Assessing Changes in Household Food Consumption and Nutrition Intake in Cambodia

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Executive Summary

Over recent years, Cambodia has undergone a remarkable transformation, both socially and economically. These sweeping changes have rippled through various aspects of the nation's fabric, leaving a distinct mark on food consumption patterns and overall nutritional status. There are some major changes observed in food consumption within Cambodia such as lower rice consumption across the regions in country, increasing in the consumption of protein and fats, decreasing in vegetable consumption, particularly in green leafy vegetables and shifting towards unhealthy dietary choices raises concerns about the potential negative impact on public health, contributing to the rising prevalence of overweight, obesity, and non-communicable diseases such as diabetes and cardiovascular diseases.

As It is important to assess the changes in household food consumption and nutrition intake in Cambodia, thus the study aims to provide a comprehensive overview of the current situation and trends of food consumption and nutrition in the country by using Cambodia Socio-Economic Survey (CSES) over the last 20 years. To our knowledge, this is the first study that attempts to examine the patterns and drivers of these changes in such a long period. The study will consider the changes in various aspects of food consumption, including expenditure, own produce, processed food, food groups, etc. It will also analyse how these changes vary by social groups, gender, urban vs rural areas, and geographical regions. In addition to household food consumption at home, this study will also assess the changes in household away-from-home food consumption (AFHC), including changes in the share of AFHC expenditures in total expenditure and changes in the amount of nutrition consumed away from home.

While the study reveals a positive trend of Cambodians spending less of their income on food, indicating improved economic well-being and access to diverse food options, this trend masks a harsh reality for vulnerable populations. Households classified as "ID-Poor" and "Female Headed Households" bear the brunt of food expenditures, dedicating a staggering 50% of their income to meet their basic nutritional needs. This stark disparity highlights the precarious situation of low-income households. When faced with fluctuating food prices or economic shocks, their already limited resources become strained, potentially jeopardizing their access to adequate and nutritious food and leading to food insecurity and malnutrition.

The study reveals that Cambodian households typically rely on a staple-based diet, with rice as the cornerstone. Carbohydrates are further complemented by animal protein, primarily sourced from freshwater fish, and flavorful condiments like fish sauce and soy sauce. While fruit consumption remains relatively consistent, a concerning decline in vegetable intake has emerged, highlighting a shift in dietary patterns.

Contents

List of Figures

List of Tables

List of abbreviations

AFHC	Away-from-home food consumption
CDHS	Cambodia Demographic and Health Survey
CSES	The Cambodia Socio-Economic Survey
DHS	Demographic and Health Survey
DDS	Dietary Diversity Score
FCDs	Food composition databases
FCT	Food composition table
FCTC	Food Composition Table for Cambodia
LMICs	Low- and middle-income countries
NCDs	Non-communicable diseases
NIS	The National Institute of Statistics of Cambodia
ANOVA	The principles of Analysis of Variance
USDA	The United States Department of Agriculture

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1. Introduction

1.1. Objectives of Study

This working paper embarks on an in-depth analysis of household food consumption and nutrition intake in Cambodia over the past two decades, utilizing data from the Cambodia Socio-Economic Survey (CSES). To the best of our knowledge, this study stands as the first comprehensive examination of the patterns and driving forces behind these changes within such an extensive timeframe. Our investigation delves into the evolution of various facets of food consumption, encompassing expenditure patterns, own-produced food consumption, processed food intake, and changes in food group consumption. Additionally, we explore how these changes vary across social groups, gender, urban-rural divides, and geographical regions across Cambodia. Furthermore, we investigate the intricate relationships between food consumption and production dynamics, occupational characteristics, remoteness, migration patterns, shocks, the COVID-19 pandemic, dietary shifts, micronutrient intakes, and demand-side drivers. Expanding beyond household food consumption at home, our study also evaluates the changes in household away-from-home food consumption (AFHC), including shifts in the proportion of AFHC expenditures relative to total expenditure and changes in the nutritional intake derived from AFHC.

At the heart of this study lies the central research question: How have household food consumption and nutrition intake evolved in Cambodia over the past 20 years? What are the primary factors influencing these transformations? This question stems from Cambodia's remarkable economic growth and poverty reduction achievements over the past two decades, while simultaneously facing persistent challenges in ensuring nutrition security for its population. UNICEF figures indicate that 32% of children under five years of age are stunted (low height for age), while 10% suffer from wasting (low weight for height). Additionally, dietary deficiencies in zinc, iodine, and B vitamins are prevalent among women of reproductive age and children. Conversely, overweight and obesity rates are rising among adults, highlighting the double burden of malnutrition.

The structure of this working paper is as follows: Section 2 presents a comprehensive literature review of previous studies on food consumption and nutrition in Cambodia and other developing countries. Section 3 meticulously outlines the data sources and methodologies employed in this study. Section 4 unveils the results and discussions pertaining to the trends and determinants of food consumption and nutrition intake. Section 5 concludes by presenting policy recommendations based on our findings.

2. Literature reviews

2.1. Food consumption trends in Cambodia

Cambodia over years has experienced significant social and economic transformations. These changes have had implications for various aspects of the country, including food consumption patterns and nutrition status. Factors such as urbanisation, industrialisation, income inequality,

and climate change have been identified as key drivers influencing these shifts (Kearney 2019; Sim and Laohasiriwong 2019). The following outlines the major changes observed in food consumption within Cambodia.

Rice Consumption: Rice, a traditional staple food, continues to play a central role in the daily diet of Cambodian individuals. According to the United States Department of Agriculture (USDA) (https://apps.fas.usda.gov/psdonline/app/index.html#/app/home), rice consumption per capita[1] in Cambodia has remained consistently high, with a notable increase from 213 kg in 2000 to 248 kg in 2022. Rice provides an average of 1,095 kcal, which accounts for approximately 60% of the total energy intake (IFReDI 2013). It is also a significant source of protein, contributing to about 35% of the protein intake per capita and provides 17% of fats and 32% of iron per capita (IFReDI 2013). It is important to note that rice consumption patterns may vary across different regions within the country. Research by (In et al. 2015) found regional variations in rice consumption, with lower consumption in coastal regions and higher consumption in areas surrounding the Mekong River.

Protein and Fat Consumptions: There has been an increase in the consumption of protein in Cambodia. This shift can be attributed to increased incomes and improved accessibility to protein-rich food sources. Data extracted from Faostat (https://www.fao.org/faostat/en/#data/FBS) shows a slight increase in average protein consumption per person per day[2], from 62.27 g in 2010 to 64.38 g in 2020. Fish accounts for a significant portion of the protein intake, with 37% of the total protein and 76% of the animal protein intake derived from fish (IFReDI 2013). Regional variations in meat consumption have also been observed. Cambodian households living near water bodies consume 2.8 times more fish than meat and poultry (Mousset et al. 2016). Additionally, the relatively high consumption of fish in rural areas can be attributed to the high price of meat and the availability of fish (Roos et al. 2007).

In terms of fat consumption, Cambodian dietary patterns have also experienced changes. In early 2000, the per capita daily intake of total fat was reported at 19 grams (Mogensen 2001). Over the following years, there has been an observed increase in fat consumption. In 2020, Faostat data indicated that the average daily per capita fat intake in Cambodia was approximately 37.76 grams.

Vegetable Consumptions: Over a considerable period of time, there has been a notable rise in vegetable consumption in Cambodia. The average daily per capita intake of vegetables was reported as 92 grams (Mogensen 2001). This figure had slightly increased and varies across different regions in Cambodia. Bunthang et al. (2012) found that both Phnom Penh and Coastal areas had similar and significant daily vegetable intake, with Phnom Penh at 132.1 grams and the

[1] Measure of the amount of milled rice consumed by a person in a year.
[2] The total protein supply available for human consumption divided by the total number of actual population utilizing it.

Coastal areas at 134.6 grams. Conversely, the plain, mountain, and plateau regions exhibited lower vegetable consumption, with the mountain and plateau areas having the lowest intake at an average of 103.5 grams per day. The rise in vegetable consumption can be attributed to factors such as their increased availability, accessibility, higher national production, and comparatively lower cost (Kanungsukkasem et al. 2009; Peltzer and Pengpid 2012). In contrast to this trend, the recent food and nutrition security trend analysis report (2022) indicates a decrease in vegetable consumption, particularly in green leafy vegetables.

***Fast and Processed Foods, and Associated Health Risks**:* Urbanisation has significantly influenced food consumption patterns in Cambodia, leading to a shift towards the consumption of processed foods and sugary beverages. A study conducted in Phnom Penh revealed that a significant proportion of individuals within the working age group reported consuming fast food and sweetened beverages (Sim and Laohasiriwong 2019). Additionally, due to rapid economic development, there has been an increase in the consumption of processed foods in the capital city and urban areas. This shift towards unhealthy dietary choices raises concerns about the potential negative impact on public health, contributing to the rising prevalence of overweight, obesity, and non-communicable diseases such as diabetes and cardiovascular diseases. The recent Cambodia Demographic and Health Survey (CDHS) indicated a steady increase in overweight and obesity among non-pregnant women of reproductive age from 18% in 2014 to 39% in 2021-2022 (Um & An Sr 2023).

Climate Change and Food Security: Cambodia is widely considered to be one of Southeast Asia's most disaster-prone nations, vulnerable to a variety of ongoing hazards (World Bank 2021). Climate change can have significant implications for food consumption patterns and household incomes. Changes in temperature, rainfall, and pest patterns associated with climate change can lead to reduced crop productivity, ultimately affecting the availability and affordability of food (Lobell and Gourdji 2012). The effects of climate change on food consumption go beyond immediate availability. Ol (2022) emphasises the multiple impacts of climate change on child development in Cambodia. Climate-related events can lead to health shocks, affecting children's well-being and nutrition. Inadequate diets, resulting from decreased crop yields or changes in food availability, can further exacerbate the situation. Additionally, climate change-related challenges can impose burdens on households, affecting their ability to secure sufficient food and maintain adequate feeding practices.

2.2. Triple Burden of Micronutrient Deficiencies

Notwithstanding the general rise in food intake in Cambodia, the nation encounters noteworthy obstacles in relation to micronutrient deficiencies and undernutrition. According to the CDHS 2022, stunting prevalence declined from 50% in 2000 to 22% in 2021-22, while rates of wasting and overweight among children have remained relatively stable since 2005. As indicated in the recent food and nutrition security analysis report (2022), there is a progressive shift towards a diet characterised by higher consumption of fatty and sugary foods, particularly processed and

ultra-processed foods, accompanied by infrequent consumption of vegetables. This trend exacerbates the "triple burden" of malnutrition in the country, referring to the simultaneous presence of undernutrition, micronutrient deficiencies, and escalating overnutrition among the population.

While the prevalence of overweight and obesity among women has significantly increased in Cambodia, indicating the impact of the nutritional transition, child nutrition remains a concern, with high rates of stunting and disparities observed between urban and rural areas. According to data from the National Institute of Statistics (2014), there has been a significant increase in the prevalence of overweight and obesity among women aged 15-49 in Cambodia. In 2000, 6% of women in this age group were classified as overweight or obese, but by 2014, this number had risen to 18%. In contrast to this trend, the survey findings from 2014 indicate concerning statistics regarding child nutrition in Cambodia. One in three children under the age of 5 were classified as stunted, indicating impaired growth and development. Notably, approximately 26% of stunted children had an overweight or obese mother, as reported by Horiuchi et al. (2018).

Research carried out in the region has indicated a correlation between urbanization and the adoption of industrialized diets, leading to an increased prevalence of overweight individuals. This trend aligns with the predictions of the nutritional transition proposed by (Popkin 2006; 2001). Furthermore, it has been consistently observed that children from lower socioeconomic backgrounds are at a higher risk of experiencing stunted growth, as evidenced by studies conducted by (Horiuchi et al. 2018) and (Pries et al. 2017).

A study by Greffeuille et al. (2016) using data from the Cambodia Demographic Health Surveys between 2000 and 2014 revealed a decrease in wasting until 2010, followed by a slight increase, affecting approximately one in ten children by 2014. The prevalence of overweight children was below 10%, but disparities emerged between different wealth quintiles in 2010 and between living areas in 2014. Stunting remained higher among rural children and those with mothers lacking education. Addressing socioeconomic disparities and household wealth status is crucial for tackling these nutritional challenges and promoting child health in Cambodia. In a survey conducted by Horiuchi et al. (2018) on children aged 6-17 years in 23 provinces and Phnom Penh, urban areas displayed better nutritional outcomes compared to rural areas. Rural boys aged 13-15 years had a higher stunting rate (50.8%), while urban areas had a higher prevalence of overweight and obesity. Urban children had higher protein and fat intake, while rural children consumed a larger percentage of energy from carbohydrates and lower percentages from proteins and fats, potentially due to differing food consumption patterns. Urban children also had higher intakes of meats/eggs and dairy products compared to rural children.

2.3. Factors influencing food consumption

- **Socioeconomic and demographic factors**

Gender: gender plays a role in certain preferences for types of food. (Wardle et al. 2004) reported that women were more likely than males in almost all of the 23 countries to say they avoided high-fat diets, consumed fruit and fiber, and limited their intake of salt (to a lesser amount). Furthermore, they placed a higher value on eating healthily and were more likely to be dieting. Dieting status explained around 22% of the gender differences in choices for fat, 23% of choices for fiber, and 7% of choices for fruit, but not any of the gender differences in choices for salt. Nearly 50% of the variations in each of the dietary behaviors were explained by health beliefs, which individually accounted for about 40% of the variations. Accordingly, gender differences in food preferences seem to be partly explained by women's greater involvement in weight control and partly by their stronger beliefs in healthy eating.

Age: Age is a significant factor in consumption because as people get older, they tend to center their decisions on their health and diet.

Marital status: Important social determinants that can affect health behaviors and outcomes include the composition and structure of a family. (Eng PM et al. 2005) found that getting divorced or widowed was linked to decreased eating of vegetables, increased consumption of fried food away from the house, and decreased consumption of fried food inside the house among men.

Education level: A healthy diet and a lower prevalence of overweight are linked to higher education levels. The impact of education on food consumption was examined by Islam and Sim in 2021. Researchers discovered that people with upper secondary education or higher levels of education generally consume more nutritious meals than people with lower secondary education or lower levels of education. It implies that schooling may exacerbate the disparity in the intake of food bundles that are healthful.

Level of income: As their income rises, people are predisposed to consume more, though not by the same amount as their actual income growth. Among Ukrainian households, the effects of household income on food consumption were examined by(Kotykova, Pohorielova, and Babych 2020). According to the study, product affordability has a big impact on the volume and composition of food consumption. Aside from having significantly lower incomes than other household types, households in rural areas and those with large populations also tend to have the poorest food standards.

Occupation: In the sense that education enables one to pursue a specific sort of schooling and occupation-pursuit results in money, occupation serves as a connecting element between education and income. As a result, it affects a person's attitude, interests, and motivations, which in turn affects both the type and quantity of purchases (Singh 1968).

Ethnicity: Abdullah, Teo, and Foo (2016)analyzed the eating habits of the Chinese and Malay ethnic groups in Maylasia and discovered that there were notable disparities in the dietary habits and associated risk factors of Malay and Chinese teenagers. Particularly, Malay teenagers scored

significantly higher on the Western-based and regional-based food patterns, while Chinese teenagers scored higher on the healthy-based food pattern. It's possible that this racial disparity in eating habits reflects sociocultural disparities in regard to food choices.

Religion: Religion is a major determinant of how people consume food because it has a great influence on people's beliefs and convictions and because many people will do anything for their religion. Some religious beliefs imply abstinence from particular foods, which has an impact on regional food demand and affects marketing choices for food.

Land: Being an agricultural country, owning land reveals the general level of wealth for households. Landless people are typically extremely impoverished, and this will affect how they eat. An analysis of household food security in Bangladesh by (Faridi and Wadood 2010) revealed that the amount of land a household held had a significant impact on the situation. The likelihood that a household will have enough food to eat increases by about five for every decimal of land.

- **Other factors**

Price of food items: Individuals' eating habits may be impacted by the high cost of food items. According to Green et al. (2013), countries with low- and high-income levels experience bigger decreases in food intake as a result of price increases for all items.

Access to food commodities: Access to food is associated with higher food consumption, which raises energy intake. In some rural locations, it can be challenging to go around, and there may be food insecurity as a result of poor health and limited access to food due to a lack of food resources in the region. Physical limitations might make it difficult to do food-related tasks like shopping and cooking, which can lead to considerable changes in eating habits, yet food security and body mass index are not always associated.

Urbanization: Food preferences and dietary patterns are impacted by urbanization, and in contrast to rural areas, all food in cities must be purchased. Hovhannisyan and Devadoss (2020) investigated how urbanization affected China's food consumption patterns and found that demand for cereals, vegetables, fats, and oils decreased while demand for meats, fruit, and eggs grew.

Region: The amount of food consumed may vary by location. Because of household wealth and educational levels, for instance, the study by In et al. (2015)revealed that the capital city of Cambodia consumes more fruit and meat than other parts of the country.

2.4. Gaps and limitations in existing data sources and methods

This literature review identifies several key critical gaps and limitations within existing studies, shedding light on areas that warrant further investigation and research. These identified gaps offer valuable insights into the current state of knowledge, providing a foundation for future studies to address these shortcomings.

- One significant gap is the lack of adequate investment in food composition databases (FCDs) in low- and middle-income countries (LMICs), specifically in Cambodia. Existing studies did not report the existence of a comprehensive FCD specifically designed for Cambodia, leading to reliance on nutrient data from FCDs of other countries (Windus et al. 2022). This limitation introduces the potential for systematic errors in data analysis, as these databases may not fully represent Cambodian-specific foods or mixed dishes.
- Another important research gap lies in the focus on households' adult males and females, with limited attention given to adult males or older adults (Windus et al. 2022). Even national surveys like the 5-yearly Demographic and Health Survey (CDHS) primarily collect nutrition data on mothers and children under 5 years old. To establish a more comprehensive groundwork for future studies on specific population subgroups, conducting a national nutrition survey that encompasses all age and gender groups in a representative manner is essential.
- Societal and socio-demographic traits present additional limitations in dietary assessment research in Cambodia. Factors such as misreporting of dietary intake, cultural practices, local food habits, and communal eating patterns can introduce complexities in data collection and analysis. Addressing these limitations is critical to ensure accurate and reliable results in dietary assessment research (Windus et al. 2022).
- The use of 24-hour recalls to assess dietary intake also presents a limitation as it provides information for only a single day, disregarding natural variations in nutrient intake over time. To enhance data reliability, employing a multiple-day dietary intake assessment with a four- or five-stage multiple-pass process is recommended, as suggested by (Gibson, et al. (2017) and Steinfeldt, Anand, et al. (2013).
- Shared plate eating in Cambodian households poses challenges in estimating individual-level portions during dietary assessment. Developing effective methods to collect individual-level intake from shared plates (Burrows et al. 2019) and providing pre-recall training on portion size estimation using visual aids can improve the accuracy of dietary intake estimation in low- and middle-income countries (Gibson, Charrondiere, and Bell 2017; Sharma and Chadha 2017).
- A large number of studies use cross-sectional data, limiting their ability to establish causality between food consumption and other factors (Bunthang et al. 2012; Horiuchi et al. 2018; In et al. 2015; Sim and Laohasiriwong 2019). Longitudinal cohort study designs are recommended to better understand the causal relationships between food consumption and various factors.
- There is a significant research emphasis on malnutrition and anemia within the field of maternal and child health, with limited studies specifically investigating non-communicable diseases (NCDs) (Chhoun et al. 2017; Sar and Marks 2015; Sim and Laohasiriwong 2019; Um and An Sr 2023). Given Cambodia's ongoing economic progress, addressing the emerging concern of increasing NCD prevalence is of paramount importance.

3. Data and Methods

3.1. CAMBODIA SOCIO-ECONOMIC SURVEY Dataset (CSES)

This study utilized the Cambodia Socio-Economic Survey (CSES), a comprehensive national household survey conducted by the National Institute of Statistics (NIS) of Cambodia, to monitor changes in household food consumption and nutrition intake over the past two decades. The CSES, conducted 17 times since 1993 with a larger sample size every five years, serves as a rich repository of reliable and timely data on living standards, income, expenditure, consumption, education, health, labor force participation, and other socio-economic characteristics of the Cambodian population.

The CSES data provides a robust foundation for measuring household food consumption and nutrition intake over time by employing various indicators that reflect the quantity and diversity of food consumed by households. One of the key strengths of the CSES is its cross-sectional nature, which enables the examination of changing patterns using t-tests of mean averages for each survey wave.

The CSES utilizes a two-stage stratified sampling design. In the first stage, enumeration areas or villages are randomly selected as primary sampling units (PSUs). In the second stage, households within the chosen PSUs are randomly selected using a systematic sampling technique. The sample size varies according to the year and frequency of the survey. For instance, in 2019-20, the CSES covered 10,075 households selected from 1008 villages across all 25 provinces. Data collection is conducted through face-to-face interviews using standardized questionnaires that encompass a wide range of topics, including household roster, housing conditions, agricultural activities, education attainment and enrollment, health status and utilization of health services, labor force participation and employment status, income sources and transfers, expenditure patterns and consumption levels, poverty indicators, and subjective well-being.

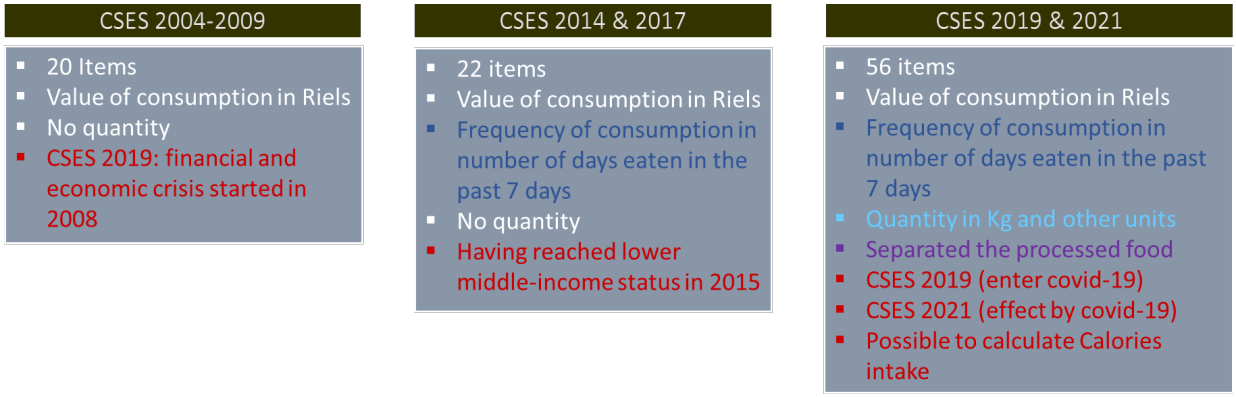
The present analysis is based on five larger sample surveys of 10,000+ households (in 2004, 2009, 2014, 2019/2020 and 2021) and one smaller sample survey of 3,840 households in 2017. These sample surveys allow for estimates at the national level, by geographic domain (Phnom Penh, other urban areas, and rural areas) and by ecological zone (Phnom Penh, Plain, Tonle Sap, plateau, and coastal).

Table 1. Sample size of CSES 2004-2021, by rural and urban area

Year	Rural	Urban	Total
2021	6,300	3,780	10,080
2019/2020	6,330	3,745	10,075
2017	2,290	1,550	3,840
2014	8,351	3,744	12,095
2009	9,586	2,385	11,971
2004	11,990	2,994	14,984

Examining food consumption patterns across different years reveals some recurring trends and notable events that shaped these patterns as shown in below figure. The 2009 CSES captured the impact of the 2008 financial crisis on household livelihoods. Cambodia's attainment of lower-middle-income country status in 2015 is reflected in the improved economic conditions documented by the 2014 and 2017 CSES. While the 2019 CSES data was collected before the COVID-19 pandemic, it provides insights into pre-pandemic food consumption patterns. The effects of the pandemic are evident in the 2021 CSES data. Importantly, the 2019/2020 and 2021 CSES data allow for calculating per capita calorie intake.

Figure 1. Food consumption patterns across different years



3.2. Food Composition Table for Cambodia (FCT)

In a significant step towards enhancing nutrition research and policymaking in Cambodia, a food composition table (FCT) has been meticulously constructed, encompassing 52 food items commonly consumed by Cambodian households (Annex. Table 7). This valuable resource, compiled from diverse data sources, including the SMILing project and FAO/INFOODS, provides comprehensive information on the nutrient content of these essential food items.

The development of this FCT fills a critical gap in nutrition data availability for Cambodia, enabling researchers and policymakers to make informed decisions regarding dietary recommendations, food fortification strategies, and nutrition education programs. By understanding the nutrient profiles of frequently consumed foods, stakeholders can effectively address nutritional deficiencies and promote healthier dietary patterns among the Cambodian population.

The FCT includes detailed information on the macronutrient content (carbohydrates, proteins, and fats) of each food item, along with a comprehensive profile of micronutrients, including vitamins and minerals. This comprehensive data empowers researchers to assess the adequacy of micronutrient intake among different population groups and identify potential areas of concern.

Moreover, the FCT facilitates the development of accurate food consumption patterns, which are essential for analyzing dietary intake and evaluating the impact of nutrition interventions. By

incorporating the FCT into dietary assessment tools, researchers can gain a more precise understanding of the nutritional status of the Cambodian population.

The construction of this FCT represents a significant milestone in advancing nutrition knowledge and evidence-based decision-making in Cambodia. This valuable resource will undoubtedly contribute to improving the nutritional well-being of the Cambodian population and fostering a healthier future for all.

3.3. Methodology

Descriptive analysis is employed to present the data on food consumption and nutrition intake by different variables such as expenditure, own produce, processed food, food group, food away from home, social groups, gender, urban vs rural, and demographic regions over 20 years period using some rounds CSES. The descriptive analysis provides an overview of the trends and patterns of food consumption and nutrition intake across time and space. To estimate the nutritional value of each food item in the Cambodia Socio-Economic Survey (CSES), we will use Food Composition Table for Cambodia (FCTC). The FCTC provides information on the nutrient content per 100 grams of edible portion for 52 food items commonly consumed in Cambodia. We used this data to calculate the nutritional value per kilogram of each food item in CSES. We then estimated the productivity of energy (measured in kilojoules), protein, and the micronutrients calcium, iron, zinc, vitamin A, and vitamin B12 consumed per capita of each household. Then the level of micronutrient deficiency will be calculated to identify the prevalence and severity of micronutrient deficiency among different groups.

Regression analysis will also be used to estimate the relationships between food consumption and nutrition intake and various explanatory variables such as occupation, remoteness, covid-19. The regression analysis allows us to test hypotheses and determine the factors that affect food consumption and nutrition intake. The regression analysis also helps us to control for confounding factors and measure the magnitude and direction of the effects.

4. Results and Discussion

4.1. Descriptive Results

4.1.1. Share of food expenditure

Household food expenditure refers to the total amount of money spent by a household on food within a specified period, which includes the cost of food obtained from different sources such as grocery stores, restaurants, and other food establishments, as well as food grown or produced at home. The concept of food share, on the other hand, pertains to the percentage of total consumption that is comprised of food items, including both non-alcoholic and alcoholic beverages. To calculate the food share, one must first determine the overall expenditure of all foods and drinks consumed, and then calculate the percentage of the total that is made up of food. This measurement is essential because it helps to gauge the significance of food in a household's overall consumption, which can provide insights into their dietary habits and overall health.

Figure 2. Share of food in total household expenditure in 7days, 2004-2021

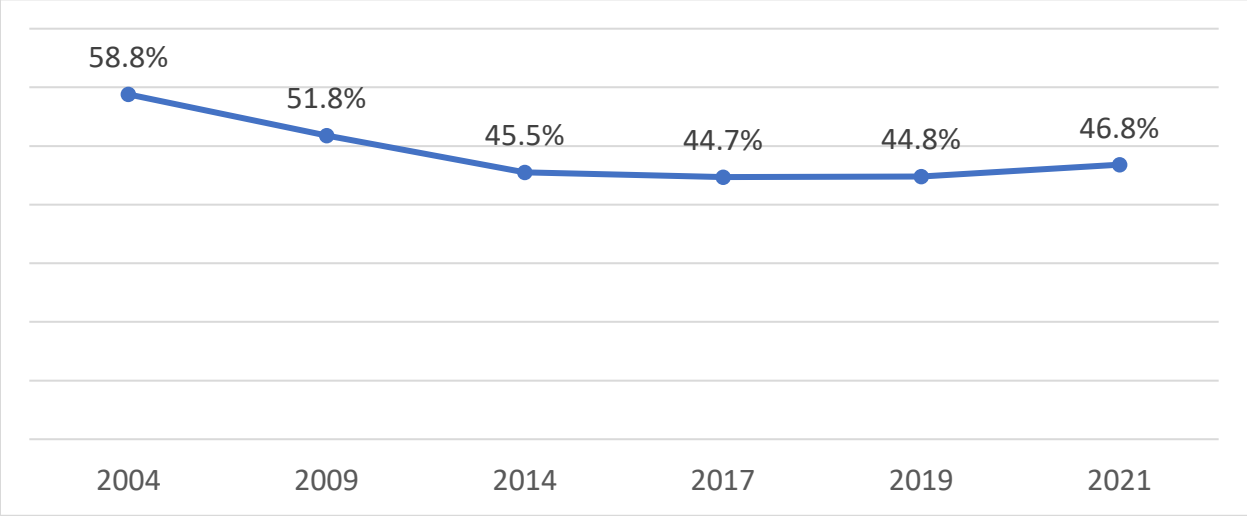
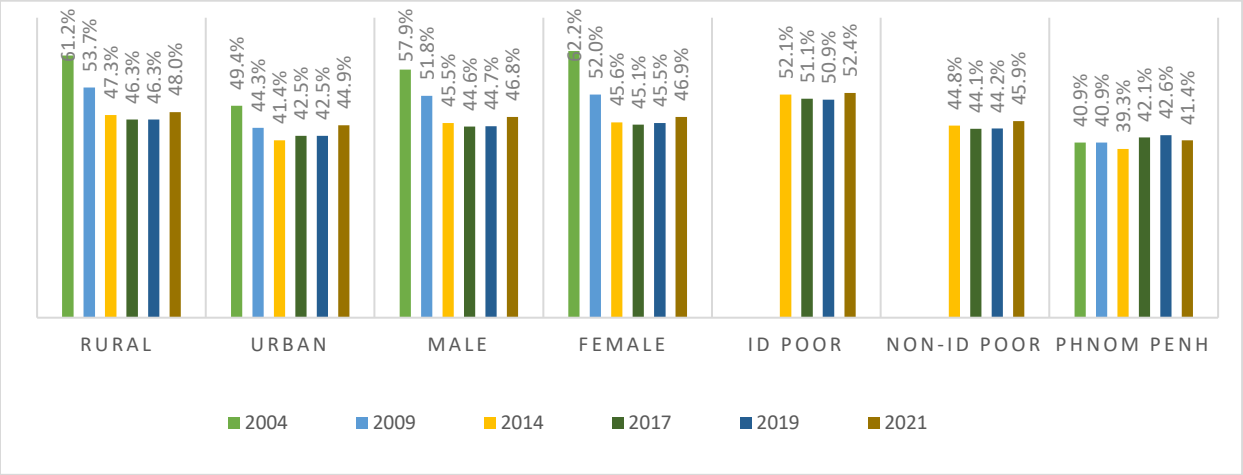


Figure 2 shows the share of household food expenditure per week in Cambodia from 2004 to 2021, overall, the share of household food expenditure in Cambodia has decreased over time, from 58.8% in 2004 to 46.8% in 2021. However, the food share has rebounded in 2021,

Aggregated by rural and urban area, the trend of share of household food expenditure in rural decrease from 51.2% in 2004 to 46.3% in 2019, and rebound in 2021 to 48%. The same as rural, the share of household food expenditure in urban areas also decrease from 2004 to 2019. However, the figure also shows that the share of household food expenditure is higher in rural areas than in urban areas. Rural households in Cambodia dedicate a larger share of their income to food than their urban counterparts due to lower average incomes, reliance on subsistence agriculture, limited access to affordable markets, and potential differences in dietary preferences and seasonality.

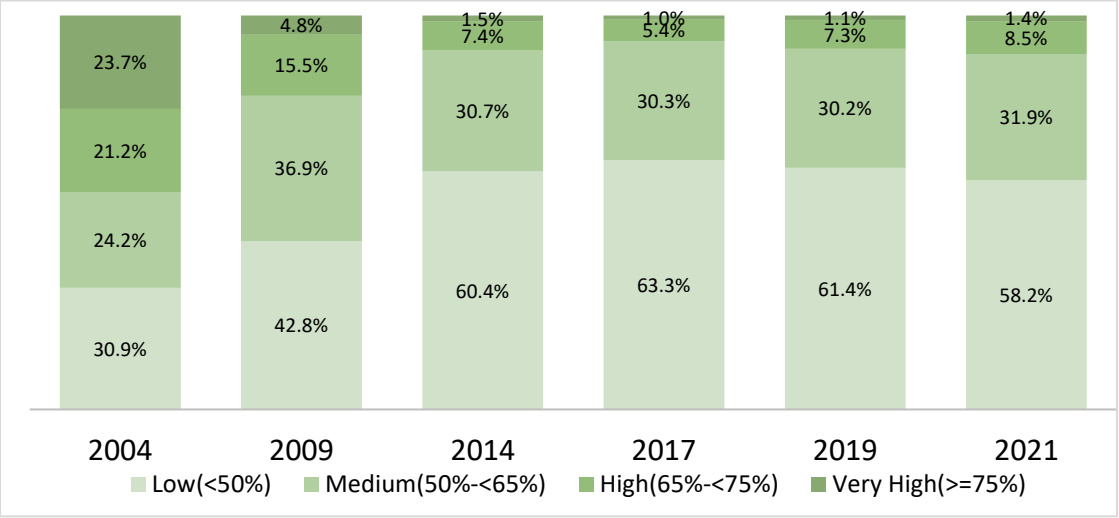
Figure 3. Percentage of households in each food expenditure share category, disaggregated



Across the period 2004-2019, households led by female consistently dedicated a larger share of their total income towards food expenses compared to those led by men. Female-headed households often face lower average income levels compared to their male-headed counterparts. This limited financial resource forces them to allocate a larger proportion of their income to essential needs like food, leaving less for other expenses. In addition, female-headed households are more likely to have young children and older adults residing with them. Both groups require a greater focus on proper nutrition, potentially leading to higher food expenditures.

ID Poor households spend a much larger portion of their income on food compared to non-ID Poor households. On average, ID-poor households dedicate half of their income to food, while non-ID-poor households spend around 44%. This pattern has been consistent between 2004 and 2021.

Figure 4. Percentage of households in each food expenditure share category, by year



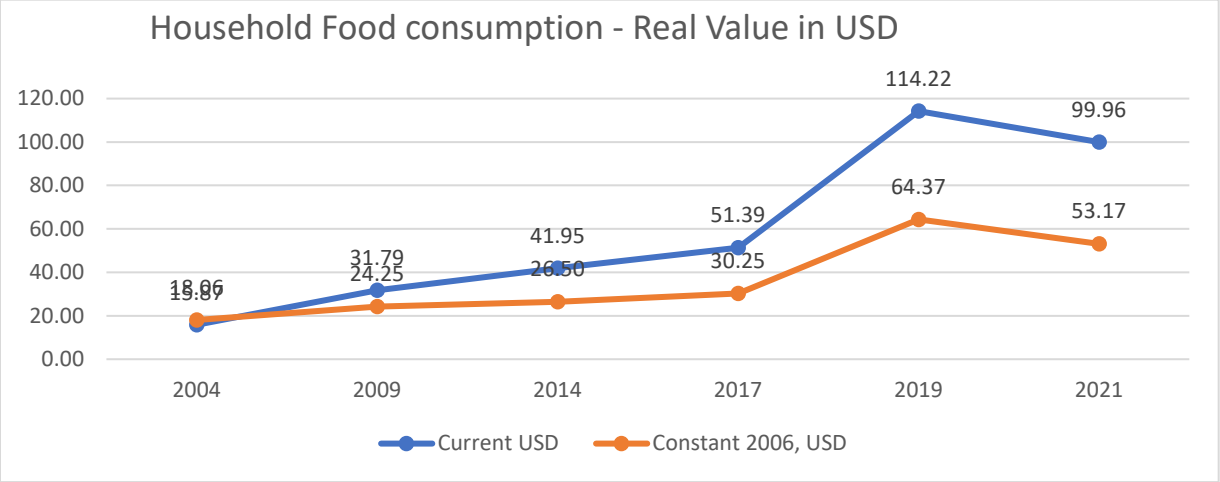
The Food Expenditure Share (FES) reveals the percentage of a household's budget dedicated to food, offering valuable insights into how families prioritize and allocate their limited resources. This indicator serves as a proxy for both food access and economic vulnerability, with a higher FES suggesting greater susceptibility to food insecurity and economic hardship. Households with a higher proportion of their budget allocated to food are considered more vulnerable to food insecurity. This is because they have less financial flexibility to adapt their spending habits in response to changes in food prices or household income. For example, a sudden increase in food prices would disproportionately impact these households, potentially limiting their access to nutritious food. Similarly, a decrease in income could force them to cut back on essential food purchases, further jeopardizing their food security.

Figure 4 reveals significant changes in household food expenditure patterns in Cambodia between 2004 and 2021. The percentage of households with the highest food expenditure share (>75% of total expenditure) has dramatically decreased, plummeting from 23.7% in 2004 to a mere 1.4% in 2021. Conversely, the share of households with the lowest food expenditure share (<50% of total expenditure) has steadily increased, rising from 30.9% in 2004 to a remarkable 58.2% in 2021. This trend indicates a positive shift towards improved economic well-being among Cambodian households. As the proportion of households spending a smaller percentage of their income on food grows, it signifies a decreased vulnerability to food insecurity and economic hardship.

4.1.2. Household food consumption expenditure in real value

It can be observed that household food expenditure in real value in Cambodia has experienced fluctuations over time, with a general trend of increasing expenditure as shown in Figure 4. In 2004, the average household expenditure on food was 70,835.85 KHR in constant 2006 prices. This value increased to 217,947.70 KHR in 2021, representing a growth of approximately

Figure 5. Food Consumption Expenditure in 7 Days in Real Value (USD)



Source: exchange rate 2004 from https://exchangerates.org/usd/khr/in-2004; 2009, 2014, 2017, 2019, 2021 from NBC

The marginal decrease in food expenditure observed in 2021 can be attributed to a confluence of factors, including the disruptive impact of the COVID-19 pandemic, which triggered economic hardship and job losses for a significant portion of the Cambodian population. Additionally, the pandemic may have induced shifts in dietary patterns, leading to a reduction in spending on food consumed outside the home.

4.1.3. Share of food group to total food consumption

Table 2 provides a valuable snapshot of the share of food by each food group in Cambodia and also shows that the share of some food groups has changed over time. The consumption patterns of various food groups in Cambodia have undergone significant shifts over the past two decades, reflecting the interplay of economic, social, and health factors.

Table 2. Share of purchased food about total purchased food

Share of purchased food	2004	2009	2014	2017	2019	2021
Staples	29.%	22.9%	19.5%	16.1%	15.2%	15.4%
Pulses	2.3%	3.8%	2.7%	2.7%	1.5%	1.1%
Vegetables	8.6%	9.5%	1.0%	9.7%	7.5%	7.7%
Fruits	4.2%	6.3%	0.0%	5.9%	5.7%	5.4%
Animal proteins	35.6%	36.9%	35.7%	33.5%	38.3%	39.8%
Milk and dairy products	0.0%	0.0%	4.3%	5.5%	2.4%	2.3%
Fats	2.5%	2.8%	2.1%	1.5%	1.2%	1.1%
Sugars and condiments	7.2%	7.8%	16.3%	7.0%	5.6%	4.2%
Non-alcoholic beverages	0.7%	4.1%	3.9%	4.7%	4.8%	5.4%
Alcoholic and tobacco products	5.0%	10.3%	12.0%	13.4%	4.3%	3.3%
Other food products	0.9%	2.7%	7.1%	2.6%	0.3%	0.4%

Staples, comprising cereals and tubers, have witnessed a declining trend in their share of purchased food, from 29% in 2004 to 15.4% in 2021 This decline could be attributed to a shift towards other food groups due to rising income levels and changing dietary preferences.

Pulses, encompassing nuts and legumes, remain underutilized in Cambodia, with households typically consuming them at loa wer percentage. The percentage has dropped from about more than 2% to 1.1% in 2021. This fluctuation suggests that pulse consumption patterns are susceptible to external factors and may require targeted interventions to promote their regular intake.

While vegetable consumption in Cambodia showed a positive trend between 2004 and 2017, increasing from 8.6% to 9.7%, it witnessed a significant decline in 2019 and 2021, dropping to just 5%. This suggests a reversal of the previous positive trajectory and warrants further investigation to identify the underlying factors contributing to this decrease. Additionally, fruit consumption has seen a continuous decline from 2004 to 2021, highlighting a concerning trend in the dietary habits of the population.

Animal proteins, including eggs, meat, and fish, have increased, with their share of purchased food reaching a high of 35.6% in 2004 and reaching 39.8 in 2021 which iindicatesa growing

demand for protein sources. This can be attributed to economic growth, increased access to meat products, and changing cultural norms around meat consumption.

Milk and dairy products experienced a significant increase in their share of purchased food, rising from 0% in 2004 to 5.5% in 2017. However, this upward trend was temporarily interrupted in 2019 and 2021, with the share of milk and dairy products declining to 2.4%. This decline may be attributed to factors such as shifting consumer preferences, increased awareness of lactose intolerance, and economic fluctuations.

The consumption of non-alcoholic beverages has witnessed a remarkable surge in recent years, with the percentage of households purchasing these drinks skyrocketing from a mere 0.7% in 2004 to an astounding 5.4% in 2021. However, the surge in non-alcoholic beverage consumption has also raised concerns about its potential impact on public health. Excessive consumption of sugary drinks has been linked to various health issues, including obesity, type 2 diabetes, and heart disease.

The consumption of alcoholic beverages and tobacco in Cambodia experienced a significant increase, rising from 5% in 2004 to over 10% in 2017. However, there has been a notable decrease in recent years, with the percentage stabilizing around 3%-4% in both 2019 and 2021.

4.1.4. Share of Food Taken Away from Home

The proportion of food consumed outside the home in Cambodia has exhibited a consistent upward trajectory from 2004 to 2019, reaching its highest point of 10.39% in 2017 (Figure 5). However, this upward trend experienced a slight reversal in 2021, with the share of food away from home declining to 9.15%. This dip may be attributed to the disruptive effects of the COVID-19 pandemic, which adversely impacted the restaurant industry.

Figure 6. Share of Food taken away from home, by year

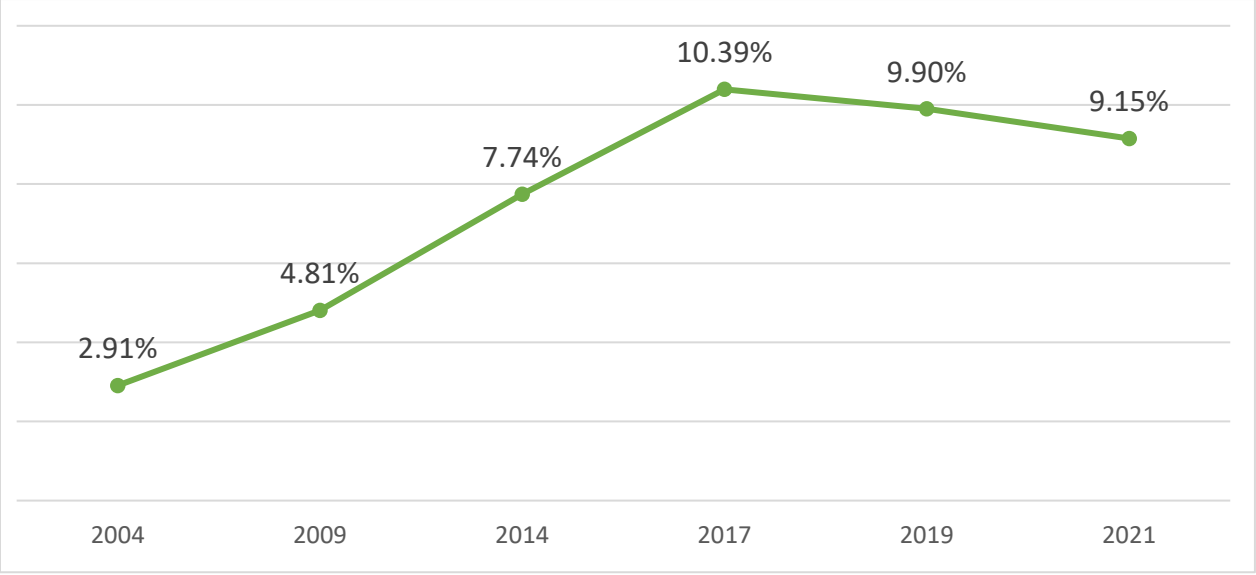


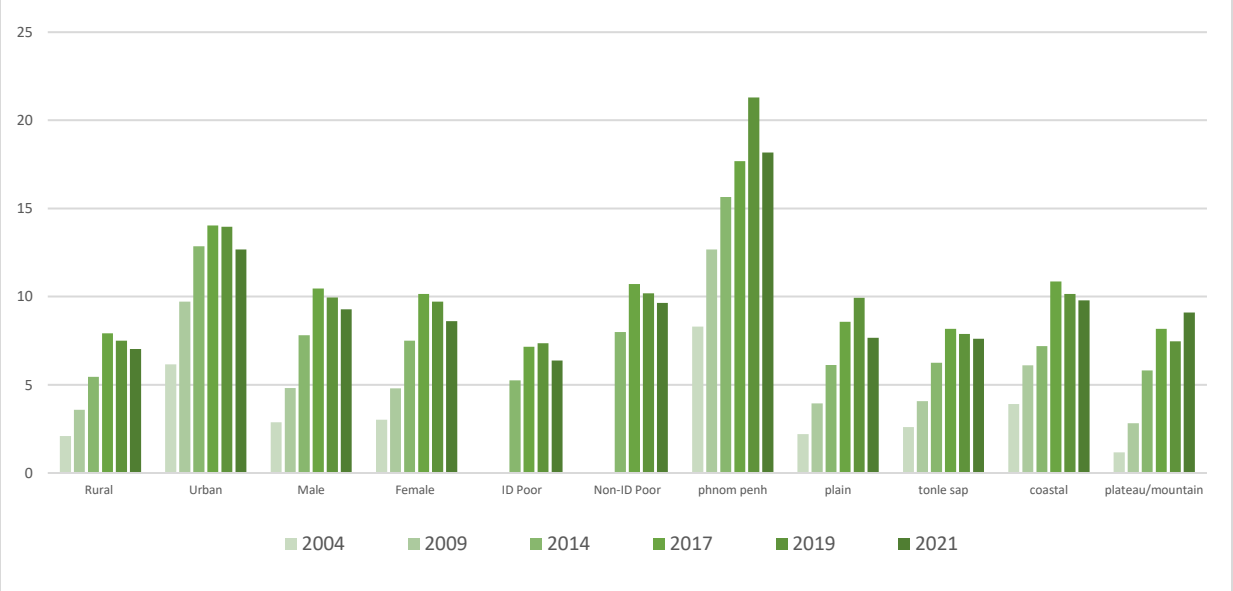
Figure 7 reveals a clear disparity in food consumption habits between rural and urban areas in Cambodia. Specifically, the share of food taken away from home is consistently higher in urban

regions, reaching peak percentages of 14.03% and 13.96% in 2017 and 2019, respectively. Notably, Phnom Penh, the capital city, stands as the leading contributor to this trend, followed closely by the coastal zone. This suggests a potential correlation between urbanization and increased reliance on takeaway food options.

Non-ID-poor households consistently have a higher percentage of food taken away from home than ID-poor households. Several factors may contribute to the higher share of food taken away from home in urban areas and among Non-ID poor households such as urban lifestyles, greater disposable income in which Non-ID poor households generally have higher disposable incomes than ID poor households and allows them to spend more on food taken away from home.

Last but not least, urban areas as well as Phnom Penh typically offer a wider variety of food options, including restaurants, fast food outlets, and food stalls. This greater diversity of food options may also appeal to Non-ID poor households, who have more disposable income to spend on foo

Figure 7. Share of food taken away from home by each year disaggregated



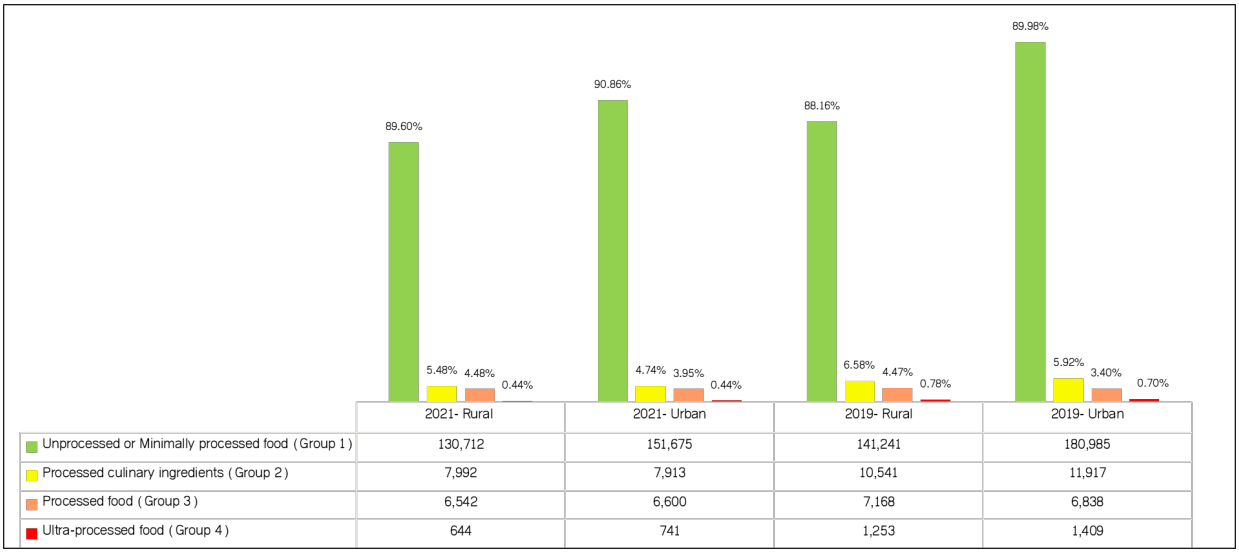
It is important to note that the consumption of food taken away from home can have both positive and negative implications for public health. On the one hand, it can provide convenient and affordable access to food, especially for people with busy schedules. On the other hand, it can also lead to increased consumption of processed foods, sugary drinks, and unhealthy fats.

4.1.5. Share of Processed food

To categorize processed food items, NOVA food groups are utilized to classify items into distinct food processing groups. The specific definitions for each food processing category are outlined in the accompanying Annex. In simpler terms, NOVA food groups serve as a classification system

to organize processed food items based on the level of processing they have undergone. It categorizes foods into four distinct groups, each with its characteristics and potential health implications. The Annex provides detailed explanations for each food processing category, ensuring clarity and consistency in the classification process. This detailed categorization allows for a more precise understanding of the types of processed foods consumed and their potential impact on health.

Figure 8. Share of processed food



	2021- Rural	2021- Urban	2019- Rural	2019- Urban
Unprocessed or Minimally processed food (Group 1)	130,712	151,675	141,241	180,985
Processed culinary ingredients (Group 2)	7,992	7,913	10,541	11,917
Processed food (Group 3)	6,542	6,600	7,168	6,838
Ultra-processed food (Group 4)	644	741	1,253	1,409

4.1.6. Food Consumption Frequency

Cambodian diet encompasses a diverse array of food groups, each contributing to the overall nutritional intake and dietary patterns of the population. To delve deeper into these consumption trends, the food items are categorized into eight distinct groups: staples (cereals and tubers), pulses (nuts and legumes), vegetables, fruits, animal proteins (eggs, meat, and fish), milk and dairy products, fats, and sugars/condiments.

1. Staples (Cereals and Tubers): Rice reigns supreme as the most ubiquitous cereal in Cambodia, serving as the cornerstone of the majority of meals. Households consistently consume cereals and/or tubers throughout the week, highlighting their central role in the Cambodian diet. The observed rise in staple consumption between 2014 and 2021 underscores the enduring importance of these food items in Cambodian cuisine.

2. Pulses (Nuts and Legumes): Despite their nutritional value and potential health benefits, the consumption of pulses remains relatively low in Cambodia. Households typically consume pulses on less than one day per week, indicating a missed opportunity to fully harness the nutritional benefits of these legumes. The gradual decline in pulse consumption raises concerns about the overall diversity of the Cambodian diet.

3. Vegetables: Vegetable consumption exhibited a downward trend from 2014 to 2021, with the average frequency dropping from less than four days per week to just five days per week in 2019 and 2021. This decline in vegetable intake raises concerns about the adequacy of micronutrients in the Cambodian diet, as vegetables are a rich source of vitamins and minerals.

4. Fruits: While fruit consumption remains lower than that of vegetables, there has been a gradual upward trend in recent years. Households typically consume fruits two to three days per week, indicating a growing appreciation for the nutritional value and taste of fruits. This trend suggests a positive shift towards a more diverse and nutritious diet.

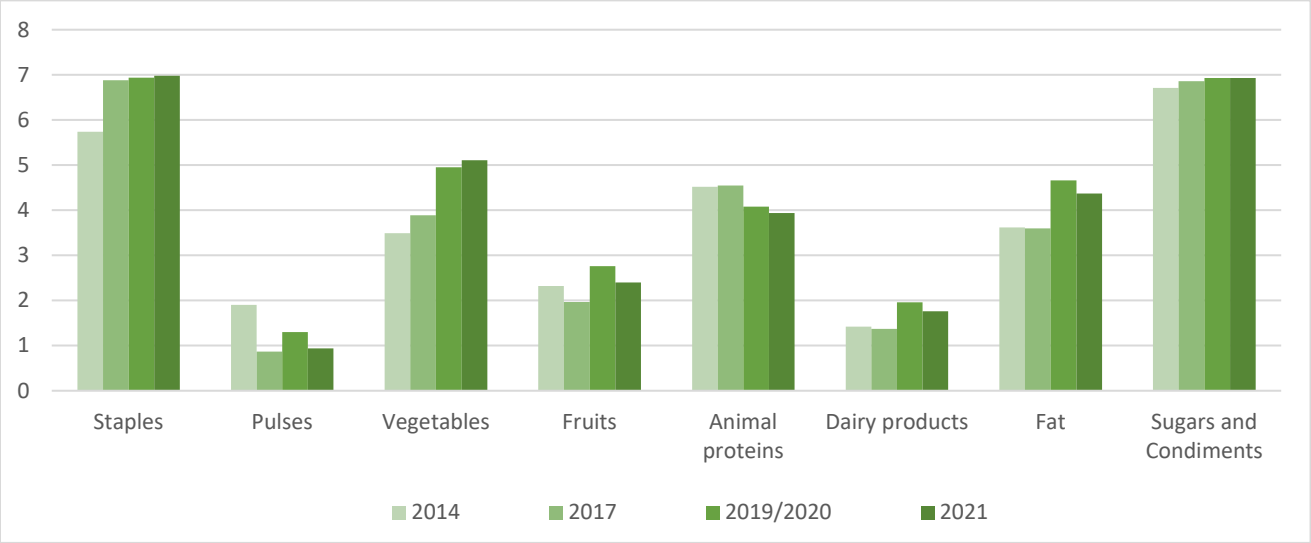
5. Animal Proteins (Eggs, Meat, and Fish): Fish holds a prominent position in Cambodian meals, particularly in rural areas. However, the overall consumption of animal proteins remains relatively low, with households typically consuming these food items less than five days per week. This pattern highlights the need for interventions to promote the intake of animal-based protein sources, particularly in vulnerable populations.

6. Milk and Dairy Products: Milk and dairy products are consumed less frequently than other food groups, with an average consumption of less than two days per week. However, a slight increase in consumption was observed in 2019 and 2020, suggesting a growing awareness of the nutritional benefits of these food items.

7. Fats consumption has remained relatively stable over the years, with households typically consuming fats less than five days per week. This pattern warrants further investigation to assess the quality and sources of fat intake, as excessive consumption of unhealthy fats can pose health risks.

8. Sugars and Condiments: Similar to staple consumption, sugar and condiment intake has increased from 2014 to 2021. This trend coincides with the rise in staple consumption, suggesting a potential link between the two. While sugars and condiments provide flavour and enhance meals, excessive consumption can lead to health issues such as obesity and diabetes.

Figure 9. Average days of consumption for the Eight Food Groups



4.1.7. Share of households consuming foods rich in Vitamin A, protein, and iron

Vitamin A is an essential nutrient that plays a crucial role in maintaining good vision, a healthy immune system, and normal cell growth. It is also important for reproductive health and fetal development. Food sources rich in vitamin A include:

- Vegetables: Sweet potatoes, carrots, pumpkin, spinach, kale, collard greens, broccoli, and sweet red peppers.
- Fruits: Mangoes, apricots, cantaloupe, papaya, and oranges.
- Animal proteins (eggs, meat, and fish): Eggs, liver, oily fish (such as salmon, tuna, and mackerel), and beef.
- Milk and dairy products: Milk, cheese, yoghurt, and fortified margarine.

Protein is essential for building and repairing tissues, producing enzymes and hormones, and transporting nutrients throughout the body. It also plays a role in maintaining muscle mass and strength.

Food sources rich in protein include:

- Pulses (nuts and legumes): Beans (such as kidney beans, lentils, and chickpeas), peas, nuts (such as almonds, pistachios, and walnuts), and seeds (such as chia seeds, flaxseeds, and pumpkin seeds).
- Animal proteins (eggs, meat, and fish): Eggs, lean meats (such as chicken, fish, and pork), and seafood (such as shrimp, clams, and oysters).
- Milk and dairy products: Milk, cheese, yoghurt, and kefir.

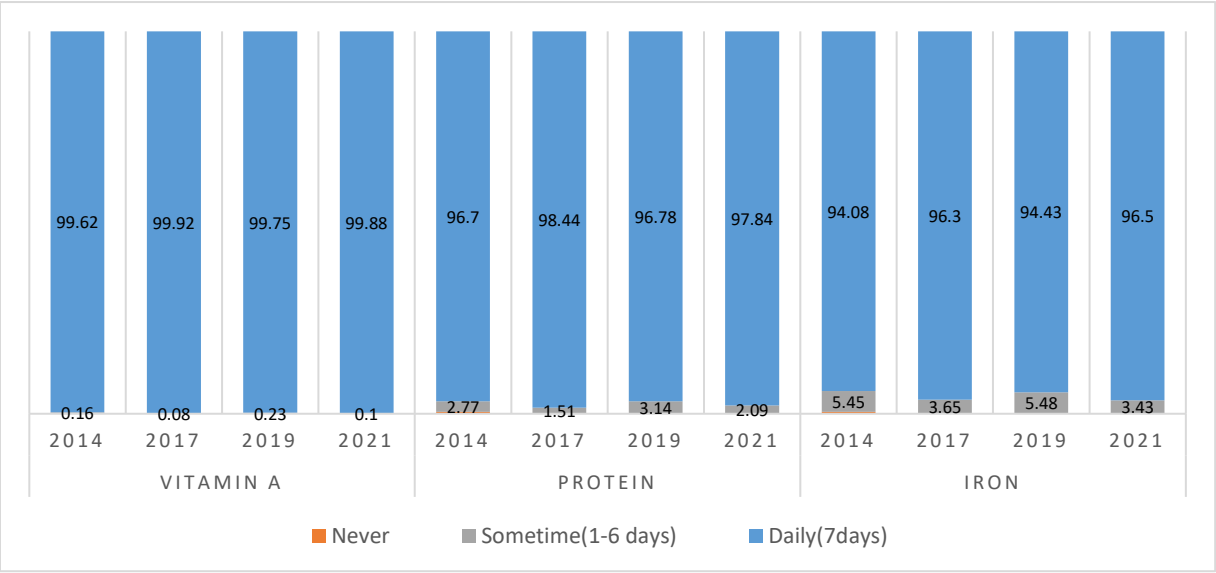
Iron is essential for carrying oxygen throughout the body and for producing energy. It is also important for maintaining healthy cells and tissues.

Food sources rich in iron include:

- Animal proteins (eggs, meat, and fish): Liver, beef, chicken, dark meat turkey, and seafood (such as oysters, clams, and sardines).
- Other sources: Beans (such as kidney beans, lentils, and chickpeas), fortified cereals, nuts (such as cashews and almonds), and dried fruits (such as prunes and raisins).
- It is important to note that the absorption of iron from food is enhanced by vitamin C. Therefore, it is recommended to consume foods rich in vitamin C, such as oranges, strawberries, and tomatoes, along with iron-rich foods.

As depicted in Figure 9, the proportion of households consuming food rich in Vitamin A, protein, and iron has experienced a remarkable surge in Cambodia, with the percentage surpassing the 90% threshold for all nutritional categories. This encouraging trend underscores a positive trajectory towards enhanced household food security and nutrition. Despite these notable advancements, there is still scope for improvement, particularly in the realm of iron-rich food consumption. The prevalence of anaemia among women and children in Cambodia remains a prevalent concern, highlighting the need for targeted interventions to address iron deficiencies.

Figure 10. Share of households Consuming foods rich in Vitamin A, Protein, and Iron (Percentage)

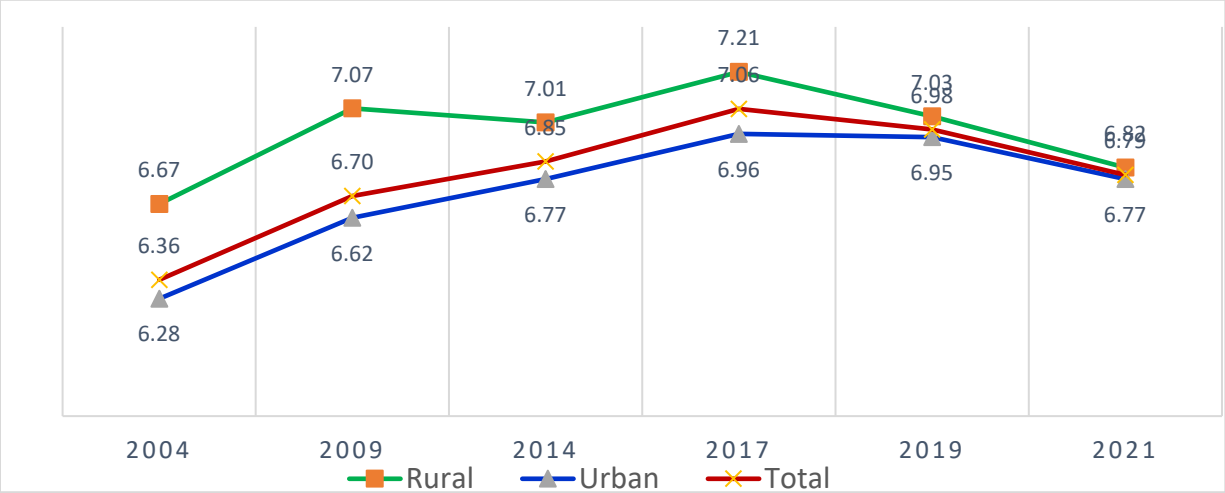


Figures 10 and 11 reveal that the proportion of households consuming Vitamin A-rich foods,Protein-rich foods andiron-rich foods have remained remarkably stable over the past seven years, consistently exceeding 90% across all aggregation levels. This sustained high consumption rate can be attributed to a synergy of factors, including government initiatives, enhanced public awareness, improved accessibility of Vitamin A-rich foods, and overall economic growth.

4.1.8. Dietary Diversity Score (DDS)

Nutritional diversity is important for a healthy diet. A balanced diet should include a variety of foods from all food groups to provide the body with the nutrients it needs to function properly. Different food groups provide different essential nutrients.

Figure 11. The average number of food groups household consumed7 daysdays



For example, vegetables and fruits are rich in vitamins and minerals, whole grains and legumes provide fibre and complex carbohydrates. Lean protein sources, such as fish, poultry, and beans, are essential for building and repairing tissues, while dairy products provide calcium and other important nutrients. It is important to remember that no single food group can provide all of the nutrients that the body needs. A healthy diet includes a variety of foods from all food groups.

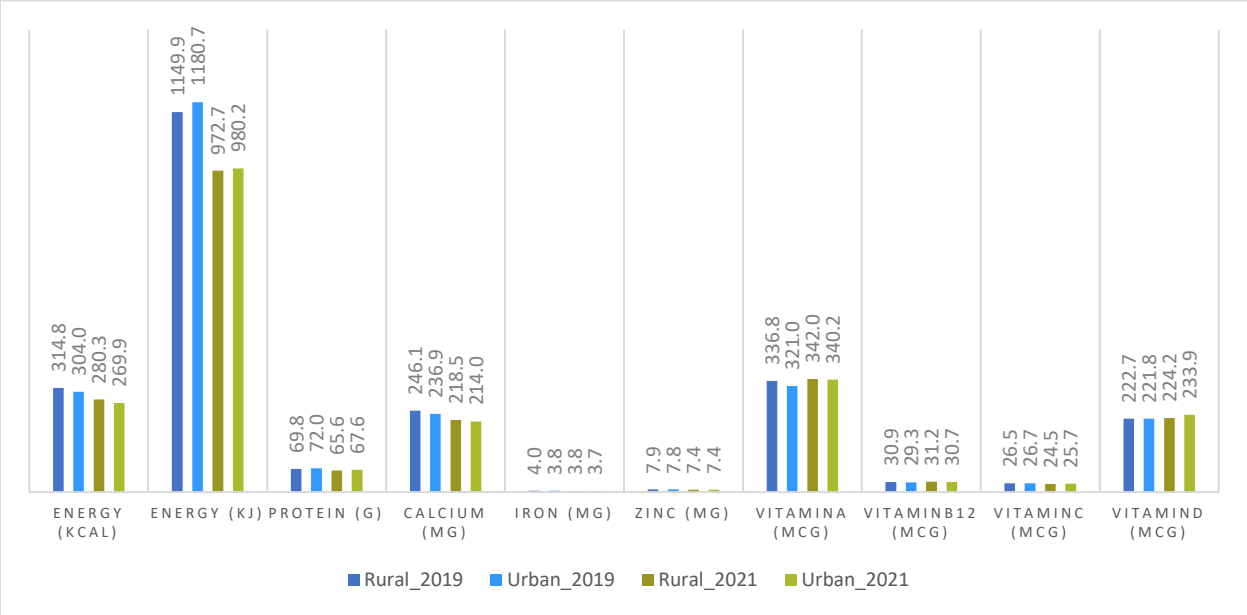
The average number of food groups that a household consumed in 7 days in Cambodia increased from 6.36 in 2004 to 6.79 in 2021. This suggests that Cambodian households have become more diversified in their food consumption over time. However, it is important to note that the average number of food groups consumed varies by region and income level. Households in rural areas tend to consume more food groups than households in urban areas.

4.1.9. Amount of nutrients consumed

Data on the quantity of food consumed by households is available solely in the CSES 2019/2020 and CSES 2021 surveys, enabling the calculation of nutrient intake. This is accomplished by multiplying the quantity of food consumed with the corresponding values from the Cambodian Food Composition Table (FCTC) (refer to Table 7 in Annex) and dividing by the number of individuals in each household, using adult equivalents.

Figure 14 illustrates that the consumption patterns of essential nutrients between rural and urban households in Cambodia exhibit relatively minor differences for certain nutrients, including protein, calcium, zinc, vitamin B12, vitamin C, and vitamin D.

Figure 12. Nutrients Consumed by person/day in Rural and Urban



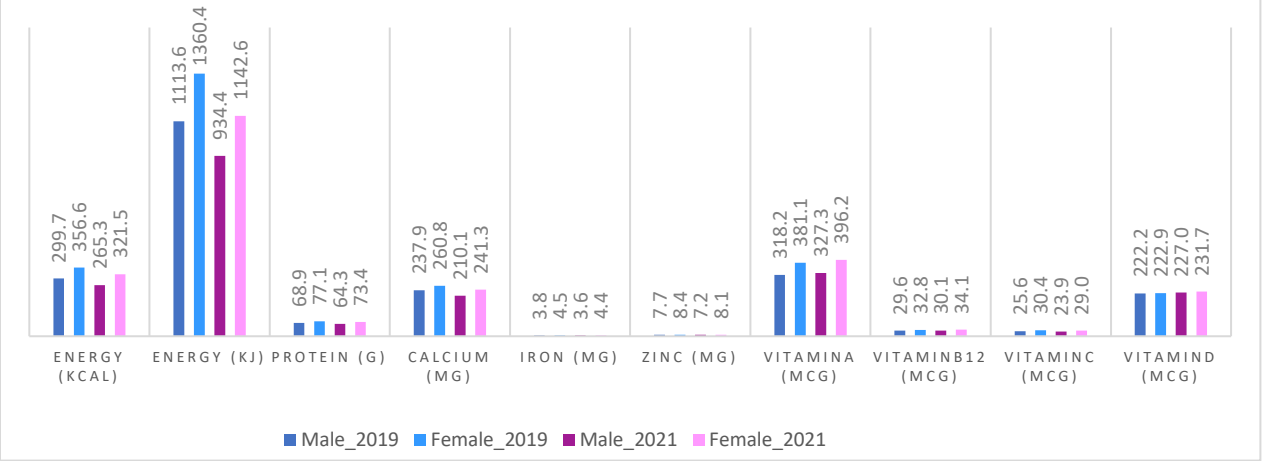
This suggests that both rural and urban areas have access to a diverse range of foods that provide these nutrients. However, there is a notable disparity in the average energy intake between rural

and urban areas. In 2019, rural households consumed an average of 1,149.9 kilojoules (KJ) of energy per person per day, while urban households consumed an average of 1,108.7 KJ per person per day. This difference persists in 2021, with rural areas maintaining a slightly higher average energy intake.

Conversely, rural areas surpass urban areas in terms of average vitamin A consumption. In 2019, rural households consumed an average of 336.8 micrograms of vitamin A per person per day, while urban households consumed an average of 321 micrograms per person per day. This trend continues in 2021, with rural areas maintaining a higher average vitamin A consumption. This suggests that rural households may consume more vitamin A-rich foods, such as dark green leafy vegetables and orange fruits, compared to their urban counterparts. This could be due to greater access to these foods in rural areas or differences in dietary preferences.

Figure 15 reveals a gender disparity in nutrient intake in Cambodia, with females consistently consuming more nutrient-rich foods than males. This pattern holds for all nutrient categories examined, including energy, protein, and a variety of vitamins.

Figure 13. Nutrients Consumed by Male and Female (person/day)



5. Statistical Results

5.1. Summary Statistics

Based on the information presented in Table 7, the average monthly household income in Cambodia is approximately 2.58 million Riels. Households typically consume an average of 1.9 million Riels per month, with food expenditures accounting for around 1.04 million Riels. On average, households consume a diverse range of foods, incorporating approximately 8.68 different food groups into their monthly diets.

In terms of household characteristics, the average household size is around 4.39 people. Additionally, approximately 19.1% of households derive 50% or more of their total income from crop production, while 39.4% of households reside in urban areas. On average, households have approximately 1.31 children under the age of 15 and 0.26 elderly members aged 65 or older. The

average age of the household head is approximately 47.17 years, and 16.1% of household heads are female.

Table 3. Summary statistics CSES 2019

Variable	***Description***	***Observation***	***Mean***	***Std. Dev.***	***Min***	***Max***
monthly_hhincome2	monthly household income in Riels	7,220	2585349	4019951	341.6667	8.85E+07
monthly_total_consumption	monthly household total consumption in Riels	7,220	1906143	1726869	55816.67	5.49E+07
monthly_foodexp	monthly household food consumption in Riels	7,220	1047160	628865.5	290.11	9398698
food_diversity	number of food groups consumed by households	7,220	8.683518	1.426688	0	12
log_food	log of household food consumption	7,220	13.69784	0.690913	5.67026	16.05608
log_income2	log of household monthly income	7,220	14.20665	1.267327	5.833836	18.29799
hh_size	household size	7,220	4.388366	1.701796	1	17
log_consumption	log of household monthly consumption	7,220	14.26109	0.602217	10.92983	17.821
log_consumption_sq	square of log of household monthly consumption	7,220	203.7412	17.28138	119.4611	317.588
crops_farmer	1 if income from crops is 50% or more of total income; 0 if otherwise	7,220	0.190997	0.393114	0	1
urban	1 if the household is located in an urban area; 0 if otherwise	7,220	0.393906	0.488648	0	1
hm_children	number of children under 15 years of age in the household	7,220	1.307341	1.107031	0	7
hm_elderly	number of elderly 65 years old and above in the household	7,220	0.259972	0.553425	0	4
hh_age	age of household head	7,220	47.17452	13.63347	17	95
hh_gender	gender of household head; 1 if female; 0 if otherwise	7,220	0.160665	0.367247	0	1

Based on the data presented in Table 8, the average Cambodian household earns approximately 2.46 million Riels per month. Households typically allocate around 1.54 million Riels towards monthly household expenses, with food expenditures accounting for around 0.91 million Riels. Additionally, households consume a diverse array of foods, incorporating an average of 8.31 different food groups into their monthly diets.

In terms of household characteristics, the average household size is around 4.38 people. Moreover, approximately 19% of households derive at least 50% of their total income from crop production. Further, 54.1% of households have some form of income from crops. Approximately 39.1% of households reside in urban areas. On average, households have approximately 1.25 children under the age of 15 and 0.27 elderly members aged 65 or older. The average age of the household head is approximately 48 years old and 36% of household heads are female.

Table 4. Summary statistics: CSES 2021

VARIABLE	DESCRIPTION	OBSERVATION	MEAN	STD. DEV.	MIN	MAX
monthly_hhincome2	monthly household income in Riels	8,166	2465820	4130709	1008.333	1.55E+08
monthly_total_consumption	monthly household total consumption in Riels	8,166	1540668	1128242	135694.3	3.60E+07
monthly_foodexp	monthly household food consumption in Riels	8,166	906346.9	440309.6	110415	4910870
food_diversity	number of food groups consumed by households	8,166	8.309944	1.330896	2	12
log_food	log of household food consumption	8,166	13.61127	0.463561	11.612	15.40696
log_income2	log of household monthly income	8,166	14.18841	1.175494	6.916054	18.8609
hh_size	household size	8,166	4.349498	1.672534	1	15
log_consumption	log of household monthly consumption	8,166	14.08613	0.548782	11.81816	17.40033
log_consumption_sq	square of log of household monthly consumption	8,166	198.7203	15.54002	139.6689	302.7714
crops_farmer	1 if income from crops is 50% or more of total income; 0 if otherwise	8,166	0.224712	0.417418	0	1
Crops farmer	1 if the household has income from crops; 0 if otherwise	8,166	0.540656	0.498375	0	1
urban	1 if the household is located in an urban area; 0 if otherwise	8,166	0.390644	0.487925	0	1
hm_children	number of children under 15 years of age in the household	8,166	1.252265	1.099147	0	8
hm_elderly	number of elderly 65 years old and above in the household	8,166	0.273941	0.567565	0	3
hh_age	age of household head	8,166	47.68993	13.47474	14	95
hh_gender	gender of household head; 1 if female; 0 if otherwise	8,166	0.540656	0.498375	0	1

5.2. Regression Results

This section provides regression results using the CSES dataset for 2019/2020 and 2021. The regression assesses factors affecting the consumption behavior of households which is proxied by food consumption share, food consumption value and food diversity consumed by households. Table 9 presents regression results using a pooled cross-sectional dataset of 2019/2020 and 2021 Column (1) and (3) represent regression results including household income variable, which is often proxied by household expenditure. Therefore, to test whether household income variable and expenditure would cause multicollinearity, column (2) and (4) exclude household income variable. The table shows that results are consistent across the four models.

From Table 9, household food consumption share to total expenditure is statistically and significantly affected by household size, household total expenditure, location of residence and whether the family's income from crops account for more than 50 percent of household total income. It is shown that an increase of one family member may lead to an increasing in food share of a household consumption and food expenditure respectively. In contrast, households who earn a high proportion of their income from crops spend less on food; this is apparently due to the fact that they can consume part of their own crops production as well as other livestock raising.

The opposite signs between that of the long total household consumption and its square indicate that household income proxied by total household expenditure increase their food consumption both in value and share to total consumption; however, at a certain level of income, the positive effect diminishes or even become negative which implies that household are diversifying their consumption basket by turning to consume other necessary and luxury goods. Table 5 also shows that urban households are more likely to spend more on food compared than that of in the rural areas, and thus, experience higher share of food to total consumption. Coefficients of number of children and elderly in the households show opposite signs, positive and negative respectively, but are not statistically significant.

It is also noted from Table 5 that households tend to spend more on food in 2021 than in 2020 because the Covid-19 pandemic changed household consumption behavior towards food rather than other goods through their income decline. The above pattern of findings is consistent when disaggregating dataset by year (See Annex xx).

Table 5. Cross section result (CSES 2019/2020 vs 2021)

	(1)	(2)	(3)	(4)
VARIABLES	**food_share**	**food_share**	**log_food**	**log_food**
log_income2	0.00156		-0.000853	
	(0.00114)		(0.00319)	
hh_size	0.0143***	0.0146***	0.0315***	0.0313***
	(0.00106)	(0.00104)	(0.00332)	(0.00337)
log_consumption	0.872***	0.876***	4.997***	4.995***
	(0.0853)	(0.0849)	(0.359)	(0.357)
log_consumption_sq	-0.0363***	-0.0364***	-0.152***	-0.152***
	(0.00298)	(0.00297)	(0.0124)	(0.0124)
crops_farmer	-0.0104***	-0.0109***	-0.0188***	-0.0186***
	(0.00280)	(0.00279)	(0.00712)	(0.00701)
urban	0.0429***	0.0434***	0.0837***	0.0834***
	(0.00250)	(0.00247)	(0.00700)	(0.00702)
hm_children	0.00266*	0.00228	0.00339	0.00359
	(0.00143)	(0.00141)	(0.00345)	(0.00348)
hm_elderly	-0.00302	-0.00328	-0.00957	-0.00943
	(0.00229)	(0.00228)	(0.00680)	(0.00670)
hh_age	-3.68e-05	-4.24e-05	0.000300	0.000303
	(0.000106)	(0.000106)	(0.000329)	(0.000332)
hh_gender	-0.00427	-0.00422	-0.0137	-0.0137
	(0.00332)	(0.00331)	(0.0110)	(0.0110)
year2	0.0107***	0.0109***	0.0271***	0.0270***
	(0.00235)	(0.00234)	(0.00716)	(0.00700)
Constant	**-4.524*** **	**-4.538*** **	**-26.78*** **	**-26.77*** **

	(0.607)	(0.606)	(2.573)	(2.565)
Observations	**15,386**	**15,386**	**15,386**	**15,386**
R-squared	**0.293**	**0.293**	**0.547**	**0.547**

According to Table 12, the regression analysis of food diversity data from the CSES 2019 and CSES 2021 surveys reveals a consistent and significant positive correlation between income and food diversity. Households with higher incomes consistently consume a more diverse range of foods compared to those with lower incomes. This relationship remains statistically significant across both survey years, indicating its robustness over time.

Similarly, larger household size and higher food consumption are also associated with greater food diversity, suggesting that these factors contribute to a more varied diet. Additionally, urban households generally exhibit a more diverse diet than rural households, likely due to improved access to a wider variety of food options in urban areas.

Table 6. Regression Results on Food Diversity

VARIABLES	2019-2021		2019		2021	
	(1)	(2)	(3)	(4)	(5)	(6)
	food_diversity	food_diversity	food_diversity	food_diversity	food_diversity	food_diversity
log_income2	-0.0244**		-0.0315**		-0.0196	
	(0.0107)		(0.0137)		(0.0163)	
hh_size	0.0138	0.00853	0.0170	0.0105	0.00713	0.00280
	(0.00949)	(0.00920)	(0.0128)	(0.0124)	(0.0141)	(0.0136)
log_consumption	8.099***	8.038***	10.08***	9.953***	6.861***	6.834***
	(0.516)	(0.512)	(0.778)	(0.774)	(0.684)	(0.681)
log_consumption_sq	-0.259***	-0.257***	-0.329***	-0.325***	-0.215***	-0.215***
	(0.0180)	(0.0179)	(0.0274)	(0.0273)	(0.0236)	(0.0235)
crops_farmer	0.0554**	0.0625**	0.0726**	0.0799**	0.0353	0.0424
	(0.0265)	(0.0264)	(0.0346)	(0.0345)	(0.0409)	(0.0409)
urban	-0.216***	-0.224***	-0.180***	-0.190***	-0.260***	-0.266***
	(0.0226)	(0.0224)	(0.0297)	(0.0293)	(0.0347)	(0.0344)
hm_children	0.113***	0.119***	0.102***	0.110***	0.127***	0.131***
	(0.0131)	(0.0129)	(0.0174)	(0.0170)	(0.0199)	(0.0196)
hm_elderly	0.00771	0.0117	0.0660**	0.0710***	-0.0608*	-0.0576*
	(0.0214)	(0.0213)	(0.0277)	(0.0275)	(0.0334)	(0.0333)
hh_age	-0.000621	-0.000533	-0.00375***	-0.00361***	0.00303**	0.00308**
	(0.000959)	(0.000958)	(0.00124)	(0.00123)	(0.00149)	(0.00149)
hh_gender	-0.246***	-0.247***	-0.187***	-0.187***	-0.308***	-0.309***
	(0.0277)	(0.0277)	(0.0356)	(0.0356)	(0.0429)	(0.0429)
year2	-0.252***	-0.255***				
	(0.0212)	(0.0213)				

Constant	-53.80***	-53.58***	-67.85***	-67.21***	-45.17***	-45.15***
	(3.554)	(3.532)	(5.498)	(5.486)	(4.941)	(4.922)
Observations	15,386	15,386	8,166	8,166	7,220	7,220
R-squared	0.153	0.153	0.155	0.154	0.125	0.124

The presence of children and elderly members in the household also influences food diversity. Households with children consistently consume a more diverse range of foods compared to households without children. This is likely attributable to the higher nutritional needs of children, necessitating a broader spectrum of food choices. Conversely, the presence of elderly members tends to be associated with a less diverse diet, possibly due to their generally lower nutritional requirements. These findings align with the results of two independent studies conducted in 2022. The first study, conducted by the Cambodian Ministry of Planning and the World Food Programme, found a significant association between food diversity and income, household size, and location. Similarly, the second study, conducted by the CDRI, identified income, household size, and education level as significant determinants of food diversity. Both studies also noted the positive association between food diversity and the presence of children, while confirming the negative association with elderly members.

6. Conclusion and Policy implication

6.1. Conclusion

This research sheds valuable light on the factors that influence household food consumption in Cambodia, highlighting the evolving dietary preferences and shifting consumption patterns across food groups. Notably, the research demonstrates a significant decrease in the share of household expenditure dedicated to food, dropping from over 50% in 2004 to around 40% in 2021. This decline suggests that Cambodians are spending a smaller portion of their income on food, potentially indicative of improved economic well-being and access to a wider variety of food options. However, the burden is significantly amplified for households identified as "ID-Poor" and “Female Headed Household” who are forced to allocate a staggering 50% of their income to meet their food needs. This stark disparity exposes the vulnerability of low-income households in the face of fluctuating food prices or economic shocks. With limited resources already stretched thin, such disturbances can significantly compromise their ability to access adequate and nutritious food, potentially leading to food insecurity and malnutrition.

The study highlights that access to crops and potentially livestock allows families to meet their food needs partially through self-consumption, reducing their reliance on purchased food and contributing to lower food expenditure proportions. Diversification of consumption suggests that as income levels rise, households tend to diversify their consumption beyond basic necessities like food. This implies that while higher income initially leads to increased food spending, at a certain point, families prioritize other goods and services, leading to a decline in the proportion of income dedicated to food. Household are diversifying their consumption basket by turning to

consume other necessary and luxury goods. An important insight gained from the study is the significant increase in household food expenditures in 2021 compared to 2019/2020. This trend reflects the impact of the COVID-19 pandemic, which led to altered consumption patterns. As incomes declined, households focused their spending on food, prioritizing it over other non-essential items. The analysis illustrated about Cambodian households typically rely on a staple-based diet, featuring rice as a primary source of carbohydrates alongside staples like animal protein (particularly freshwater fish) and flavorful condiments such as fish sauce and soy sauce. While fruit consumption remains relatively consistent across households, a concerning trend emerges with the decline in vegetable intake. In sum, the research sheds light on a worrying disparity between the recognized value of healthy diets and their actual adoption among the Cambodian population. While some individuals may not prioritize healthy eating, for others, the lack of economic resources makes nutritious food simply unaffordable. This paradox necessitates a multifaceted approach to bridge the gap and empower Cambodians to embrace healthier dietary choices.

6.2. Policy Implications

By analyzing changes in food consumption and nutrition patterns in Cambodia, several crucial insights emerge, shedding light on the challenges and solutions to tackling the complex issue of malnutrition. These findings unveil a dynamic food landscape, highlighting areas of progress and persistent concerns.

- There is a growing trend of consuming non-alcoholic beverages including soft drink, which raises concerns about public health. While fruit consumption remains relatively frequent across households, vegetable intake has shown a concerning decline. This trend necessitates further investigation and targeted interventions to encourage increased vegetable consumption, which is vital for ensuring adequate micronutrient intake and promoting overall health. It emphases the importance of taking actions to enhance public awareness about the health implications of consuming unhealthy drinks as well as important nutrients in vegetables and fruit. Collaboration among all stakeholders in the various government ministries of Cambodia is necessary to promote this cause. Greffeuille et al. (2016) further suggested that effective strategies to prevent and control unhealthy drinks in children should take into account the fact that prevalence increases more quickly in urban areas and in the richest populations and that programs improving household feeding practices in the most-at-risk populations should benefit both mothers and their offspring. Increasing public awareness by education and awareness campaigns about health risks associated with excessive consumption of fats, sugars, and processed foods while promoting the importance of fruits and vegetables. Implementing policies to regulate the marketing and availability of unhealthy foods and promote access to affordable and nutritious options.

- The long-term impact of socio-economic inequality on malnutrition, particularly among disadvantaged households, are highlighted (Nakphong and Beltrán-Sánchez 2021). Expanding

access to early education is crucial for reducing social inequities and ensuring fair access to nutritious food. Additionally, the findings indicate that maternal employment between 2010 and 2014 was linked to higher rates of child stunting among overweight mothers. Early education programs would greatly benefit children of low-income working mothers. Efforts to improve wages, working conditions, and gender wage disparities are still needed in industries like agriculture, manufacturing, and service. By formalising employment, providing adequate overtime compensation, and creating opportunities for career advancement, it can improve both maternal and child health.

- The study underscores the crucial role of crop and livestock access in enhancing food security. By enabling families to partially fulfill their food needs through self-consumption, such access can Reduce reliance on purchased food and contribute to lower food expenditure proportions. Therefore, policy interventions should focus on supporting and expanding access to crops and livestock for vulnerable populations by encouraging the cultivation of a wider range of crops, including fruits, vegetables can ensure access to diverse and nutritious food sources for self-consumption.

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Annex:

Table 7 Food Composition for Cambodia

Food Composition for Cambodia: Nutrient Content Per 100g Edible Portion																						
No.	Food Name in English	Source	ENERC (kcal)	ENERC (kJ)	WATER (g)	PROTCNT (g)	FAT (g)	CHOAVLDF (g)	FIBTG (g)	ASH (g)	CA (mg)	FE (mg)	ZN (mg)	VITA_RAE (mcg)	VITD (mcg)	THIA (mg)	RIBF (mg)	NIA (mg)	VITB6 (mg)	FOL (mcg)	VITB12 (mcg)	VITC (mg)
01	...rice, quality 1	*	352	1493	11.8	7.18	0.75	78.4	1.3	0.58	21	1.17	0.83	0	0	0.093	0.035	2.2	0.15	9	0	0
02	...rice, quality 2	**	344		14.0	7.90	1.00	75.9	0.40	0.80	30	1.30	1.50	0		0.10	0.03	1.60	0.15	9	0.00	0.00
03	...rice noodles/ fried noodle	**	110		72.0	1.70	0.00	25.7	0.50	0.10	12	0.20	0.25	0		0.04	0.01	0.08	0.01	3	0.00	0.00
04	...chinese noodle/ khmer noodles	*	111	471	72	1.7	0.56	24	1.6	0.1	12	0.2	0.74	0	0	0.04	0.01	1.3	0.015	3	0	0
05	...other cereals or flour and other bakery	*	397	1662	24.8	2.8	20.4	50.2	0.8	1	149	2.2	0.46	93	0	0.12	0.05	1	0.042	41	0.25	0
07	...Mudfish	*	97	409	78	18.2	2.7	0	0	1.1	90	0.5	0.93	203	118	0.04	0.12	2.3	0.12	5	1.9	1.7
08	...Catfish	*	209	869	65	16	14.7	3.1	0	1.1	20	0.68	0.2	374	500	0.01	0.45	2.3	0.012	10	2.2	0.7
09	...Other inlandfish	*	156	650.13	66.40	19.74	6.86	4.27	0.01	3.41	175.75	1.09	1.09	324.50	340.00	0.06	0.20	2.39	0.16	15.67	1.69	1.00
10	...shrimp/lopster	***	82		79.2	17.6	0.90	0.90	0.00	1.40	79	1.60	1.11	20		0.04	0.08	2.30	0.10	3	1.16	0.00
11	...Crabs	*	87	365	74.4	12.3	3.3	2	0	8	120	1.4	4.3	210	0	0.01	0.51	2.1	0.15	44	9	0
12	...Other seafood	*	109	484	73.9	19.9	3.25	1.5	0	1.45	62	1.4	0.6	105	292	0.11	0.24	7.1	0.4	1	2.4	4.5
13	...preserved or processed fish/seafood	*	120	508	44	8.6	1	19.1	0	27.3	1380	20.5	2	54	2	0.01	0.12	3.7	0.16	19	1.1	2
14	...*Pork*	*	184	769	68	19	12	0	0	1	18	1	2	5	49	1	0	4	0	3	1	1
15	...*Beef*	*	117	491	74	21.3	3.5	0	0	1.05	24	2.45	2.2	66	3	0.06	0.15	5.6	0.47	8	3.3	0.5
16	...*Duck*	**	267		59.5	17.8	21.8	0.00	0.00	0.90	13	1.80	1.36	270		0.07	0.15	4.70	0.19	13	0.25	2.80
17	...*Chicken*	*	148	612	71.3	20.4	7.07	0.17	0.1	0.97	14	0.9	0.4	20	0	0.057	0.09	8	0.53	9	0.34	0.33
18	...*Other meat products*	*	619	2569	2.3	51.2	46	0	0	0.7	19	2	0.6	26	69	0.02	0.14	2	0.14	0	0.67	0
19	...*eggs and egg-based products*	*	155	636	73.8	12.9	10.5	1.7	0	1.18	47	2.4	0.93	237	5	0.13	0.23	0.4	0.25	80	5.4	0
20	...milk or yoghurt	*	61		88.7	3.30	3.70	3.60	0.00	0.70	120	0.10	0.59	26		0.04	0.20	0.10	0.03	7	0.37	0.70
21	...oils or fats	*	900	3700	0	0	100	0	0	0	0	0.05	0.67	0	0	0	0	0	0.033	0	0	0
22	...Banana	*	98.00	414	74.00	1.23	0.33	21.45	2.10	0.73	9.00	0.50	0.34	11.00	0.00	0.06	0.08	0.73	0.37	29.00	0.00	10.25
23	...mangoes	**	69		82.6	0.60	0.30	15.9	1.80	0.60	10	0.40	0.56	38		0.05	0.05	0.30	0.13	14	0.00	30.0
24	...*longan (mien)*	***	67		82.9	0.90	0.10	-	-	0.50	5	0.70	0.20	1	0.00	0.080	0.040	17	0.043	-	0.00	24.00
25	...*papaya*	**	35		90.1	1.00	0.00	7.70	0.60	0.60	40	1.40	0.10	55		0.02	0.02	0.40	0.02	38	0.00	54.0
26	...tamarind	*	120	497	57.8	2	0.2	16	23	1	81	1.3	0.1	4	0	0.3	0.08	1.9	0.066	14	0	3
27	...coconut	****	97		89.7	0.10	0.30		2.3	0.40	15	0.10	0.21			0.1	0.1	0.2	0.1	6	0.00	4.93
28	...nuts and edible seeds	*	557	2306	6.3	25.6	43.9	8.23	13.5	2.53	64	5.67	2.07	0	0	1.1	0.17	16	0.35	240	0	0
29	...maize and corn crop	*	338	1429	15	7.59	4.27	62.8	9	1	13	4.76	2.74	0	0	0.3	0.16	2.3	0.51	26	0	0
30	...other fresh fruits	*	56.50	197.00	86.50	0.69	0.28	8.78	3.25	0.45	25.00	0.75	0.54	9.50	0.00	0.06	0.05	0.92	0.05	39.50	0.00	30.80
32	...trakun (watercress marsh cabbage)	*	35	105	91.5	2.88	0.4	1.15	2.8	1.33	73	2.83	0.4	246	0	0.07	0.16	0.85	0.096	57	0	23
33	...spring onion/ garlic/ leeks leaves	*	60.25	232.75	84.50	2.35	0.30	9.48	2.55	0.78	47.50	1.05	0.71	23.75	0.00	0.19	0.05	0.47	0.45	21.50	0.00	14.54
34	...cabbage/ leaves	*	25	83	93.3	1.65	0.2	1.8	2	1	83	1	0.63	208	0	0.07	0.16	0.5	0.19	187	0	26
35	...gourd, cucumber, pumpkin, eggplant	*	22.67	88.00	93.67	0.81	0.20	3.25	1.43	0.49	21.33	0.54	0.12	3.67	0.00	0.05	0.05	0.42	0.05	11.33	0.00	13.64
36	...other fresh vegetables	*	49.26	168.05	87.71	3.06	0.60	3.94	3.32	1.34	119.89	2.05	0.45	137.53	0.00	0.29	0.18	2.89	0.15	43.23	0.00	28.12
37	...prepared and preserved vegetables	*	22	99	90.9	1.2	0.2	3.7	1	3	51	0.3	0.19	0	0	0.01	0.06	0.3	0.19	66	0	20
38	...tubers (potato, sweet potato, carrot,	*	72.00	247.14	84.07	1.21	0.52	11.28	1.99	0.93	50.43	1.29	5.81	45.86	0.00	0.21	0.09	0.61	0.40	15.00	0.00	13.79
39	...mushrooms/ dried mushrooms	*	26.50	143.00	90.55	3.37	0.27	3.57	1.85	0.38	15.00	1.00	0.47	1.00	0.95	0.10	0.37	4.00	0.06	33.00	0.02	4.23
40	... pea, bean/ soybean/ bean sprout	*	182.50	748.50	48.00	13.79	0.80	22.69	12.40	2.20	66.50	3.80	1.58	6.00	0.00	0.42	0.18	1.70	0.23	343.00	0.00	13.35
41	...sugar cane/ palm sugar	*	385.00	1635.50	3.20	0.35	0.13	95.60	0.10	0.70	128.50	2.23	0.26	0.00	0.00	0.05	0.05	0.40	0.03	1.00	0.00	0.00
42	...sweets	*	397	1662	24.8	2.8	20.4	50.2	0.8	1	149	2.2	0.46	93	0	0.12	0.05	1	0.042	41	0.25	0
44	...pepper	*	314	1312	13.3	9.7	7.35	39.6	25.3	4.75	497	6.6	0.3	13	0	0.045	0.14	2.6	0.29	10	0	1.5
46	...fish sources/ soy sources/ chilly sources	*	95.00	343.00	63.00	6.93	0.41	12.23	0.40	17.00	115.00	2.39	0.32	14.00	0.00	0.02	0.37	2.20	0.30	34.50	0.24	0.25
47	Other ingredients	*	95	366	58	10.7	3.7	0	9.3	19.9	83	3.8	4.89	1	0	0	0.12	1.3	0.38	4	0	6
50	...coffee, tea, and chocolate	*	403	1704	2	15.2	7.1	68.8	1.6	5.1	219	4.9	0.35	0	0	0.02	0.04	18	0.029	0	0	0
52	...soft drinks, orange juices, friut juices	*****		50	87.6	0.00	0.00	12.40	0.0	0.00	0	0.00	0.00	0	0.00	0.000	0.000	0	0.000	0	0.00	0.00
53	...ice cream	*****		527	1.7	5.70	28.40	61.30	1.9	1.00	48	0.70	2.66	14	0.10	0.480	0.070	3	0.020	8	0.00	0.00
54	...beer at home	******	43		92.0	0.56	0.00		0.0	0.16	4	0.02	0.01			0.0	0.0	0.0	0.0	6	0.02	0.00
55	...wine at home	******	43		92.0	0.56	0.00		0.0	0.16	4	0.02	0.01			0.0	0.0	0.0	0.0	6	0.02	0.00
56	...other alcohol not in bar or restaurant	******	43		92.0	0.56	0.00		0.0	0.16	4	0.02	0.01			0.0	0.0	0.0	0.0	6	0.02	0.00

Table 8 NOVA food groups: definition according to the extent and purpose of food processing, with examples

Degree of processing Groups	Definition
Unprocessed or Minimally processed food (Group 1)	➢ Unprocessed: edible parts of plants (fruits, seeds, leaves, stems, roots, tubers) or of animals (muscle, offals, eggs, milk), and also fungi, algae and water, after separation from nature. ➢ Minimally processed: unprocessed foods altered by industrial processes such as removal of inedible or unwanted parts, drying, crushing, grinding, fractioning, roasting, boiling, pasteurisation, refrigeration, freezing, placing in containers, vacuum packaging, non-alcoholic fermentation, and other methods that do not add salt, sugar, oils or fats or other food substances to the original food.
Processed culinary ingredients (Group 2)	Substances obtained directly from group 1 foods or from nature by industrial processes such as pressing, centrifuging, refining, extracting or mining. Their use is in the preparation, seasoning and cooking of group 1 foods. These products may contain additives that prolong product duration, protect original properties or prevent proliferation of microorganisms.
Processed food (Group 3)	Products made by adding salt, oil, sugar or other group 2 ingredients to group 1 foods, using preservation methods such as canning and bottling, and, in the case of breads and cheeses, using non-alcoholic fermentation. Processes and ingredients here aim to increase the durability of group 1 foods and make them more enjoyable by modifying or enhancing their sensory qualities. These products may contain additives that prolong product duration, protect original properties or prevent proliferation of microorganisms.
Ultra-processed food (Group 4)	Formulations of ingredients, mostly of exclusive industrial use, that result from a series of industrial processes (hence 'ultra-processed'), many requiring sophisticated equipment and technology. Processes enabling the manufacture of ultra-processed foods include the fractioning of whole foods into substances, chemical modifications of these substances, assembly of unmodified and modified food substances using industrial techniques such as extrusion, modeling and pre-frying, frequent application of additives whose function is to make the final product palatable or hyper-palatable ('cosmetic additives'), and sophisticated packaging, usually with synthetic materials.

Table 9 Detail of Food Expenditure in Real Value (USD)

Year	Current KHR	CPI base year 2006=100	Constant 2006, KHR	Exhange rate	Current USD	Constant 2006, USD
2004	62,234.96	87.858	70,835.85	3,921.74	15.87	18.06
2009	132,254.40	131.12	100,861.38	4,159.88	31.79	24.25
2014	169,464.10	158.29	107,060.84	4,039.83	41.95	26.50
2017	208,164.70	169.87	122,543.47	4,050.58	51.39	30.25
2019	463,860.50	177.43	261,435.42	4,061.15	114.22	64.37
2021	409,699.90	187.98	217,947.70	4,098.72	99.96	53.17

Figure 14. Percentage of households consuming foods rich in Vitamin A, disaggregated

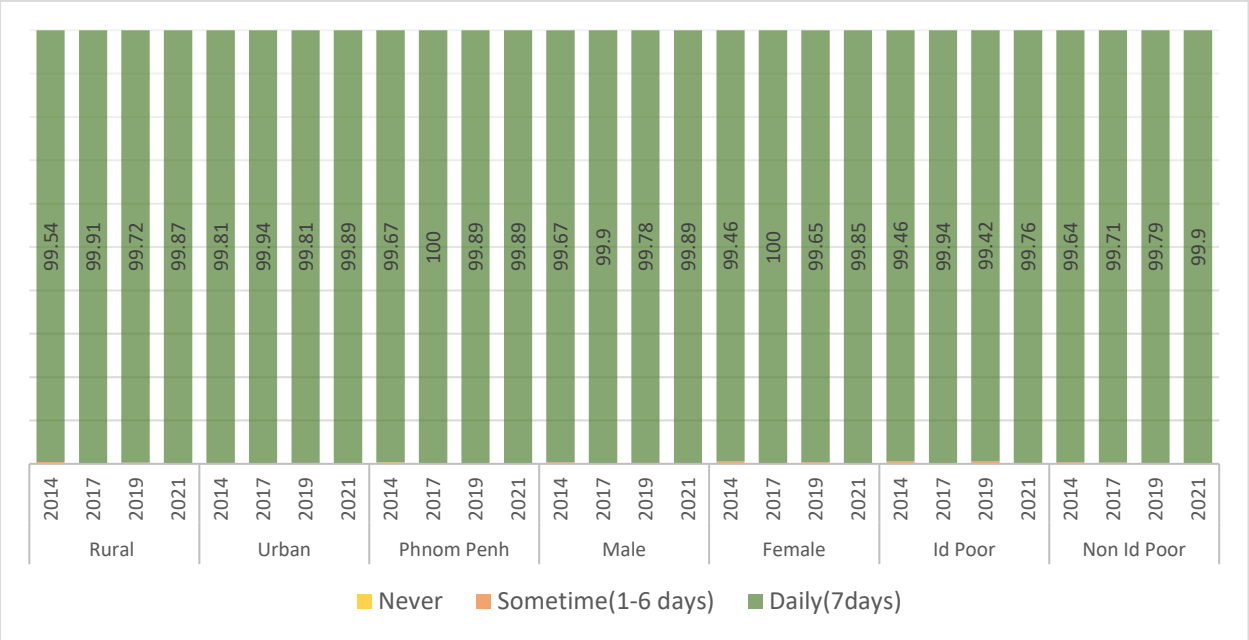

Figure 15. Percentage of households consuming foods rich in Protein, disaggregated

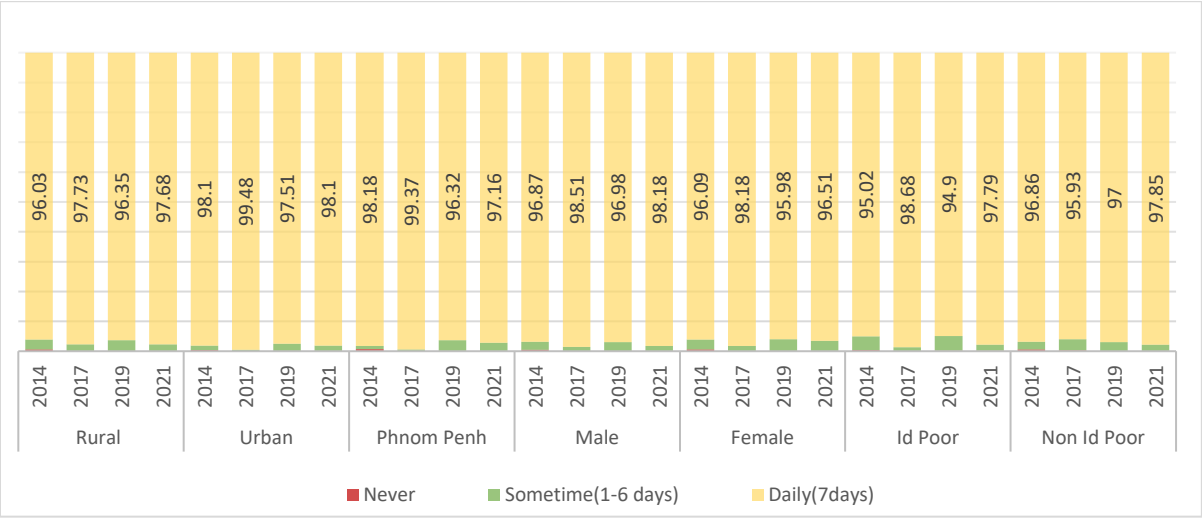

Figure 16. Percentage of households consuming foods rich in Iron, disaggregated

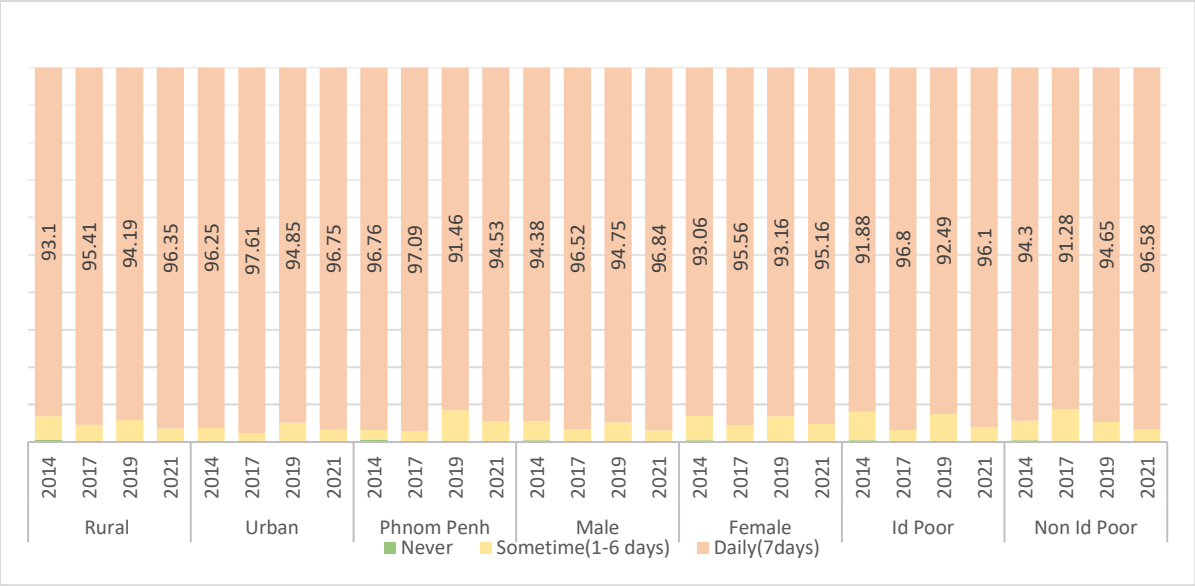

Table 10. Regression results of food diversity

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	food_diversity12	food_diversity12	log_food	log_food	food_share	food_share
log_income2	-0.0303**		0.00531*		0.00177	
	(0.0138)		(0.00301)		(0.00157)	
hh_size	0.0149	0.00851	0.0424***	0.0436***	0.0195***	0.0199***
	(0.0128)	(0.0125)	(0.00281)	(0.00276)	(0.00138)	(0.00135)
log_consumption	9.988***	9.854***	5.272***	5.295***	1.178***	1.186***
	(0.779)	(0.775)	(0.256)	(0.256)	(0.107)	(0.107)
log_consumption_sq	-0.326***	-0.322***	-0.165***	-0.165***	-0.0483***	-0.0485***
	(0.0274)	(0.0273)	(0.00917)	(0.00917)	(0.00379)	(0.00378)
cropsfarmer	0.0731**	0.0811***	-0.0276***	-0.0290***	-0.0162***	-0.0167***
	(0.0306)	(0.0304)	(0.00616)	(0.00608)	(0.00329)	(0.00325)
urban	-0.166***	-0.174***	0.0797***	0.0811***	0.0398***	0.0403***
	(0.0314)	(0.0312)	(0.00626)	(0.00623)	(0.00331)	(0.00329)
hm_children	0.104***	0.112***	-0.000423	-0.00179	0.000919	0.000464
	(0.0174)	(0.0170)	(0.00349)	(0.00342)	(0.00184)	(0.00181)
hm_elderly	0.0667**	0.0716***	-0.00731	-0.00816	-0.00447	-0.00476
	(0.0277)	(0.0275)	(0.00547)	(0.00545)	(0.00291)	(0.00290)
hh_age	-0.00374***	-0.00361***	1.44e-05	-8.16e-06	-5.02e-05	-5.78e-05
	(0.00124)	(0.00123)	(0.000253)	(0.000254)	(0.000135)	(0.000135)
hh_gender	-0.186***	-0.187***	-0.00816	-0.00814	-0.00599	-0.00599
	(0.0355)	(0.0355)	(0.00793)	(0.00793)	(0.00419)	(0.00419)

Constant	**-67.23*** **	**-66.55*** **	**-28.17*** **	**-28.29*** **	**-6.467*** **	**-6.507*** **
	(5.505)	**(5.488)**	**(1.789)**	**(1.789)**	**(0.752)**	**(0.750)**
Observations	**8,166**	**8,166**	**8,166**	**8,166**	**8,166**	**8,166**
R-squared	**0.155**	**0.154**	**0.715**	**0.715**	**0.354**	**0.354**

Table 11. Cross Section CSES 2019

	2019			
	(1)	(2)	(3)	(4)
VARIABLES	food_share	food_share	log_food	log_food
log_income2	0.000944		-0.00717	
	(0.00164)		(0.00546)	
hh_size	0.00977***	0.00998***	0.0223***	0.0207***
	(0.00158)	(0.00156)	(0.00592)	(0.00599)
log_consumption	0.892***	0.893***	5.431***	5.421***
	(0.121)	(0.121)	(0.608)	(0.607)
log_consumption_sq	-0.0360***	-0.0360***	-0.164***	-0.164***
	(0.00419)	(0.00418)	(0.0209)	(0.0208)
crops_farmer	-0.00780*	-0.00814*	-0.0166	-0.0140
	(0.00439)	(0.00438)	(0.0136)	(0.0133)
urban	0.0391***	0.0394***	0.0730***	0.0707***
	(0.00390)	(0.00387)	(0.0133)	(0.0134)
hm_children	0.00414*	0.00393*	0.00695	0.00856
	(0.00220)	(0.00218)	(0.00612)	(0.00621)
hm_elderly	-0.000328	-0.000485	-0.00994	-0.00875
	(0.00362)	(0.00360)	(0.0134)	(0.0132)
hh_age	-1.02e-05	-1.29e-05	0.000650	0.000670
	(0.000165)	(0.000165)	(0.000637)	(0.000641)
hh_gender	-0.00206	-0.00200	-0.0198	-0.0203
	(0.00518)	(0.00518)	(0.0215)	(0.0216)
Constant	**-4.852*** **	**-4.853*** **	**-30.36*** **	**-30.35*** **
	(0.870)	**(0.869)**	**(4.404)**	**(4.405)**
Observations	**7,220**	**7,220**	**7,220**	**7,220**
R-squared	**0.229**	**0.229**	**0.467**	**0.467**

Table 12. Cross Section CSES 2021

	2021			
	(1)	(2)	(3)	(4)
VARIABLES	**food_share**	**food_share**	**log_food**	**log_food**
log_income2	0.00223		0.00619**	
	(0.00155)		(0.00297)	
hh_size	0.0190***	0.0195***	0.0416***	0.0428***
	(0.00138)	(0.00135)	(0.00280)	(0.00275)
log_consumption	1.154***	1.163***	5.229***	5.254***
	(0.106)	(0.106)	(0.256)	(0.256)
log_consumption_sq	-0.0474***	-0.0477***	-0.163***	-0.164***
	(0.00375)	(0.00374)	(0.00914)	(0.00915)
crops_farmer	-0.0110***	-0.0115***	-0.0162**	-0.0176***
	(0.00358)	(0.00357)	(0.00681)	(0.00677)
urban	0.0439***	0.0446***	0.0871***	0.0891***
	(0.00316)	(0.00311)	(0.00606)	(0.00599)
hm_children	0.00145	0.000890	0.000493	-0.00106
	(0.00184)	(0.00181)	(0.00349)	(0.00342)
hm_elderly	-0.00430	-0.00465	-0.00700	-0.00799
	(0.00291)	(0.00290)	(0.00546)	(0.00545)
hh_age	-5.12e-05	-6.07e-05	1.10e-05	-1.53e-05
	(0.000134)	(0.000135)	(0.000253)	(0.000254)
hh_gender	-0.00533	-0.00531	-0.00676	-0.00671
	(0.00417)	(0.00417)	(0.00789)	(0.00789)
Constant	**-6.307*** **	**-6.352*** **	**-27.89*** **	**-28.01*** **
	(0.744)	**(0.743)**	**(1.784)**	**(1.786)**
Observations	**8,166**	**8,166**	**8,166**	**8,166**
R-squared	**0.353**	**0.353**	**0.715**	**0.714**