There are **150** sampled villages allocated among the identified Zones using the alternatives method:

a: 30 sample villages (PSUs) and **240** sample households (SSUs) were allocated into to each zone; each zone was classified as either urban or rural sector, there are **15** sample villages (PSUs) and **120** sample households (SSUs) was distribute in to every sector urban and rural for all zone.

b: 8 sample households was selected with equal probability in every selected village from sector urban and rural.

The following table shows the number of villages and household's distribution by zone, provinces, urban and rural according to the latest listed of village frame of the general population census of Cambodia, 2008 has been done by National Institute of Statistics (NIS).

Table 1: Sampling Frame

Zone	Code	Province Name	No of Villages			No of Households		
			Urban	Rural	Total	Urban	Rural	Total
Phnom Penh	12	Phnom Penh	572	122	694	232,935	17,379	250,314
Coastal	07	Kampot	23	459	482	9,816	119,697	129,513
Coastal	09	Koh Kong	16	103	119	7,384	16,771	24,155
Coastal	18	Sihanoukville	27	476	503	5,389	77,899	83,288
Coastal	23	Kep	2	14	16	962	6,231	7,193
Sub-Totat			68	1052	1120	23551	220,598	244,149
Plain	03	Kampong Cham	88	1,671	1,759	24,875	342,704	367,579
Plain	08	Kandal	100	983	1,083	36,287	218,573	254,860
Plain	14	Prey Veng	16	1,121	1,137	6,988	219,272	226,260
Plain	20	Svay Rieng	12	678	690	3,562	111,196	114,758
Plain	21	Takeo	12	1,104	1,116	2,688	181,017	183,705
Sub-Totat			228	5,557	5,785	74,400	1,072,762	1,147,162
Plateau/Mountain	13	Preah Vihear	10	202	212	2052	30598	32650
Plateau/Mountain	22	Oddar Meanchey	16	272	288	3573	34568	38141
Plateau/Mountain	24	Pailin	11	72	83	3209	11203	14412
Plateau/Mountain	10	Kratie	20	240	260	7,400	57,797	65,197
Plateau/Mountain	11	Mondul Kiri	4	95	99	937	11,318	12,255
Plateau/Mountain	16	Ratanak Kiri	7	234	241	3,736	23,722	27,458
Plateau/Mountain	19	Stung Treng	5	129	134	3,182	17,633	20,815
Plateau/Mountain	05	Kampong Speu	66	1,293	1,359	10,530	138,615	149,145
Sub-Totat			139	2,537	2,676	34,619	325,454	360,073
Tonle Sap	01	Banteay Meanchey	53	587	640	37165	107280	144445
Tonle Sap	02	Battambang	84	703	787	35656	173909	209565
Tonle Sap	17	Siemreap	52	874	926	33934	144878	178812
Tonle Sap	04	Kampong Chhnang	26	542	568	8,294	92,218	100,512
Tonle Sap	06	Kampong Thom	22	745	767	6,674	127,156	133,830
Tonle Sap	15	Pursat	15	95	110	18,318	26,295	44,613
Sub-Totat			252	3,546	3,798	140,041	671,736	811,777
GRAND TOTAL			1,259	12,814	14,073	505,546	2,307,929	2,813,475

Source: The latest of villages frame of the General Population Census of Cambodia 2008, prepared by NIS

Table.2: Distribution No of sample village and household by Zone, Provinces Urban and Rural

Zone	Pro-Code	Province Name	Number of sample villages			Number of sample households		
			Urban	Rural	Total	Urban	Rural	Total
Phnom Penh	12	Phnom Penh	15	15	30	120	120	240
Sub-Totat			15	15	30	120	120	240
Coastal	07	Kampot	4	10	14	32	80	112
Coastal	09	Koh Kong	3	2	5	24	16	40
Coastal	18	Sihanoukville	7	2	9	56	16	72
Coastal	23	Kep	1	1	2	8	8	16
Sub-Totat			15	15	30	120	120	240
Plain	03	Kampong Cham	5	4	9	40	32	72
Plain	08	Kandal	7	3	10	56	24	80
Plain	14	Prey Veng	1	3	4	8	24	32
Plain	20	Svay Rieng	1	2	3	8	16	24
Plain	21	Takeo	1	3	4	8	24	32
Sub-Totat			15	15	30	120	120	240
Plateau/Mountain	13	Preah Vihear	1	0	1	8	0	8
Plateau/Mountain	22	Oddar Meanchey	1	0	1	8	0	8
Plateau/Mountain	24	Pailin	2	0	2	16	0	16
Plateau/Mountain	10	Kratie	3	0	3	24	0	24
Plateau/Mountain	11	Mondul Kiri	1	0	1	8	0	8
Plateau/Mountain	16	Ratanak Kiri	1	0	1	8	0	8
Plateau/Mountain	19	Stung Treng	2	0	2	16	0	16
Plateau/Mountain	05	Kampong Speu	4	15	19	32	120	152
Sub-Totat			15	15	30	120	120	240
Tonle Sap	01	Banteay Meanchey	4	2	6	32	16	48
Tonle Sap	02	Battambang	4	4	8	32	32	64
Tonle Sap	17	Siemreap	4	3	7	32	24	56
Tonle Sap	04	Kampong Chhnang	1	1	2	8	8	16
Tonle Sap	06	Kampong Thom	1	3	4	8	24	32
Tonle Sap	15	Pursat	1	2	3	8	16	24
Sub-Totat			15	15	30	120	120	240
GRAND TOTAL			75	75	150	600	600	1200

Prepared by They Kheam, National Institute of Statistics.

VI. THE PROBABILITY OF SAMPLE SELECTION

a: First stage

The selection probability of village in the ith stratum (*h)* was computed as:

$$P_{1hi} = \frac{n_h \,.\, M_{hi}}{M_h}$$

Where:

$\mathbf{P}_{1hi}$ = probability of selecting the ith village in stratum (*h*)

$\mathbf{n}_h$ = number of sample villages to be drawn from stratum (*h*)

$\mathbf{M}_{hi}$ = number of households in village (*i*) as recorded in the sampling frame

$\mathbf{M}_h$ = total number of households in stratum (*h*) as recorded in the frame.

b: Second stage

In this stage, **8** sample households were selected with equal probability in each selected villages in sector urban and rural. The probability of selecting the jth household in the ith village is given by:

$$P_{2hij} = \frac{F_{hi}}{V_{hi}}$$

Where:

$\boldsymbol{V}_{hi}$ is the number of households in the selected (i^{th}) village according to the village chief.

$\boldsymbol{F}_{hi}$ is the actual number of sample households in urban or rural sectors in the sample i^{th} village.

The overall selection probability for household (***hij)*** will be:

$$P_{hij} = \frac{n_h \times M_{hi}}{M_h} \times \frac{F_{hi}}{V_{hi}}$$

VII. SAMPLING WEIGHT

The sampling weight for household (*hij*) is the inverse of the overall selection probability:

$$W_{hij} = \frac{M_h}{n_h \times M_{hi}} \times \frac{V_{hi}}{F_{hi}}$$

VIII. ESTIMATION PROCEDURE (Extrapolation)

a: Estimation Procedure for Household Information
The estimate of the stratum total is given by the following formula:

$$\hat{Y}_h = \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} y_{hij} \qquad \text{for} \quad i = 1, 2, \ldots, n_h \quad j = 1, 2, \ldots, m_{hi}$$

Where:

$\hat{Y}_h$ = estimate of characteristic ***y*** for stratum ***h***

y_{hij} = any characteristic of household ***j*** in sample village ***i*** in stratum ***h***

m_{hi} = number of sample households in village ***i***

n_h = number of sample villages in stratum ***h***

W_{hij} = as defined

APPENDIX B:

DATA PROCESSING

PART I. Food Consumption Analysis

A. Household Food Consumption

The following estimates will be generated for household consumption by ecological zones and urbanicity:

1. Mean one-day per capita food consumption.
2. Percentage of food to total intake.
3. Proportion of households with per capita energy and nutrient intake that meet the Recommended Energy and Nutrient Intake (RENI) among Cambodia households.

The following estimates will be generated for fish consumption by ecological zones and urbanicity:

1. Mean one-day per capita of fish consumption by fish groups (freshwater, marine, aquaculture and other aquatic animals), by freshwater fish types (blackfish, grayfish and whitefish)
2. Percentage of fish to total food intake

B. Individual Food Consumption

The following estimates will be generated for individual food consumption by ecological zones and urbanicity:

1. Mean one-day per capita food consumption, standard error, confidence interval, coefficient of variation, and percent of total intake among different age groups and gender
2. Mean one-day energy and nutrient intake and proportion that met the RENI among different age group and gender
3.

The following estimates will be generated for individual fish consumption by ecological zones and urbanicity:

1. Mean one-day per capita fish consumption, standard error, confidence interval, coefficient of variation, and percent of total intake by fish groups and types among different age groups and gender
2. Mean contribution of fish consumption by fish groups and types to one-day energy and nutrient intake among different age group and gender.

PART II. Household Food Insecurity Survey

Descriptive analysis and frequency distribution will be done to describe the household food security of the Cambodian households. It will be further described by ecological zones and urbanicity.

The following estimates will be generated to describe food (in) security of the households:

1. Percentage of food insecure mothers/caregivers and frequency of experience during the past 4 weeks before the surveys.
2. Estimates of the prevalence of food insecure households with children
3. Prevalence of insecure households and frequency of experience during the past 4 weeks before the survey

SOCIO-ECONOMIC AND DEMOGRAPHIC SURVEY

Descriptive analysis and frequency distribution will be done to describe the socio-demographic characteristics of the Cambodian households. Characteristics of these households will be further described per ecological zones and urbanicity.

The following estimates of household and household member profiles will be generated:

A. Household profile
   1. Percentage distribution of households by educational attainment
   2. Percentage distribution of households by tenure
   3. Percentage distribution of households by land ownership
   4. Percentage distribution of households by size
   5. Percentage distribution of households by residency
   6. Percentage distribution of households by assets (appliances, equipment, machinery, etc)
   7. Percentage distribution of households by food expenditure

B. Household member profile
   1. Percentage distribution of household member by educational attainment
   2. Percentage distribution of household member by occupation
   3. Percentage distribution of household member by source of income
   4. Percentage distribution of household member by gender (male, female)
   5.

STATISTICAL ANALYSIS

ESTIMATION PROCEDURE

Survey Weight

The complexity of the sample design of the survey needs to be considered in generating estimates of mean of indicators of interest and proportion of attribute of interest. Survey weights and variance estimation are the two aspects to be taken into account. Surveys weights compensate for the unequal selection probability used in the sample design and for non-response. Considering all these aspects, the final survey weight is computed as the product of base weights and non-response adjustment rate. Base weight is calculated as the inverse of the unit's probability of selection for the sample, i.e. $w_d = 1/f_d$, where f_d is the adjusted probability of selection of household in a given ecozone d . In the case of non-response weighting adjustments, a weighting class adjustment form given by $w'_d = \frac{n_d}{n_d'}$ is to be employed, where n_d is the total eligible respondents in ecozone d and n'_d is the achieved number of respondents in ecozone d .

Ecozone Level, Gender and urbanicity

Estimate of the mean food intake will be done per ecozone (PH, mountains and plateaus, plains, coastal, and tonle sap). Consider estimating a population total. Let Y_i be the value of the response variable Y, W_i the final weight for respondent i, the number of population units that respondent i represents and $\sum W_i$ estimates the total number of units in the population N. Thus, the estimator for the population total Y is given as $\hat{Y} = \sum W_i Y_i$. Clearly, the estimator for the population mean, is $\bar{Y} = \frac{\sum W_i Y_i}{\sum W_i}$.

Variance Estimation

Consider estimating population total in each stratum, then variance of $\hat{Y}_h = \sum_\alpha \sum_i W_{\alpha i} Y_{\alpha i}$ can be estimated by

$$v(\hat{Y}_h) = \frac{a_h}{a_{h-1}} \sum_\alpha \left(Y_{h\alpha} - \frac{\hat{Y}_h}{a_h} \right)^2$$

where $Y_{h\alpha} = \sum_i W_{\alpha i} Y_{\alpha i}$ is the weighted total of the survey variable Y for PSU α in stratum h and a_h is the number of sampled PSUs in that stratum.

APPENDIX C:

ENUMERATORS GUIDE AND QUESTIONNAIRS ON THE FOOD AND NUTRIENT CONSUMPTION SURVEY 2011

I. Introduction

This survey focuses on household food consumption and other indicators of food security undertaken in each ecological zone covering all provinces of Cambodia with the aim of determining national food and nutrition security. Specifically, this survey will assess the relative contribution made by each major category of fish species (*blackfish*, *greyfish*, *whitefish*) and Other Aquatic Animal (OAAs) to food and nutrition security.

The household food consumption survey will include some socio-demographic data, but the bulk of the questions is streamlined in estimating the food and nutrition security of each of the household by using the food frequency questionnaire (FFQ) and the 24-hour food recall questionnaire. The 24-hour food recall questionnaire will also include questions on the consumptive and non-consumptive use of fish and identification of fish consumed by fish type (black, grey and whitefish). Identification of fish type consumed will be aided by use of the fish catalogue developed at Inland Fisheries Research and Development Institute (IFReDI), Fisheries Administration, Cambodia. The food frequency questionnaire is modified to estimate the seasonality of the food consumed by the household.

Other indicators (ordinal scale) of food security will be scored using the USAID Food and Nutrition Technical Assistance (FANTA)- Household Food Insecurity Access Scale (HFIAS)
For the household, a face-to-face interview with the mother (who usually prepares the food) will be conducted using the food frequency and the food security questionnaires.
All individual members of the household will also be interviewed (face-to-face) using the 24-hour food recall questionnaire.

The household food consumption survey will employ the food weighing method in collecting one-day food intake data, that is, food eaten during breakfast, lunch, dinner and in-between meals inside and outside the household. Food wastage in every meal and left-over of the day's consumption will also be accounted for.
Details of the questionnaires are found in Annex 4.
It must be remembered that **ALL INFORMATION THAT ARE ASKED IN THE QUESTIONNAIRES MUST BE PROVIDED.**

II. Questionnaires

A. Respondent and Household Information

1. Fill in the boxes before ***Respondent Information***. Appropriately write the corresponding code for ecological zone, province, village and household number (no.) as found in Annex 1.
2. Get the questionnaire identification number ID by combining the codes in the order from ecological zone, province, village to household No. See example below.

Ecological Zone: PHN	Province:1	Village:7
Household No:5	**Questionnaire ID No: PHN175**	Time:(Start_____ Finish_____)

3. Write the **Questionnaire ID No**. **PHN175** in all the pages of the questionnaire. This will facilitate the return of any detached page to the original questionnaire.
4. Fill in the exact time **when the interview is started.** Fill in the time **when finished at the end of the interview.**
5. Fill in the **RESPONDENT INFORMATION.**
6. Fill in the **HOUSEHOLD INFORMATION**.

B. The Household Food Insecurity Access Scale

The details of the food security questionnaire are found **Table 1 Annex 4.**

B.1. Recording the response

1. Each of the questions in the food security questionnaire is asked with a recall period of four weeks or 30 days. The response options are pre-coded as 0 = No Go to ___) and 1 = Yes. Questions 1 to 9 are occurrence questions. Questions 1.a to 9.a are frequency-of-occurrence questions. See Annex 2 for more details.

1. The respondent is first asked an occurrence question, that is, whether the condition has happened at all in the past four weeks. The occurrence question (**Q1**) is **"In the past four weeks, did you worry that your household would not have enough food?"** Response or answer is either **No** or Yes.

a. If the respondent answered "**Yes**" to the occurrence question (**Q1**), write **1** in the box under **CODE.** Then proceed to **Q1.a**, **"How often did this happen?"**

a.1. **Q1.a** is the **frequency-of-occurrence question**. This is asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks. See **RESPONSE OPTIONS** in the table below.

a.2. If the respondent answered **" Sometimes (three to ten times in the past four weeks)",** write **2** in the box under **CODE.**

NO	QUESTION	RESPONSE OPTIONS	CODE
1.	In the past four weeks, did you worry that your household would not have enough food?	0 = No (skip to Q2) 1=Yes	…|_1_|
1.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	…|_2_|

b. If the respondent answered **"No"** to the occurrence question (**Q1**), write **0** in the box under **CODE,** then GO to another occurrence question, **Q2**. See the table below.

NO	QUESTION	RESPONSE OPTIONS	CODE
1.	In the past four weeks, did you worry that your household would not have enough food?	0 = No (Go to Q2) 1 =Yes	….|_0_|
1.a	How often did this happen? **DO NOT ANSWER**	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|
2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (Go to Q3) 1 = Yes	….|_1_|

B.2. Asking Questions and Providing Answers

The respondent should be the person in the household who is most involved with the food preparation and meals. Usually, this is the mother. The mother, as the respondent, answers most of the questions in behalf of the household and its members. During the interview, instances will happen that the respondent may not elicit an answer or response. This may be due to the fact that the respondent does not understand the question. The interviewer then may prompt the respondent to answer by either explaining some terms in the questions or by giving examples.

In the food security questionnaire (HFIAS), there are two terms that are used throughout the questionnaire that are highly context specific. These are "**household**" and "**lack of resources**" which the respondent may not fully understand. Thus, the interviewer must provide the definition and examples. The definition and examples are already included in the questionnaire.

The definitions for these terms should be read by the interviewer the first time they are used in a question. These definitions and the questions themselves of should be read just as they are written on the questionnaire and are written in *italics* either below the occurrence or the frequency-of-occurrence question.

During the interview, both the questions and either the definition or the examples should be read by the interviewer. The **RESPONSE OPTIONS** are never read aloud to the respondent but rather allow the respondent to answer in his or her own words.

Below is an example of an occurrence question with an interviewer-provided definition. Both must be read aloud by the interviewer.

NO	QUESTION	RESPONSE OPTIONS	CODE
1.	In the past four weeks, did you worry that your household would not have enough food? *By "**household**" we mean those of you that sleep under the same roof and take meals together at least four days a week.*	0 = No (Go to Q2) 1=Yes	….|__|

If the respondent does not understand the question (**Q1**), then the interviewer may prompt the respondent by reading the definition of ***household***. The definition may be restated by the enumerator to facilitate its understanding by the respondent.

Below is example of a question (**Q4**) with an interviewer-provided example.

NO	QUESTION	RESPONSE OPTIONS	CODE
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources? ***"A food you really did not want to eat" might include wheat porridge, wild taro root, eels, snake, insects, etc.***	0 = No (Go to Q2) 1=Yes	….|_**1**_|

If, after asking an occurrence question (**Q4**), the respondent answered "**No**" but added that it only happened **a few times**, then the correct code is '**1**' (Yes).

NO	QUESTION	RESPONSE OPTIONS	CODE
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources? ***"A food you really did not want to eat" might include***	0 = No (Go to Q2) 1=Yes	….|_**1**_|

	wheat porridge, wild taro root, eels, snake, insects, etc. Respondent's answer**: No but a few times.**		

The frequency-of-occurrence question (**Q4.a**) should then be asked. If the respondent describes a frequency as "three to ten times" in the past four weeks, the correct response selection for the frequency-of-occurrence question is "**Sometimes**", and the correct code is '**2**'. If the respondent has difficulty in replying, then the interviewer can encourage a response by listing the set of options again. The box below illustrates the example as described above.

O	QUESTION	RESPONSE OPTIONS	CODE
4.	How often did this happen? Respondent answer: **four times**	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	..|_**2**_|

B.3. Administration of the questionnaire

The administration of the questionnaire requires proximately 15 minutes per household.

B.4. Instructions for Individual Questions

Refer to **Annex 3** for instructions for individual questions.

C. Food Frequency Questionnaire (FFQ)

The format of the food frequency questionnaire is shown in **Table 2 Annex 4.**

A food frequency questionnaire is used to obtain qualitative or semi-quantitative descriptive information about the usual food consumption patterns. This is accomplished by assessing the frequency with which certain food items or food groups are consumed during a specified time or period (daily, weekly, monthly or yearly). For the purpose of this study the questionnaire is modified to enable the respondent to recall the frequency of all food/meal/dish that was eaten by the family during the wet and dry season.

The respondent for this questionnaire is usually the household member who prepares and procures the food and, in usual cases, the mother is the respondent.

The interviewer should have a wide knowledge of the traditional meals/dishes, including the ingredients that are being cooked/prepared here in Cambodia (especially in the provinces).

1. The food items in the food frequency questionnaire are already grouped into different food types: a) cereals and cereal products; b) starchy roots and tubers; c) pulses; d) meat; e) fish; f) eggs; g) sweets and syrups; h) vegetables; i) fruits, j) milk; k) fats; l) others. For the purpose of this study, fish is further grouped in fish types (blackfish, grey fish and whitefish), aquaculture, marine and preserved.

The questionnaire contains a prelisted food items under each food type. Food items gathered in the course of the interview and were eaten by the household will be listed as others. During checking of the questionnaire after the interview has been completed, interviewer will list them under their appropriate food type.
Interviewer will obtain the frequency of eating the different food items during the dry and the wet season.
A fish catalogue will be provided to help the respondent identify the fish type that the household ate.
Below are the suggested steps in filling in the food security questionnaire.

1. **DO NOT ANSWER** the shaded columns. The data will be derived from the 24 hour food recall questionnaire.

2. Filling in the columns with the data.
   a. Fill in the data asked for each column from left to right.
   b. Determine the frequency of intake of each of the food item by the household starting from the wet season to the dry season.

      i. If the respondent answered that the food item was eaten daily during the wet season, then ask how many times the food was eaten in a day or daily. Then, ask the same for the dry season. Below is an example.

         Interviewer: How many times did you eat cooked during the wet season that is, during the months from June to October?
         Respondent: Daily.
         Interviewer: How many times did you eat cooked rice in a day?
         Respondent: Three times.

      Interviewer records 3x under Daily.

		FREQUENCY			FREQUENCY		
		WET SEASON (June-October)			DRY SEASON (November-May))		
Food Item	Amount of Usual Portion of Intake	Daily	Weekly	Monthly	Daily	Weekly	Monthly
Rice, cooked		3			4		

      Interviewer asks the same question –response pattern for the dry season. If the final answer is four times, then it is recorded as shown above.

      ii. If the respondent answered weekly, the frequency of eating the food within one (1) week is determined following the same question-response pattern applied as in (i).

         Interviewer: How many times do you eat rice porridge during the _____ season that is, during the months from _____?
         Respondent: Weekly.

Interviewer: How many times did you eat rice porridge within one week

Respondent: Three times (for the wet season).
Respondent: Five times (for the dry season).

Respondent's answers are recorded as shown below.

		FREQUENCY			FREQUENCY		
		WET SEASON (June-October)			DRY SEASON (November-May))		
Food Item	Amount of Usual Portion of Intake	Daily	Weekly	Monthly	Daily	Weekly	Monthly
Rice porridge			3			5	

iii. Using the same question-response pattern, the respondent's answers are twice a month for the wet season and once a month for the dry season; the responses are recorded as shown below.

		FREQUENCY			FREQUENCY		
		WET SEASON (June-October)			DRY SEASON (November-May))		
Food Item	Amount of Usual Portion of Intake	Daily	Weekly	Monthly	Daily	Weekly	Monthly
Pork porridge				2			1

iv. If for instance, the question-response pattern is five times daily in the wet season and ten times within a month in the dry season, the responses are recorded as below.

		FREQUENCY			FREQUENCY		
		WET SEASON (June-October)			DRY SEASON (November-May))		
Food Item	Amount of Usual Portion of Intake	Daily	Weekly	Monthly	Daily	Weekly	Monthly
Fish porridge		5					10

D. 24-Hour Food Recall Questionnaire

The 24-hour food recall measures the retrospective food intake of an individual.

Use Table 3 of the 24-hour food recall questionnaire for the mother, Table 5 for infants and young children and Table 6 for other members of the household. Details of the 24-hour food recall questionnaire is found in Annex 2.

Start the interview with the household member who prepares the food. Usually, the mother is the first respondent.

1. Fill in **columns 2, 3, 4 and 5,** use **Table 3**. See **Annex 4.** Information will be obtained from the respondent, who usually is the mother. In case the mother is not around, any member of the family who also is usually involved in the preparation of food/dish may be interviewed.
   a. For filling up **column 2, NAME OF FOOD ITEM/DISH/DRINKS**, ask the respondent to recall all the food item/dish/drinks that s/he prepared for and eaten by the household during the preceding 24-hrs (yesterday) starting at the time of waking and before going to sleep.

Respondent: (Mother) " I cooked boiled egg, coffee and rice yesterday morning, rice porridge and dried fish for lunch, boiled mix vegetables and rice for dinner".

List in **column 2**.

Shown below is **column 2** with the list of food item/dish/drinks prepared by the mother and eaten by the household.

MEAL	NAME OF FOOD ITEM/DISH/DRINKS	METHOD OF PREPARATION	INGREDIENTS	SOURCE (A.P.) (If fish is mentioned go to Table 4)
1	*2*	*3*	*4*	*5*
Breakfast	boiled egg			
	Cooked rice			
	Coffee			
Lunch	Rice porridge			
	Dried fish			
Dinner	Boiled mixed vegetables			
	Cooked rice			

Read aloud to the respondent the listed food items /dish /drinks in **column 2** to confirm if there has been no food items /dish/drinks that might have been missed out.

   b. For filling up **column 3, METHOD OF FOOD PREPARATION,** ask the respondent to describe in detail the method of cooking each of the food item/dish/drinks listed in column 2. Methods of cooking maybe boiling, stewing,

frying, blanching, grilling, roasting, toasting, sautéing, stir-fry, brewing as in coffee, baking, etc.

MEAL	NAME OF FOOD ITEM/DISH/DRINKS	METHOD OF PREPARATION	INGREDIENTS	SOURCE (A.P.) (If fish is mentioned go to Table 4)
1	*2*	*3*	*4*	*5*
Breakfast	boiled egg	boiling		
	Cooked rice	Steaming/boiling		
	Coffee	Boiling/brewing		
Lunch	Rice porridge	Boiling until thick		
	Dried fish	Frying		
Dinner	Boiled mixed vegetables	Boiling		
	Cooked rice	Steaming/boiling		

c. For filling up column 4, INGREDIENTS, ask the respondent to enumerate the ingredients that were used in cooking the food item/dish/drinks. Ask the respondent to describe in detail the nature and characteristics of the ingredients that were used like specific parts of the animal or plants, brand name, type of cereal (glutinous or non-waxy), variety, enriched or fortified, breed of chicken, type of egg, cut of meat, etc.. Interviewer must also asks the **amount** of the ingredients that were used during cooking such amounts of water and rice used in rice porridge, amount of fish in fish porridge or amount of vegetables used in stewed or boiled mixed vegetable, amount of salt, pepper or oil used, and others. If the respondent could not give the amounts, Interviewer must obtain the amounts by actual weighing of the ingredients.

d.

MEAL	NAME OF FOOD ITEM/DISH/ DRINKS	METHOD OF PREPARATION	INGREDIENTS	SOURCE (A.P.) (If fish is mentioned go to Table 4)
1	*2*	*3*	*4*	*5*
Breakfast	boiled egg	boiling	**Egg**: 1 chicken egg, medium size, white color)	
	Cooked rice	Steaming/boiling	**Rice**: 6 cups of raw rice, non-waxy, white in color	

			Water: 6 cups of water	
	Coffee	Boiling/brewing	**Coffe**e: 5 tablespoons, native, ground **Water:** 7 cups of water	
Lunch	Rice porridge	Boiling until thick	**Rice:** ¼ k (250 g), waxy or glutinous, white **Water :** 5 cups of water	
	Dried fish	Frying (fried in 1 tablespoon oil)	**Fish:** 200 grams **Oil**: 2 tablespoons	
Dinner	Boiled mixed vegetables	Boiling (3 cups of young leaves or edible portion in 2 cups of water)	**Carrots:** 100 grams **Morning glory:** 150 grams **Squash Leaves**: 120 grams **Salt:** 1 teaspoon	
	Cooked rice	Steaming/boiling	**Rice**: 4 cups of raw rice, non-waxy, white in color **Water:** cups of water	

e. For filling up **column 5, SOURCE,** ask the respondent to describe the source of each of the ingredient like purchased from the market, traded, own production, etc. If fish is used as an ingredient, use **Table 4.** See Annex 4 for its details.

MEAL	NAME OF FOOD ITEM/DISH/DRINKS	METHOD OF PREPARATION	INGREDIENTS	SOURCE (A.P.) (If fish is mentioned go to Table 4)
1	*2*	*3*	*4*	*5*
Breakfast	boiled egg	boiling	**Egg**: 1 chicken egg, medium size, white color)	Market, purchased
	Cooked rice	Steaming/boiling	**Rice**: 6 cups of raw rice, non-waxy, white in color **Water:** 6 cups of water	**Rice**: own production
	Coffee	Boiling/brewing	**Coffe**e: 5 tablespoons, native, ground **Water:** 7 cups of water	**Coffee:** traded
Lunch	Rice porridge	Boiling until thick	**Rice:** ¼ k (250 g), waxy or	**Rice:** market,

			glutinous, white **Water :** 5 cups of water	purchased
	Dried fish	Frying (fried in 1 tablespoon oil)	**Fish:** 200 grams **Oil**: 2 tablespoons	**Fish: (Go to Table 4)** **Oil:** market, purchased
Dinner	Boiled mixed vegetables	Boiling (3 cups of young leaves or edible portion in 2 cups of water)	**Carrots:** 100 grams **Morning glory:** 150 grams **Squash Leaves**: 120 grams **Salt:** 1 teaspoon	**Carrots:** market, purchased **Morning glory:** own production **Squash leaves:** own production **Salt:** market, purchased
	Cooked rice	Steaming/boiling	**Rice**: 4 cups of raw rice, non-waxy, white in color **Water:** cups of water	**Rice**: market, purchased

CONSUMPTIVE AND NON-CONSUMPTIVE USE OF FISH IN THE HOUSEHOLD

The purpose of this questionnaire is to determine where the household gets its fish and what is immediately done to the fish after acquiring it. This is **Table 4** of the 24-hour food recall questionnaire.

In the instance that the respondent could not identify the fish eaten by the household, use the fish catalogue for proper identification whether blackfish, grayfish, whitefish, marine or aquaculture. In the example below, respondent identified the fish as blackfish and was eaten at lunch. See column 2 of Table 3.
For filling in Table 4, the following steps should be followed.

1. Ask for the source where they got the fish. Get the corresponding amount. For example, 1 kg (1000 g) of blackfish was purchased from the market, 1kg (1000 g) of blackfish was harvested from their farm.

2. Ask what is done with the blackfish after acquiring it, also get the corresponding amount. For example, 500 grams were stored and 1500 grams were cooked and eaten.

Table 4. Consumptive and Non-Consumptive Use of Fish and Other Aquatic Animals (OAA) in the Household.

Type of Fish	Type of Fresh Fish	Species	Source	Corresponding Amount of Fish (grams)	Total Amount of Fish (grams)	Consumptive and Non-Consumptive Use	Corresponding Amount of Fish (grams)
A. FRESHWATER FISH							
BREAKFAST	1- Blackfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	2- Greyfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	3- Whitefish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
LUNCH	1- Blackfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	2- Greyfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	3- Whitefish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
DINNER	1- Blackfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	2- Greyfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	

			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	3- Whitefish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
B. AQUACULTURE							
BREAKFAST			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
LUNCH			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
DINNER			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	

C. MARINE							
BREAKFAST			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
LUNCH			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
DINNER			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	

2. For filling in **columns 6, 7, 8, 9, and 10**, start the interview with the mother. Use **Table 3** which is the same table that you used for filling up **columns 1 to 5**.
   a. For younger children, interview the mother or primary caretaker. There is a separate table for children, **Table 5**. Instructions on how to fill in the table is found on page _85 (Point E)____.
   b. For the elderly, if they are no longer capable of answering the questions, then, interview the mother or primary caretaker. Use **Table 6.**
   c. If other members of the household were not present during the interview, the mother will also be interviewed in their behalf. **Use Table 6.**
   d. For the other members of the household, use **Table6**.

3. For filling up **columns 6 and 7**, all food eaten by each member of the household should be weighed, but in circumstances that it cannot be done, get an accurate estimation of portion size. Express weights in milligram (mg), grams(g) or kilogram (K) and length, height and width in millimeter (mm), centimeter (cm) or meter (m). Weigh or measure twice.

   Estimation of food eaten can be done as described below.
   a. Portion size can be estimated by use of measures like standard measuring cup, teaspoon, tablespoon, household bowl, glass or use of ruler.
   b. If the food is available at the time of interview, get the actual weight by using the weighing scale. Some examples are found below.

   [1] If there is no boiled egg available, just weigh the raw egg and note it on the column that you measured the raw ingredient.

   [2]If there is cooked rice, measure the actual weight by using the cup used by the household member.

   [3]If fish type is not available, ask which part of the fish was eaten, then measure the length using a ruler.

   [4] If carrot is not available, get length, width or height, using a ruler.

MEAL	NAME OF FOOD ITEM/DISH/DRINKS	METHOD OF PREPARATION	INGREDIENTS	SOURCE (A.P.) (If fish is mentioned go to Table 4)	PORTION SIZE EATEN BY THE HOUSEHOLD	ACTUAL WEIGHT OF FOOD EATEN
1	*2*	*3*	*4*	*5*	*6*	*7*
Breakfast	boiled egg	boiling	**Egg**: 1 chicken egg, medium size, white color)	**Egg:** Market, purchased		**60 g (raw)**[1]
	Cooked rice	Steaming/boiling	**Rice**: 6 cups of raw rice, non-waxy, white in color **Water:** 6 cups of water	**Rice**: own production		**130 g**
	Coffee	Boiling/brewing	**Coffe**e: 5 tablespoons, native, ground **Water:** 7 cups of water	**Coffee:** traded		
Lunch	Rice porridge	Boiling until thick	**Rice:** ¼ k (250 g), waxy or glutinous, white **Water :** 5 cups of water	**Rice:** market, purchased		
	Dried fish	Frying (fried in 1 tablespoon oil)	**Fish:** 200 grams **Oil**: 2 tablespoons	**Fish: (Go to Table 4)** **Oil:** market, purchased	**6 cm long**[3]	
Dinner	Boiled mixed vegetables	Boiling (3 cups of young leaves or edible portion in 2 cups of water)	**Carrots:** 100 grams **Morning glory:** 150 grams **Squash Leaves**: 120 grams **Salt:** 1 teaspoon	**Carrots:** market, purchased **Morning glory:** own production **Squash leaves:** own production **Salt:** market, purchased	**4 cm long, 1 cm thick, 4 pieces**[4]	
	Cooked rice	Steaming/boiling	**Rice**: 4 cups of raw rice, non-waxy, white in color **Water:** cups of water	**Rice**: market, purchased		

c. If fish is mentioned, identify the fish, then; get the portion size or weight (Table 5). If possible use a ruler in estimating the amount of fish eaten by measuring the length.
    - For identification of fish, ask the respondent by showing the fish catalogue provided. The interviewer will then check if it belongs to the grayfish, whitefish and blackfish types, marine or aquaculture. Then write the species where the fish belong for counter checking. For OAA (other aquatic animals) just provide the common name.

d. For mixed dish,
    - Weigh each ingredient (raw or cooked).
    - Estimate total weight of cooked food.
        - Ask the mother to show the level of the cooked food in the cooking pot.
        - Pour water up to this level.
        - Weigh.

e. If possible ask respondents to serve the actual portion size of each staple food including gruels or porridge consumed into their own bowls or plates, then get actual weight.

4. For filling in **columns 8, 9 and 10**, weigh food or measure portion size for any leftovers for each of the food items, dish, drinks or ingredients. Measure the left over and record in the appropriate column.

   Example**: Interviewer**: "Was there any leftover from what you have eaten?
   Respondent: " I only ate half of the food".

Plate waste/ Leftovers (grams/portion)	[1]WHAT WAS DONE TO THE LEFTOVER 1= EATEN AGAIN[2] 2= THROWN 3= FED TO THE ANIMALS 4=FERTILIZERS 5=OTHERS(PLEASE SPECIFY	[2]EATEN AGAIN BY WHOM AND HOW MUCH
8	*9*	*10*
Half of the egg	1	By father, everything was eaten(half of the egg)

5. Review recall to check all items are recorded correctly.

6. Check if every household member has completed the 24-hour food recall questionnaire.

E. Food Intake of infant and young children in the Household.

1. Use **Table 5.** See Annex 4 for the details of the questionnaire.

2. Place name of child, age in months and gender in appropriate boxes. If there is more than one infant or young child in the family, use another form.

3. Ask if the child is still breastfeeding, if 'yes' proceed in answering all questions in the table. If 'no' proceed to question 3.

4. Ask for the frequency of breastfeeding (How many times in a day?).

5. Ask for the length of breastfeeding (How long do you breastfeed?).

6. Ask if complimentary food is given. By complimentary feeding, we mean any food, drinks, supplements, vitamins and beverages except medications that is given to the child that is not breast milk.

7. Interview the mother for filling in the 24-hour food recall questionnaire of infant and young children. Include in the food intake recall, any complementary the complimentary food given to the child.

F. Checking over the questionnaires

After completing the questionnaire and before leaving the household, interviewers should check over the completeness of each other's questionnaires. Interviewer should also check if the responses recorded are complete and legible. They may wish to write notes in the margins next to any unusual responses or stories that emerged in relation to a particular question.

The Team Leader assigned must ensure that **ALL** information asked are correctly and legibly provided.

Annex 1. Reference code of ecological zone, provinces, village and household.

Ecological Code	Zone	Province Code	Province Name	District Code	District Name	ComCode	Commune Name	Village Code	Village Name	(1)Urb; (2)Rural	HH Listed
PLN	Plain	**03**	Kampong Cham	**05**	Krong Kampong Cham	**01**	Boeng Kok	**05**	La Edth	**1**	8
PLN	Plain	**03**	Kampong Cham	**05**	Krong Kampong Cham	**03**	Sambuor Meas	**09**	Kampong Roling	**1**	8
PLN	Plain	**03**	Kampong Cham	**13**	Prey Chhor	**03**	Chrey Vien	**08**	Ou Kambot	**1**	8
PLN	Plain	**03**	Kampong Cham	**16**	Tboung Khmum	**08**	Chob	**12**	Phum Dabpram	**1**	8
PLN	Plain	**03**	Kampong Cham	**17**	Krong Suong	**01**	Suong	**11**	Chong Angkrang	**1**	8
PLN	Plain	**08**	Kandal	**02**	Kien Svay	**05**	Kbal Kaoh	**03**	Preaek Thum	**1**	8
PLN	Plain	**08**	Kandal	**02**	Kien Svay	**09**	Preaek Aeng	**03**	Mitakpheap	**1**	8
PLN	Plain	**08**	Kandal	**08**	Angk Snuol	**01**	Baek Chan	**06**	Prey Samraong	**1**	8
PLN	Plain	**08**	Kandal	**09**	Popnhea Lueu	**09**	Preaek Phnov	**01**	Duong	**1**	8
PLN	Plain	**08**	Kandal	**11**	Krong Ta Khmau	**03**	Daeum Mien	**01**	Daeum Mien	**1**	8
PLN	Plain	**08**	Kandal	**11**	Krong Ta Khmau	**04**	Ta Khmau	**02**	Preaek Samraong	**1**	8
PLN	Plain	**08**	Kandal	**11**	Krong Ta Khmau	**06**	Kampong Samnanh	**01**	Kampong Samnanh	**1**	8
PLN	Plain	**14**	Prey Veng	**07**	Peam Ro	**07**	Preaek Khsay Kha	**04**	Phum Buon	**1**	8
PLN	Plain	**20**	Svay Rieng	**06**	Krong Svay Rieng	**01**	Svay Rieng	**02**	Veal Yon	**1**	8
PLN	Plain	**21**	Takeo	**08**	Krong Doun Kaev	**02**	Roka Khnong	**09**	Phum Muoy	**1**	8
PLN	Plain	**03**	Kampong Cham	**04**	Dambae	**03**	Kouk Srok	**04**	Kouk Srok	**2**	8
PLN	Plain	**03**	Kampong Cham	**09**	Krouch Chhmar	**02**	Chumnik	**03**	Svay Damnak	**2**	8
PLN	Plain	**03**	Kampong Cham	**12**	Ponhea Kraek	**03**	Kak	**21**	Stueng Touch	**2**	8
PLN	Plain	**03**	Kampong Cham	**15**	Stueng Trang	**03**	Dang Kdar	**06**	Phum Thmei	**2**	8
PLN	Plain	**08**	Kandal	**01**	Kandal Stueng	**14**	Preaek Kampues	**05**	Srei Snam	**2**	8
PLN	Plain	**08**	Kandal	**04**	Kaoh Thum	**09**	Preaek Chrey	**02**	Preaek Chrey	**2**	8
PLN	Plain	**08**	Kandal	**08**	Angk Snuol	**14**	Samraong Leu	**02**	Boeng	**2**	8
PLN	Plain	**14**	Prey Veng	**01**	Ba Phnum	**05**	Roung Damrei	**04**	Svay Khnei	**2**	8
PLN	Plain	**14**	Prey Veng	**05**	Me Sang	**02**	Chres	**12**	Boeng	**2**	8
PLN	Plain	**14**	Prey Veng	**09**	Preah Sdach	**02**	Banteay Chakrei	**02**	Kaoh Chuor Ti Pir	**2**	8
PLN	Plain	**20**	Svay Rieng	**01**	Chantrea	**08**	Prey Kokir	**01**	Angk Kduoch	**2**	8
PLN	Plain	**20**	Svay Rieng	**05**	Svay Chrum	**10**	Kraol Kou	**07**	Boeng Rae Khang Tboung	**2**	8
PLN	Plain	**21**	Takeo	**02**	Bati	**15**	Trapeang Sab	**03**	Trapeang Tuem	**2**	8
PLN	Plain	**21**	Takeo	**07**	Samraong	**05**	Khvav	**08**	Kab Nuem	**2**	8
PLN	Plain	**21**	Takeo	**10**	Treang	**12**	Srangae	**15**	Putthi Sam	**2**	8

Ecological Code	Zone	Province Code	Province Name	District Code	District Name	ComCode	Commune Name	Village Code	Village Name	(1)Urb; (2)Rural	HH Listed
PHN	Phnom Penh	**12**	Phnom Penh	**01**	Chamkar Mon	**04**	Boeng Keng Kang Bei	**01**	Phum 1	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**01**	Chamkar Mon	**10**	Tuol Tumpung Ti Muoy	**03**	Phum 3	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**02**	Doun Penh	**06**	Phsar Kandal Ti Pir	**07**	Phum 7	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**03**	Prampir Meakkakra	**01**	Ou Ruessei Ti Muoy	**03**	Phum 3	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**03**	Prampir Meakkakra	**07**	Veal Vong	**12**	Phum 12	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**04**	Tuol Kouk	**06**	Tuek L'ak Ti Bei	**10**	Phum 10	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**04**	Tuol Kouk	**10**	Boeng Salang	**05**	Phum 5	**1**	8

PHN	Phnom Penh	**12**	Phnom Penh	**06**	Mean Chey	**01**	Stueng Mean chey	**03**	Phum Trea	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**06**	Mean Chey	**02**	Boeng Tumpun	**04**	Phum Kbal Tumnub	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**06**	Mean Chey	**06**	Chak Angrae Leu	**01**	Phum Preaek Takoang	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**07**	Ruessei Kaev	**02**	Tuol Sangkae	**02**	Phum Tuol Sangkae	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**07**	Ruessei Kaev	**06**	Ruessei Kaev	**02**	Phum Sammeakki	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**07**	Ruessei Kaev	**09**	Preaek Ta Sek	**04**	Phum Preaek Ta Sek	**2**	8
PHN	Phnom Penh	**12**	Phnom Penh	**08**	Saensokh	**01**	Phnom Penh Thmei	**05**	Phum Phnom Penh Thmei	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**08**	Saensokh	**02**	Tuek Thla	**09**	Phum Tuek Thla	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**05**	Chaom Chau	**21**	Phum Trapeang Thloeng	**1**	8
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**02**	Trapeang Krasang	**06**	Phum Trapeang Anhchanh	**2**	8
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**02**	Trapeang Krasang	**13**	Sameakki 3	**2**	8
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**03**	Kouk Roka	**06**	Phum Trapeang Pou	**2**	8
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**03**	Kouk Roka	**14**	Phum Andoung	**2**	8
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**04**	Phleung Chheh Roteh	**06**	Phum Phleung Chheh Roteh Kaeut	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**07**	Pong Tuek	**04**	Phum Voat Slaeng	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**08**	Prey Veaeng	**02**	Phum Prey Veaeng Khang Kaeut	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**09**	Samraong Kraom	**05**	Phum Samraong	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**10**	Prey Sa	**03**	Phum Prakar	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**10**	Prey Sa	**11**	Roka Kaoh	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**11**	Krang Thnong	**09**	Phum Krang Angkrang 2	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**13**	Prateah Lang	**02**	Phum Phea	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**15**	Cheung Aek	**01**	Phum Cheung Aek	**2**	?
PHN	Phnom Penh	**12**	Phnom Penh	**05**	Dangkao	**15**	Cheung Aek	**06**	Phum Borei kammeakkar	**2**	?

Zone	Province Code	Province Name	District Code	District Name	ComCode	Commune Name	Village Code	Village Name	(1)Urb; (2)Rural	HH Listed
Tonle Sap	**01**	Banteay Meanchey	**06**	Krong Serei Saophoan	**02**	Kampong Svay	**03**	Phum Pir	**1**	8
Tonle Sap	**01**	Banteay Meanchey	**06**	Krong Serei Saophoan	**07**	Preah Ponlea	**03**	Phum Bei	**1**	8
Tonle Sap	**01**	Banteay Meanchey	**10**	Krong Paoy Paet	**02**	Sangkat Paoy Paet	**01**	Kbal Spean	**1**	8
Tonle Sap	**01**	Banteay Meanchey	**10**	Krong Paoy Paet	**02**	Sangkat Paoy Paet	**03**	Kilou Lekh Buon	**1**	8
Tonle Sap	**02**	Battambang	**02**	Thma Koul	**02**	Ta Meun	**01**	Thma Koul Cheung	**1**	8
Tonle Sap	**02**	Battambang	**03**	Krong Battambang	**02**	Preaek Preah Sdach	**01**	Preaek Preah Sdach	**1**	8
Tonle Sap	**02**	Battambang	**03**	Krong Battambang	**04**	Chamkar Samraong	**04**	Voat Rumduol	**1**	8

Tonle Sap	**02**	Battambang	**03**	Krong Battambang	**10**	Svay Pao	**01**	Preaek Moha Tep	**1**	8
Tonle Sap	**04**	Kampong Chhnang	**03**	Krong Kampong Chhnang	**01**	Phsar Chhnang	**03**	Chong Kaoh	**1**	8
Tonle Sap	**06**	Kampong Thom	**03**	Krong Stueng Saen	**02**	Kampong Thum	**01**	Phum Ti Muoy	**1**	8
Tonle Sap	**15**	Pursat	**05**	Krong Pursat	**04**	Phteah Prey	**05**	Chamkar Chek Khang Cheung	**1**	8
Tonle Sap	**17**	Siemreap	**10**	Krong Siem Reab	**01**	Sla Kram	**05**	Banteay Chas	**1**	8
Tonle Sap	**17**	Siemreap	**10**	Krong Siem Reab	**02**	Svay Dankum	**09**	Kruos	**1**	8
Tonle Sap	**17**	Siemreap	**10**	Krong Siem Reab	**03**	Kouk Chak	**03**	Teaksen Tboung	**1**	8
Tonle Sap	**17**	Siemreap	**10**	Krong Siem Reab	**09**	Siem Reab	**04**	Kakranh	**1**	8
Tonle Sap	**01**	Banteay Meanchey	**04**	Preah Netr Preah	**03**	Phnum Lieb	**10**	Kantrab	**2**	8
Tonle Sap	**01**	Banteay Meanchey	**04**	Preah Netr Preah	**03**	Phnum Lieb	**10**	Kantrab	**2**	8
Tonle Sap	**01**	Banteay Meanchey	**08**	Svay Chek	**03**	Sla Kram	**09**	Boeng Snoa	**2**	8
Tonle Sap	**02**	Battambang	**02**	Thma Koul	**07**	Boeng Pring	**01**	Boeng Pring	**2**	8
Tonle Sap	**02**	Battambang	**06**	Moung Ruessei	**01**	Moung Ruessei	**09**	Daeum Doung	**2**	8
Tonle Sap	**02**	Battambang	**09**	Samlout	**02**	Kampong Lpov	**04**	Ou Daem Chek	**2**	8
Tonle Sap	**02**	Battambang	**14**	Rukhak Kiri	**02**	Prey Tralach	**16**	Pralay Dabprambei	**2**	8
Tonle Sap	**04**	Kampong Chhnang	**06**	Rolea B'ier	**03**	Cheung Kreav	**07**	Souphi	**2**	8
Tonle Sap	**06**	Kampong Thom	**01**	Baray	**02**	Ballangk	**09**	Prey Ta Trav	**2**	8
Tonle Sap	**06**	Kampong Thom	**02**	Kampong Svay	**09**	Trapeang Ruessei	**13**	Lvea Choum	**2**	8
Tonle Sap	**06**	Kampong Thom	**07**	Santuk	**08**	Tang Krasang	**08**	Thomm Neath	**2**	8
Tonle Sap	**15**	Pursat	**01**	Bakan	**09**	Ta Lou	**18**	Prahal	**2**	8
Tonle Sap	**15**	Pursat	**05**	Krong Pursat	**03**	Lolok Sa	**08**	Dab Bat	**2**	8
Tonle Sap	**17**	Siemreap	**04**	Chi Kraeng	**08**	Pongro Kraom	**07**	Pou	**2**	8
Tonle Sap	**17**	Siemreap	**09**	Prasat Bakong	**06**	Kandaek	**02**	Trapeang Tuem	**2**	8
Tonle Sap	**17**	Siemreap	**13**	Svay Leu	**04**	Svay Leu	**06**	Trapeang Svay	**2**	8

Ecological Code	Zone	Province Code	Province Name	District Code	District Name	ComCode	Commune Name	Village Code	Village Name	(1)Urb; (2)Rural	HH Listed
CTL	Coastal	**07**	Kampot	**06**	Kampong Trach	**05**	Kampong Trach Khang Kaeut	**04**	Robang Kras	**1**	8
CTL	Coastal	**07**	Kampot	**08**	Krong Kampot	**01**	Kampong Kandal	**01**	Sovann Sakor	**1**	8
CTL	Coastal	**07**	Kampot	**08**	Krong Kampot	**03**	Kampong Bay	**01**	Kampong Bay Khang Cheung	**1**	8
CTL	Coastal	**07**	Kampot	**08**	Krong Kampot	**04**	Andoung Khmer	**04**	Andoung Khmaer	**1**	8
CTL	Coastal	**09**	Koh Kong	**04**	Krong Khemarak Phoumin	**01**	Smach Mean Chey	**04**	Boeng Khun Chhang	**1**	8
CTL	Coastal	**09**	Koh Kong	**04**	Krong Khemarak Phoumin	**02**	Dang Tong	**04**	Phum Ti Buon	**1**	8
CTL	Coastal	**09**	Koh Kong	**06**	Srae Ambel	**06**	Srae Ambel	**04**	Trapeang	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**01**	Sangkat Muoy	**02**	Phum Pir	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**01**	Sangkat Muoy	**03**	Phum Bei	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**02**	Sangkat Pir	**03**	Phum Bei	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**03**	Sangkat Bei	**02**	Phum Pir	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**03**	Sangkat Bei	**03**	Phum Bei	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**04**	Sangkat Buon	**02**	Phum Pir	**1**	8
CTL	Coastal	**18**	Preah Sihanouk	**01**	Krong Preah Sihanouk	**04**	Sangkat Buon	**04**	Phum Buon	**1**	8
CTL	Coastal	**23**	Kep	**02**	Krong Kaeb	**01**	Kaeb	**01**	Kaeb	**1**	8

CTL	Coastal	**07**	Kampot	**01**	Angkor Chey	**06**	Daeum Doung	**01**	Daeum Doung	**2**	8
CTL	Coastal	**07**	Kampot	**02**	Banteay Meas	**02**	Banteay Meas Khang lech	**05**	Tbal Ken	**2**	8
CTL	Coastal	**07**	Kampot	**02**	Banteay Meas	**12**	Tuk Meas Khang Kaeut	**04**	Srae Kan Khang Kaeut	**2**	8
CTL	Coastal	**07**	Kampot	**03**	Chhuk	**04**	Chhuk	**01**	Krasang	**2**	8
CTL	Coastal	**07**	Kampot	**03**	Chhuk	**10**	Mean Chey	**05**	Veal Tbal	**2**	8
CTL	Coastal	**07**	Kampot	**04**	Chum Kiri	**04**	Srae Chaeng	**02**	Khpob Run	**2**	8
CTL	Coastal	**07**	Kampot	**05**	Dang Tong	**06**	Srae Chea Khang Cheung	**02**	Prei Pir	**2**	8
CTL	Coastal	**07**	Kampot	**06**	Kampong Trach	**04**	Damnak Kantuot Khang Tboung	**04**	Angkor Chey Ti Pir	**2**	8
CTL	Coastal	**07**	Kampot	**07**	Tuek Chhou	**01**	Boeng Tuk	**02**	Kaeb Thmei	**2**	8
CTL	Coastal	**07**	Kampot	**07**	Tuek Chhou	**12**	Prey Khmum	**03**	Prey Khmum	**2**	8
CTL	Coastal	**09**	Koh Kong	**01**	Botum Sakor	**02**	Kandaol	**04**	Tam Kan	**2**	8

Annex 2. Answering and Providing Answers.

Each of the questions in the following table is asked with a recall period of four weeks (30 days). The respondent is first asked an occurrence question – that is, whether the condition in the question happened at all in the past four weeks (yes or no). If the respondent answers "yes" to an occurrence question, a frequency-of-occurrence question is asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks.

Example:

1. In the past four weeks, did you worry that your household would not have enough food?

0 = No (skip to Q2)
1 = Yes

1.a. How often did this happen?

1 = Rarely (once or twice in the past four weeks)
2 = Sometimes (three to ten times in the past four weeks)
3 = Often (more than ten times in the past four weeks)

No. Occurrence Questions

1. In the past four weeks, did you worry that your household would not have enough food?

2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?

3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?

4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?

5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

6. In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?

7. In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?

8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?

9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

Annex 3. Instructions to Individual Questions

Q1: Worry about food

This question asks the respondent to report their personal experience with uncertainty and anxiety about acquiring food during the previous month. The interviewer should also read the definition of a "household" that was developed during the preparation of the questionnaire. Mention that this definition of household applies to all the questions with that term.

Q2: Unable to eat preferred foods

One domain of food insecurity (access) is having limited choices in the type of food that a household eats. This question asks whether any household member was not able to eat according to their preference due to a lack of resources. Preference can refer to the form of a particular food (i.e., whole rice vs. broken rice), type of staple (i.e., millet vs. corn) or a high quality food (i.e., a piece of meat or fish). Preferred foods may or may not be nutritionally high quality. The interviewer should also read the definition of a "lack of resources." Mention that this definition of household applies to all the questions with that term. The respondent needs to answer on behalf of all household members.

Q3: Eat just a few kinds of foods

This question asks about dietary choices related to variety – i.e., whether the household had to eat an undesired monotonous diet (little diversity in the different types of foods consumed). The interviewer should read the description of what a monotonous diet might be. The respondent needs to answer on behalf of all household members.

Q4: Eat foods they really do not want eat

This question, which also captures the dimension of limited choices, asks whether any household member had to eat food that they found socially or personally undesirable due to a lack of

resources. Often these are foods or food preparations that are consumed only under hardship. Different people may consider different foods to be undesirable, so it is best not to provide examples here at first. The respondent needs to answer on behalf of all household members, according to his or her own perception of the types of food household members ate during the previous four weeks. If more encouragement is required, the interviewer may give some examples using any examples included in the questionnaire and reviewed during training. For all questions, it is important to remind respondents that the examples are not an exhaustive list.

Q5: Eat a smaller meal

This question asks whether the respondent felt that the amount of food (any kind of food, not just the staple food) that any household member ate in any meal during the past four weeks was smaller than they felt they needed due to a lack of resources. The respondent should answer according to his or her perception of what constitutes enough food for the needs of the household members. The respondent needs to answer on behalf of all household members.

Q6: Eat fewer meals in a day

This question asks whether any household member, due to lack of food, had to eat fewer meals than the number typically eaten in the food secure households in their area. The respondent needs to answer on behalf of all household members.

Q7: No food of any kind in the household

This question asks about a situation in which the household has no food to eat of any kind in the home. This describes a situation where food was not available to household members through the households' usual means (e.g., through purchase, from the garden or field, from storage, etc.).

Q8: Go to sleep hungry

This question asks whether the respondent felt hungry at bedtime because of lack of food or whether the respondent was aware of other household members who were hungry at bedtime because of lack of food. The respondent needs to answer on behalf of all household members.

Q9: Go a whole day and night without eating

This question asks whether any household member did not eat from the time they awoke in the morning to the time they awoke the next morning due to lack of food. The respondent needs to answer on behalf of all household members.

Annex 3. The questionnaire format for the study

Date:	**Name of Interviewer:**		**Team:**
Ecological Zone **Name:** **Code:**	**Province Name:** **Code:**	**District Name:** **Code:**	
Commune Name: **Code:**	**Village Name:** **Code:**	**Household No:**	
Questionnaire Code:	**Time Start: _____Time Finish: _____**		**1- Urban 2-rural**

RESPONDENT INFORMATION

1. Name of Respondent:	**1.a.** Age:	**1.b.** Gender: 1- Male 2- Female
2. Address: Contact No(s).:		
3. Marital Status: 1- Single 2-Married 3- Widow 4- Divorced 5- Separated	**4.** Educational Attainment: 1-Did not attend school 2- Finished Primary school 3- Finished Secondary school 4- Finished High School 5- Finished College/University 6- Finished Vocational/Technical 7-Attended any of the above, did not finish specify: _____ 8-Other, Please specify: _____	

HOUSEHOLD INFORMATION

5. House: 1-owned 2- rented 3- others, please specify_____	
6. Type of House: 1- wooden 2- concrete 3-Leave 4-Floating 5-Other, Please specify _____	1- one story 2- two-story 3- three-story
7. Landownership: 1- owned 2- leased	
8. Number of Household Members: (_____)	
9. Residence: 1- Permanent 2- Migrant	
10. Household Assets	

Check if the household owns one currently:

1- Radio	8- Battery for Lighting	15- Water Pump
2- Television	9- Cart	16- Cash Savings
3- Cell phone	10- Plough	17- Jewelry
4- Bicycle	11- Hand tractor	18- Others; SPECIFY:_____
5- Motorbike	12- Tractor	
6- Car, Taxi	13- Thresher	
7- Sewing Machine	14- Rice Mill	

Source of Household Income

11. Household members:

11.a. Name	**11.b.** Age	**10.c.** Gender	**11.d.** Educational Attainment	**11.e.** Sources of Income*	**11.f.** Income

Educational Attainment: 1-Did not attend school 2- Finished Primary school 3- Finished Secondary school 4- Finished High School 5- Finished College/University 6- Finished Vocational/Technical 7-Attended any of the above, did not finish specify: _____ 8-Other, Please specify: _____	**12. Total Household Income:**
	* Source of income 1- No source of income 2-Agricultural(Farmer, Forestry and fishery workers) 3-Professional Occupation (Professionals) 4-Service and sales workers 5-Craft and related workers 6- Others; specify_____

Household Food Source:

13. Where does the family get its food? 1 - Purchased (Market) 2 - Traded (Market) 3- Own production 4- Fishing 5- Hunting 6- Others; specify_____

14. Amount of money spent on purchasing food items from the household income? _____

15. Is there a pregnant mother in the family? 1- Yes 2- No

If yes, Please encircle: A- 1-3 month B- 4-5 month C- 6- 9 month

16. Is there a lactating mother in the family? 1- Yes 2- No

Table 1. Household Food Insecurity Access Scale (HFIAS) Measurement Tool

NO	QUESTION	RESPONSE OPTIONS	CODE
1.	In the past four weeks, did you worry that your household would not have enough food?	0 - No (Go to Q2) 1 - Yes	|___|
1.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 - No (Go to Q3) 1 - Yes	|___|
2.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks)	|___|

		2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 - No (Go to Q4) 1 - Yes	|___|
3.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 - No (Go to Q5) 1 - Yes	|___|
4.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
5.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 - No (Go to Q6) 1 - Yes	|___|
5.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
6.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 - No (Go to Q7) 1 - Yes	|___|
6.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 - No (Go to Q8) 1 - Yes	|___|
7.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
8.	In the past four weeks, did you or any household	0 - No (Go to Q9)	|___|

	member go to sleep at night hungry because there was not enough food?	1 - Yes	
8.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 - No (questionnaire is finished) 1 - Yes	|___|
9.a	How often did this happen?	1 - Rarely (once or twice in the past four weeks) 2 - Sometimes (three to ten times in the past four weeks) 3 - Often (more than ten times in the past four weeks)	|___|

Cross-checked by……

Table 2. Food Frequency Questionnaire

1.1. Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	FREQUENCY WET SEASON (May- October)			Equivalent EP weight (g) /day (Do not answer during the interview)	FREQUENCY DRY SEASON (November- April)			Equivalent EP weight (g)/day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
CEREALS & CEREAL PRODUCTS										
Rice, cooked										
Rice, porridge										
Pork porridge										
Fish porridge										
Chicken porridge										
Chinese noodles										
Corn (Maize)										
Bread										
Noodle (Pack)										
Khmer Noodle										

1.2. Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	FREQUENCY WET SEASON (May- October)			Equivalent EP weight (g) /day (Do not answer during the interview)	FREQUENCY DRY SEASON (November- April)			Equivalent EP weight (g)/day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
STARCHY ROOTS AND TUBERS										
Potatoes										
Sweet Potato										
Cassava										
Yam										
Taro										
Sakou (arrow roots)										
PULSES										
Groundnut (beanut)										
Green Nut (Mungbean)										
Soybean										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	FREQUENCY WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	FREQUENCY DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
MEAT										
Beef										
Pork										

Chicken										
Duck										
Dog										
Goat										
Rabbit										
Deer										
Wild pig										
Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	FREQUENCY WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	FREQUENCY DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
FISH (* Use the Fish Catalogue for identification)										
Freshwater fish										
Blackfish										
Greyfish										
Whitefish										
Aquaculture										

Marine										
Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	FREQUENCY WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	FREQUENCY DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Processed Fish										
Fish Paste (Prahoc, Mam)										
Other Fermented Fish (Pa'ok)										
Salted/Dried Fish										
Smoked Fish										
Fish Sauce										
Other Aquatic Animals										
Frogs										

Birds										
Shrimps										
Snakes										
Molluscs										
Crabs										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Edible Insects										
Crickets										
Kandob										
Kantes Lang										
Kantea Touk										
Red ants										
Spiders (Aping)										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
EGGS										
Duck egg										
Chicken egg										
Quail egg										
Goose egg										
Turtle egg										
Baby egg										
Salted egg										
Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	

1	2	3	4	5	6	7	8	9	10	11
DESSERT & SYRUPS										
sugar, white										
Palm sugar										
hard candy										
Fresh fruit shake										
Ice cream										
Donut/sweet rolls										
Cakes										
Cookies										
Siem dessert										
Green bean dessert										
Red bean dessert										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	2	3	4	5	6	7	8	9	10	11
VEGETABLES										
Alugbati										
leaves sweet										

potato										
Bittergourd										
Bittergourd young leave										
French beans										
Banana heart										
Cabbage										
Cauliflower										
Lettuce Salad										
Spai Kranhanh (Cabbage chinese white)										
Spai Kiev (Green mustard)										
Petsay (Spai Theou)										
Cauliflower Stem										
Morning Glory										
Kanh Chhet (Water mimosa)										
Pumpkin										
Carrots										
Chayote fruit										
Coconut shoot										
Cucumber										
Eggplant										
Food Items	Amount of usual	Equivalent EP	WET SEASON (June- October)			Equivalent EP weight	DRY SEASON (November- May)			Equivalent EP weight

	portion of intake	weight (g)				(g)/ day (Do not answer during the interview)				(g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Young leave pumpkin										
String bean										
Bottle gourd										
Horseradish leave										
Mushroom										
Green papaya										
Sponge gourd										
Tomato										
Mungbean										
Water lily										
Bamboo shoot										
Phekouk (Yambean)										
Lotus root /runner										
Chili leave										
Phti Sor										
Phti Dong										
Sloeuk Bas (Ivygourd)										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
SPICES AND HERBS										
Chili										
Onion leave/ leeks										
Onion										
White garlic										
Red garlic										
White ginger										
Black ginger										
Yellow ginger										
Light yellow ginger										
Lemon grass										
Pepper										
Lemon										
Sloeuk Kroch Soeuch (Bitter orange leave)										
Chi Neang Vong (Fennel common leave)										
Chi Rana (Fennel Common leave)										
Chi Angkam (Mint Leave)										
Ma Orm										
Sloeuk Marah prov										

(Holy Basil Leave)										
Sloeuk Kouchaiy (Celery, Leave)										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
OTHER FOOD SEASONING										
Salt										
Vinegar (Toeuk Kmeus)										
Fermented soy been										
Soy Sauce										
Tomato sauce										
Chili sauce										
Soy beancurd (Taiv Hou)										
MSG										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
FRUITS										
Apple										
Atis (sugar apple)										
Banana (Numva)										
Banana (Ambong)										
Banana (Pong Mo an)										
Banana (Snab Muk)										
Grapes										
Guava										
Lansones										
Lychee										
Mango green										
Mango ripe										
Melon										
Papaya ripe										
Pineapple										
Rambutan										
Santol										
Watermelon										

Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
MILK AND DAIRY PRODUCTS										
Infant Milk Formula										
Baby Porridge Milk										
Powder Milk (Adult)										
Canned Milk										
Coffee Cream/Mate										
Cheese										
Butter										
FATS										
Cooking Oil										
Pig fat										
Food Items	Amount of usual portion of intake	Equivalent EP weight (g)	WET SEASON (June- October)			Equivalent EP weight (g)/ day (Do not answer during the interview)	DRY SEASON (November- May)			Equivalent EP weight (g)/ day (Do not answer during the interview)
			Daily	Weekly	Monthly		Daily	Weekly	Monthly	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Beverage										
Alcoholic										

Beer										
Wine										
Local wine										
Non-Alcoholic										
Coffee										
Tee										
soft drinks										
powdered juice drink										
Instant juice drink										
OTHER FOOD ITEMS NOT LISTED ABOVE										

Cross-checked by……

Table 3. Individual 24-hour Food Recall of Household Member (Mother)

Name of Household Member:	Age:	Gender:1- Male 2- Female	1- Pregnant 2-Lactating
Name of Respondent:			

MEAL (Indicate if Breakfast, lunch and Dinner and Time eaten)	NAME OF DISH (Indicate foods eaten outside)	METHOD OF PREPARATION	INGREDIENTS /FOOD ITEM	SOURCE (A.P.) (If fish is mentioned go to Table 4) 1- Home 2- Outside	PORTION SIZE EATEN BY THE HH MEMBER	ACTUAL WEIGHT OF FOOD EATEN BY THE HH MEMBER (g)	PLATE WASTE/ LEFTOVERS[1] (grams/ portion size)	[1]WHAT WAS DONE TO THE LEFTOVER 1= EATEN AGAIN[2]2= THROWN 3= FED TO THE ANIMALS 4= FERTILIZERS 5=OTHERS(PLEASE SPECIFY	[2]EATEN AGAIN BY WHOM AND HOW MUCH
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*

Table 4. Consumptive and Non-Consumptive Use of Fish and Other Aquatic Animals (OAA) in the Household.

Type of Fish	Type of Fresh Fish	Species	Source	Corresponding Amount of Fish (grams)	Total Amount of Fish (grams)	Consumptive and Non-Consumptive Use	Corresponding Amount of Fish (grams)
A. FRESHWATER FISH							
BREAKFAST	1- Blackfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	2- Greyfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	3- Whitefish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	

LUNCH	1- Blackfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	2- Greyfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	3- Whitefish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
DINNER	1- Blackfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
	2- Greyfish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	

	3- Whitefish		1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
B. AQUACULTURE							
BREAKFAST			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
LUNCH			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	
DINNER			1- Market (purchased)			1- Stored (for consumption)	
			2- Market (traded)			2- Cooked and eaten	
			3- Own production			3- Preserved	
			4- Fishing			4- Fertilizer	
			5- Hunting			5- Feed to animal	
			6- Others; specify_____			6- Others; specify_____	

C. MARINE						
BREAKFAST		1- Market (purchased)			1- Stored (for consumption)	
		2- Market (traded)			2- Cooked and eaten	
		3- Own production			3- Preserved	
		4- Fishing			4- Fertilizer	
		5- Hunting			5- Feed to animal	
		6- Others; specify_____			6- Others; specify_____	
LUNCH		1- Market (purchased)			1- Stored (for consumption)	
		2- Market (traded)			2- Cooked and eaten	
		3- Own production			3- Preserved	
		4- Fishing			4- Fertilizer	
		5- Hunting			5- Feed to animal	
		6- Others; specify_____			6- Others; specify_____	
DINNER		1- Market (purchased)			1- Stored (for consumption)	
		2- Market (traded)			2- Cooked and eaten	
		3- Own production			3- Preserved	
		4- Fishing			4- Fertilizer	
		5- Hunting			5- Feed to animal	
		6- Others; specify_____			6- Others; specify_____	

D. OTHER AQUATIC ANIMALS						
BREAKFAST		1- Market (purchased)			1- Stored (for consumption)	
		2- Market (traded)			2- Cooked and eaten	
		3- Own production			3- Preserved	
		4- Fishing			4- Fertilizer	
		5- Hunting			5- Feed to animal	
		6- Others; specify_____			6- Others; specify_____	
LUNCH		1- Market (purchased)			1- Stored (for consumption)	
		2- Market (traded)			2- Cooked and eaten	
		3- Own production			3- Preserved	
		4- Fishing			4- Fertilizer	
		5- Hunting			5- Feed to animal	

		6- Others; specify_____			6- Others; specify_____	
DINNER		1- Market (purchased)			1- Stored (for consumption)	
		2- Market (traded)			2- Cooked and eaten	
		3- Own production			3- Preserved	
		4- Fishing			4- Fertilizer	
		5- Hunting			5- Feed to animal	
		6- Others; specify_____			6- Others; specify_____	

Table 5. Food Consumption of BREASTFED Infant and Young Children in the Household. (Respondent is the mother of the infant or young child).

Name of Child:	Age in months:	Gender: ☐ Male ☐ Female
1. Yesterday, did you breastfeed your child?	1- YES (GO to Q2). 2- No (GO to Table 6).	
2. A. How many times yesterday did you breast feed your child?	1- 1x 3- 3x 5- Others; specify:_____ 2- 2x 4- 4x	
B. For how long did you breastfeed your child?	1- 5mins3- 15mins5- Others; specify:_____ 2- 10mins 4- 20 mins	
3. Yesterday, did you give your child food other than breastmilk?	1- YES (GO to Q4) 2- NO (End the interview of the mother).	
4. At what age did your child start eating food other than breastmilk?	_____Age in months	

Table 5. Yesterday, what are the foods that you gave your child other than breastmilk? (Example, rice porridge, banana, egg, bread, etc.) (Fill up columns 1 to 7).

MEAL (Indicate if Breakfast, lunch and Dinner and Time eaten)	NAME OF DISH (Indicate foods eaten outside)	METHOD OF PREPARATION	INGREDIENTS/FOOD ITEM	SOURCE (A.P.) (If fish is mentioned go to Table 4)	PORTION SIZE EATEN BY THE HH MEMBER	ACTUAL WEIGHT OF FOOD EATEN BY THE HH MEMBER (g)	PLATE WASTE/ LEFTOVERS[1] (grams/ portion size)	[1]WHAT WAS DONE TO THE LEFTOVER 1= EATEN AGAIN[2] 2= THROWN 3= FED TO THE ANIMALS 4= FERTILIZERS 5=OTHERS(PLEASE SPECIFY	[2]EATEN AGAIN BY WHOM AND HOW MUCH
1	2	3	4	5	6	7	8	9	10

Table 6. Individual 24-hour food recall of Household Member. (For young children who are no longer breastfed, older person, father, brother, son, daughter and others)

Name of Household Member:	Age:	Gender: 1- Male 2- Female	If married: 1- Pregnant 2- Lactating
Name of Respondent:			

MEAL (Indicate if Breakfast, lunch and Dinner and Time eaten)	NAME OF DISH (Indicate foods eaten outside)	METHOD OF PREPARATION	INGREDIENTS/FOOD ITEM	SOURCE (A.P.) (If fish is mentioned go to Table 4) 1- Home 2- Outside	PORTION SIZE EATEN BY THE HH MEMBER	ACTUAL WEIGHT OF FOOD EATEN BY THE HH MEMBER (g)	PLATE WASTE/ LEFTOVERS[1] (grams/ portion size)	[1]WHAT WAS DONE TO THE LEFTOVER 1= EATEN AGAIN[2] 2= THROWN 3= FED TO THE ANIMALS 4= FERTILIZERS 5=OTHERS(PLEASE SPECIFY	[2]EATEN AGAIN BY WHOM AND HOW MUCH
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*