

Analysing the drivers of dietary diversity, diet quality  
and household food security in developing Asia: Evidence  
from urban Vietnam and rural Bangladesh

by

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## **Abstract**

This thesis explores the drivers influencing dietary diversity, diet quality and overall food security, using different approaches for urban and rural households in emerging Asia. The first empirical study investigates the possible mechanisms through which modern food environments may affect Vietnamese households' dietary diversity and diet quality. The analysis uses primary data collected in 2016 and 2017 from 1,700 households in urban Hanoi and Ho Chi Minh City, as part of the Vietnam Urban Food Consumption and Expenditure Study. To measure household diet quality, Household Dietary Diversity Scores (HDDS), and consumption frequencies of micronutrients (vitamin A and heme iron) and a macronutrient (protein), are calculated using seven-day food recall data. A Poisson regression model is estimated using a two-step control function approach to address the potential endogeneity of key explanatory variable, modern market food expenditure shares. Higher modern market food expenditure shares are significantly associated with consumption of heme iron, however, no significant relationship is found for consumption of vitamin A and protein. Results from system of equations show that modern market food expenditure shares are significantly associated with diet quality through indirect linkages with HDDS.

The second study investigates the relationship between 'western' foods consumed away-from-home, and the diet quality of 4,997 individuals in Vietnam. Diet quality is measured using 24-hour food diaries which include information on food consumed both at-home and away-from-home. Dependent variables explored are individual daily caloric intake and percent of total calories from the consumption of carbohydrates, fat and protein. After testing for potential endogeneity of the key independent variable, individuals' daily calorie shares from western food-away-from-home (western FAFH), we find that western FAFH has a significant association with high calorie intake. Our results for macronutrient shares show that western FAFH is associated with a higher intake of fat.

The third study examines the relationship between farm households' food security status, and health and economic shocks using a nationally representative sample of 3,448 rural farm households from a secondary dataset, the 2012 Bangladesh Integrated Household Survey. A consolidated Food Security Index (FSI) is calculated using a suite of food security indicators: food consumption score, food expenditure share and livelihood coping strategies to capture rural farm households' food consumption, as well as their economic vulnerability. Empirical results from an ordered probit model controlling for village-level unobservables suggest that both health and economic shocks are significantly associated with FSI. Further results show that marginal and small farming households are more vulnerable to food insecurity when health and/or economic shocks impact their households.

The results from the two analyses using Vietnam data suggest that policy makers need to be aware of the potential impact of increasingly 'obesogenic food environments' on consumer food consumption behaviour and diet quality. Finally, the results of the third analysis using rural data from Bangladeshi farming households, highlights the need for policy makers to consider the unique needs of farming households, the most vulnerable group, when designing food security interventions to address shocks or to eliminate food insecurity among rural populations.

## **Declaration**

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

I acknowledge that copyright of published works contained within this thesis resides with the copyright holder(s) of those works. I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

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## Conference papers from this thesis (peer-reviewed)

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# Chapter 1: Introduction

## 1.1 Background

The latest Food and Agriculture Organization (FAO) report, *The State of Food Security and Nutrition in the World 2018*<sup>1</sup> states that, globally, at least 821 million people worldwide are undernourished in terms of energy deficiency and one and a half billion people suffer from micronutrient deficiencies (FAO et al. 2018). At the same time, around two billion people in the world are overweight and obese (FAO et al. 2018). This coexistence of both undernourishment and over-nourishment (e.g. overweight and obesity), combined with non-communicable diseases, known as the “double-burden” or the “multiple burden” of malnutrition, is alarming, especially in developing countries which have a low human development index (HDI)<sup>2</sup>. Identifying and understanding the underlying causes contributing simultaneously to undernutrition and overnutrition and diet-related non-communicable diseases (NCDs) in these growing economies, is important in order to achieve the targeted sustainable development goals (SDGs)<sup>3</sup> on food security and improved nutrition.

Asian developing countries, which are home to more than one-half the world’s undernourished people, are encountering a significant increase in overweight and obesity in the past few years and have the fastest growing prevalence of childhood obesity in the world (FAO 2018; Popkin et al. 2012; Qaim 2017). The rising concern of the existence of undernutrition (stunting and nutrient deficiencies) and overnutrition (overweight and obesity) among the

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<sup>1</sup> The combined term “Food security and nutrition” is widely used in recognition of the traditional emphasis on availability, access, utilization and stability as essential dimensions of food security. Food security should ensure that food systems provide all households with stable access to sufficient, appropriate and safe food, while nutrition-oriented action should ensure that households and individuals have the knowledge and supportive health and environmental conditions necessary to obtain adequate nutritional benefit from food (CFS 2012).

<sup>2</sup> For more information on HDI, see “Human Development Indices and Indicators: 2018 Statistical Update” by United Nations Development Programme (UNDP).

<sup>3</sup> For more information on SDGs, see The Sustainable Development Goals Report” by United Nations (2016).

consumers in emerging Asia, warrants a better understanding of their food consumption patterns and diet quality<sup>4</sup>.

Food consumption patterns and lifestyles of the consumers tend to change over time; they may vary at the country-level and sometimes, even within the same households, and individuals tend to evolve over time. In urban areas of emerging Asia, for example, a combined set of factors, including: industrialization, globalization, increasing disposable incomes, urbanization and food system transformation<sup>5</sup> (Kelly 2016; Pingali 2007; Reardon et al. 2014; 2015; Reardon and Timmer 2014), are leading to changes in consumer tastes and preferences for food products in recent decades. These forces are influencing where consumers purchase, and how they consume food (Reardon et al. 2003; Reardon and Timmer 2012; Trail 2006). Several recent studies have found that changes in the food environment in Asian urban settings, are contributing to a diet and nutrition transition, characterized by increasing consumption of energy-dense western foods, which are often processed and high in saturated and trans-fats, salt and sugar, and relatively low in dietary fiber and nutrients (Kelly 2016; Pingali 2007; Reardon et al. 2014; Toiba et al. 2015). For example, the share of processed foods in the total food expenditure of urban areas is: 70% in Bangladesh; 72% in Indonesia; and 87% in Vietnam (Reardon and Timmer 2014). Consumption of these foods comes at the expense of relatively unprocessed traditional staples such as rice as well as relatively unprocessed and nutrient dense fish, seafood, meat and vegetables.

A set of studies (e.g. Baker and Friel 2016; Gómez et al. 2011; Reardon and Timmer 2012) contend that the aforementioned factors, especially increasing disposable incomes and urbanization, have stimulated foreign investment into the food retail and food service sectors

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<sup>4</sup> Diet quality, refers to ‘nutrient adequacy’, a diet that meets requirements for both energy and essential nutrients (Ruel 2003).

<sup>5</sup> Food system transformation is the change in food systems at all levels: production, processing and distribution/retail, consumption, and disposal (Pingali 2007; Popkin 2017).

across Asia. These studies suggest that new investment in largely western-style food outlets and shopping centres, has created a new food market ‘environment’. For example, now in most urban areas across Asia, traditional food markets (e.g. wet markets, food carts or peddlers and ‘street food’) exist alongside modern food retailers (e.g. supermarkets, hypermarkets and convenience stores), and ‘western’ foodservice establishments, including: multi-national fast food chains (e.g. McDonalds, KFC, and Burger King), family-style restaurants (e.g. Pizza Hut, TGI Fridays) and coffee shops/cafés (e.g. Starbucks, Dunkin Donuts).

The literature looking at the impact of changes in the food environment on diets, has largely focused on the relationship between the ‘supermarket revolution,’ (i.e. increasing market penetration of supermarkets and the related growth in the use of supermarkets as a source of food) and changing diet quality; and diet-related health outcomes such as obesity, Type II diabetes and heart disease (Asfaw 2008; 2011; Demmler et al. 2018; Hawkes 2008; Kelly et al. 2014; Kimenju et al. 2015; Toiba et al. 2015; Popkin et al. 2012; Rischke et al. 2015; Umberger et al. 2015). This body of work has found some evidence of a link between poor diets, NCDs and increasing use of modern food retailers, such as supermarkets (e.g. Toiba et al. 2015 and Umberger et al. 2015 in Indonesia and Kelly et al. 2014 in Thailand). However, the literature on this topic also suggests that other factors related to the changing food environment may also contribute to poor diets and diet-related health issues. These include other cotemporary factors, such as increasing access to western food service establishments that offer various types of fast, ready-to-eat meal options, as well as changing lifestyles which increase demand for western FAFH in urban emerging Asia (Lachat et al. 2009; Seguin et al. 2016). The nutritional quality of these highly processed and ready-to-eat foods and beverages is generally poor, but they are rich in energy and contain high amounts of saturated and trans-fats, salt and/or sugar (Janssen et al. 2018; Todd et al. 2010).

In previous research, FAFH, particularly from western-style fast-food outlets, has been shown to be one factor contributing to increasing levels of diet-related NCDs such as obesity (Bowman and Vinyard 2004; Cunha et al. 2018; Jaworowska et al. 2013; Paeratakul et al. 2003; Schröder et al. 2007; Seguin et al. 2016) cardiovascular disease, Type II diabetes and some types of cancer (Swinburn et al. 2004; Stender et al. 2006; Webster et al. 2009), especially in high income developed countries such as the US and some parts of Europe.

In contrast to the most developed countries, in emerging Asia, FAFH options often include a vast variety of both traditional and modern formats offering a wide array of food products and meal solutions. Traditional retailers of FAFH – often called “street food” – generally offer food products that have long been part of the local food culture. For example, the popular Vietnamese “street food” dish, pho, usually contains lean sources of protein, herbs and vegetables, and can be of relatively high nutritional value.

Western style FAFH purchased from multinational fast-food outlets, coffee shops, and ‘family-style’ restaurants, are not only convenient for time-poor consumers in rapidly urbanizing Asia, but they may also be a sign of affluence and status for the growing middle-class consumers (Reardon et al. 2014). Urban consumers, may be attracted by the promotional offers and the appealing look of these modern foods, as well as concerns about food safety. Eventually, consumers may develop preferences for western over traditional FAFH. This is particularly alarming for younger groups as the shifts to a western diet may eventually extend to permanent changes in their food consumption habits, which in turn, may contribute to an increased burden of non-communicable diseases in these developing countries.

In contrast to urban Asia, in *rural* Asia, recent trends in food insecurity and malnutrition (undernutrition), suggest that poverty and inequity remain the principal causes of hunger and malnutrition among the population (FAO 2018). The World Bank’s *Poverty and Shared*

*Prosperity 2016* report states that poverty rates are more than three times higher among rural households compared to urban households; and agricultural workers are over four times more likely to be poor relative to people employed in other sectors of the economy (World Bank 2016a).

South Asia, for example, is home to one-fourth of the world's population and is considered one of the most vulnerable regions, with continuing high rates of poverty and food insecurity (Hasegawa et al. 2018; Sivakumar and Stefanski 2010). Almost 83% of this region's total population live in rural areas, which are dominated by climate-sensitive, rain-fed agriculture (World Bank 2016a). Agricultural shocks, such as crop loss due to natural calamities, pest attacks and diseases, confront the farming households of rural South Asia and significantly impact irrigations system, soil quality and crop yields and may, therefore, potentially contribute to food insecurity (Bandara and Cai 2014). Additionally, the economic performance of these vulnerable farm households may worsen if they encounter negative health shocks, such as the sudden death or illness of a main income-earning member and the related increases in medical expenses (Alam and Mahal 2014; Genoni 2012; Islam and Maitra 2012; Mitra et al. 2015; Sparrow et al. 2014; Wagstaff and Lindelow 2014) or macro-economic shocks such as food price increase (Akter and Basher 2014).

With little or no insurance, these rural households may therefore be forced to adopt coping strategies such as reduction in daily calorie intake, consumption of less diversified foods, unequal intra-household food distribution etc., which may further intensify food insecurity, and thus, gradually move them towards chronic hunger and undernourishment (insufficient food and nutrient intake to meet dietary requirements). It is, therefore, not surprising that undernourishment continues to take its largest toll in rural Asia, despite significant improvements in food availability, especially in South Asia (FAO 2015).

## **1.2 Research gaps and motivation**

The existing literature on food security and nutrition clearly indicates that the coexistence of multiple forms of malnutrition is a growing problem in emerging Asia, both in urban and rural areas. Additionally, it is also clear that food insecurity and malnutrition is no longer a supply problem in developing Asian settings, but may rather be a problem in accessing diverse and nutritious foods in the modern food system. However, as aforementioned in the previous section, the drivers of dietary diversity, diet quality and overall food security linked to food access tend to vary over time with differential social transformation within regions and among social groups. Additionally, rural and urban food environments are substantially different from one another, especially in developing Asia. Therefore, eradicating malnutrition in this region requires different approaches in urban areas than those used in rural areas.

Furthermore, the drivers that used to affect peoples' diets two decades ago, may no longer be significant due to the emergence of new influences which may be more relevant in the present context. For example, whether the penetration of modern food retailers in urban emerging Asia influences the diet quality of the consumers, require further attention in order to understand the net effects of 'supermarketization' versus other changes in the food environment on nutrition transition. For example, the relationship between increased consumption of western FAFH and diet quality of Urban Asian consumers is not well understood. Therefore, it is possible that there are new mediating socioeconomic and environmental forces that are yet to be explored and which may have significant connections with access to nutritious food.

In rural settings, on the other hand, no known study is comprehensive enough to account for households' economic vulnerability and coping capacity, given the situation in which their food consumption occurs (Headey and Ecker 2013). This is important to understand in rural

settings where households' food insecurity, economic vulnerability and coping capacity are often inter-linked. For example, the two important food security indicators commonly used in developing countries (Carletto et al. 2013; Cribb 2011; Dewey et al. 2005; Hossain et al. 2016; Maxwell et al. 2008; Sraboni et al. 2014; Tiwari et al. 2013; Weismann et al. 2009), household dietary diversity score (HDDS) and food consumption score (FCS), provide no information on the economic burden faced by farm households attempting to improve their diets. In such contexts, it is important to consider coping mechanisms, because households that can cope better with negative shocks are likely more resilient in the face of the factors causing food insecurity. In a seminal study, Carletto et al. (2013) found that household coping indicators were useful in identifying vulnerabilities and exploring the trade-offs made by households when acquiring food, thus recommending their use as key measures complementary to the more traditional benchmarks of food security. Additionally, understanding how households cope when faced with household shocks may help policy makers design more effective strategies to improve households' risk management skills (Adger et al. 2007).

This thesis attempts to empirically address these important gaps identified in the abovementioned discussion.

### **1.3 Research questions**

In order to understand the combination of contemporary and context-specific drivers of dietary diversity, diet quality and overall household food security in urban and rural settings both, this thesis addresses the following research questions:

- I) Does food market modernization lead to improved dietary quality in urban households?
- II) Does consumption of western-style food-away-from-home (western FAFH) affect the diet quality of urban adult, adolescent and child of different age groups?



III) To what extent are negative shocks (health and economic shocks) associated with the level of food insecurity, and with economic vulnerability, in rural households?

To test these research questions empirically, this thesis has used data both from primary and secondary surveys: i) The Vietnam Urban Food Consumption and Expenditure Study, a unique primary survey conducted in 2016-2017 by a team of researchers at the University of Adelaide's Centre for Global Food and Resources, including the author of this thesis; ii) the Bangladesh Integrated Household Survey (BIHS) 2012, a secondary dataset available from the International Food Policy Research Institute (IFPRI). Both Vietnam and Bangladesh are in the midst of economic growth and nutrition transition (Abdullah 2015), and therefore, provide opportunities to explore some of the contemporary drivers that might be linked to household and individual level dietary quality and their overall food security status (i.e. food consumption status and economic coping capacity).

This thesis is novel in offering new and more robust results about the growing food security and nutrition literature in terms of the extent of the drivers of dietary diversity, dietary quality and overall food security status of the households in contemporary context. Additionally, a significant point of departure of this thesis from previous literature on the Vietnamese diet is to provide a comprehensive set of results on the contemporary drivers of diets, using individual-level 24-hour food diaries. This is the only study known to examine this relationship using a wide range of food items (743 food items) that are consumed by urban Vietnamese adults, adolescents and children.

Furthermore, the thesis provides complete information on the food security status of rural farm households in Bangladesh, using a consolidated food security index (FSI) that captures their current food consumption and economic vulnerability both.

Overall, the empirical results from this thesis may be useful for policy makers trying to improve household diet quality, which in turn, may help to minimize the co-existence of the burden of malnutrition and its different sources (nutritional inadequacies, under and over nutrition of calorie intake), especially in emerging Asian economies such as Vietnam and Bangladesh.

#### **1.4 The context of food security and nutrition in urban Vietnam and rural Bangladesh**

##### *Urban Vietnam*

Today, the Vietnamese population, is more food secure and less undernourished than it was in the immediate aftermath of the *‘Doi Moi reforms’* of the mid 1980s (Mishra and Ray 2009). The food environment in Vietnam, especially in urban areas, is changing in line with rapid economic growth. Transformation from the traditional Vietnamese diet, which was high in carbohydrates (e.g. rice) and low in fats (Dien et al. 2004), towards less starchy staples and with more energy, protein and fats coming from refined sugars, protein-rich and higher fat food items, is already evident (Hoang 2018; Mishra and Ray 2009; Thang and Popkin 2004).

Fresh vegetables play a dominant role in the traditional Vietnamese diet, which was mostly supplied by traditional wet markets in local neighbourhoods. However, food safety issues in traditional markets have been a serious concern among Vietnamese consumers in recent years and modern markets (e.g. supermarkets, hypermarkets and mini-markets) are generally considered more trustworthy in delivering food safety (Maruyama and Trung 2007; Wertheim-Heck et al. 2014; 2015). Rapid growth in the modern food retail sector in inner cities is expected since the Vietnamese government considers food market modernization an important aspect of modern society (Wertheim-Heck et al. 2015).

Additionally, in Vietnam, the trend towards western FAFH from fast-food outlets, restaurants, cafes and kiosks is emerging, and the share total food expenditures on FAFH is

relatively large (21%) (Reardon et al. 2014). However, the relationship between FAFH from western outlets and diet quality of urban consumers in Vietnam, is not well understood. The negative health impacts of increased consumption of western foods are already evident in other emerging Asian countries such as Thailand (Kelly et al. 2014), Indonesia (Toiba et al. 2015; Umberger 2015), Malaysia (Ali and Abdullah 2017) and China (Zhang et al. 2012). However, in the literature for Vietnam, there has been little attention paid to the possible association between modernization of food markets, increasing consumption of westernized food products and reduced diet quality.

Moreover, like elsewhere in Asia, overweight, obesity and other non-communicable diseases among the urban Vietnamese population are on the rise in recent years (Do et al. 2017; Ha et al. 2011; Khan and Khoi 2008; Le Ngyuen et al. 2013), and this may put additional burdens on the health sector and interrupt the ongoing overall economic growth. Therefore, the challenges in the present context require a clear understanding of whether growth in access to and consumption of western food is putting healthy Vietnamese diets at risks, and if so, to what extent is it associated with the nutrition and diet quality of urban Vietnamese consumers.

### *Rural Bangladesh*

The World Food Programme (WFP) has recognized Bangladesh as a developing country with significant growth in its gross domestic product in recent years (WFP 2018). Despite this economic growth and improving food availability, due to increasing agricultural productivity, around 40 million people, or a quarter of the Bangladeshi population, are still food insecure (WFP 2018).

A remaining concern with food security and the nutritional situation in Bangladesh is that very little improvement has occurred in terms of dietary diversity and quality among the population in general. Although Bangladesh has achieved the target of average daily per capita

calorie intake, with 2,318 kilocalories (kcal) per day, starchy staples (mainly rice) still dominate, contributing around 77% of the total energy supply (WFP 2018).

The majority of the population still live in rural areas, earning a monthly average of 13,353 BDT or US \$157.05 per household of four members or more reported in the recent Household and Expenditure Survey (HIES 2016). In addition, the incidence of poverty and food insecurity is the highest (32%) among the households working in “Agriculture, Forestry and Fisheries” (HIES 2016).

A large number of rural households working in agriculture still remain vulnerable to periodic negative shock(s), such as loss of crops due to agricultural disasters or food price hikes (Akter et al. 2013). The effect of shocks arising from agricultural incomes may, therefore, adversely affect the ability of the rural poor to access diverse and nutritious food. This could be a matter of serious concern considering that a large proportion of the population still suffer from food insecurity and chronic hunger. It is therefore important to understand what drives these vulnerable groups to become food insecure in order to improve overall food security and nutrition in rural Bangladesh.

## **1.5 Description of data and methods**

### *The Urban Vietnam Consumption and Expenditure Study 2016-2017*

The analysis of urban Vietnam households in this thesis uses data from a novel primary survey of 1,700 urban households located in Vietnam’s two largest cities: Hanoi (700 households) and Ho Chi Minh City (1000 households). Data collection methods included 1) a household survey, which was designed to collect data on socio-economics (both household and individual-level), lifestyle, food purchasing behaviour, food expenditures, and attitudes for the household; and 2) a 24-hour food recall method, where households kept records (diaries) of what was consumed by each member of the household over a 24-hour period.

After receiving ethics approval, and significant pre-testing in the field, the survey was implemented between late 2016 and early 2017 (with a four-week break to avoid any atypical food consumption fluctuations around Tet, the Vietnamese lunar New Year). Household's consent was also gained prior to the infield deployment.

The questionnaire was developed by researchers from the University of Adelaide in partnership with researchers from the Vietnam National University of Agriculture (VNUA), the Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD) and from the Fruits and Vegetables Research Institute (FAVRI), Vietnam. The survey instrument is based on earlier work conducted in Indonesia by some members of the research team (see Umberger et al. 2015 and Toiba et al. 2015). The survey was pre-tested with consumers and then various aspects of the survey were discussed with the pre-test respondents in focus groups to improve the instrument and ensure that it was appropriate for the local Vietnamese context in each of the survey locations. Both an English and Vietnamese version of the survey are available. A comprehensive training manual was developed and translated into Vietnamese to make sure the aim of each question was clear and understood by enumerators.

Households were selected using proportional sampling from ward-level population data in these two cities. Using ward-level population as the probability, 50 wards in Hanoi and 72 wards in Ho Chi Minh City were picked and then 14 households were randomly picked from each ward. The representativeness of different income groups in the survey was ensured because income reflects households' purchasing power and is, therefore, closely related to food purchasing decisions and consumption behaviour. The survey area covered is shown in Figure 1.2 in Appendix 1.

The household surveys were conducted by trained and experienced professional enumerators, through face-to-face interviews with the household member who was determined

to be the most knowledgeable about food purchasing decisions for the household. To ensure data quality, while conducting the interviews the enumerators entered data into a tablet-based application, which allowed the data to be uploaded to a server via wireless networks while enumerators were still ‘in the field’ collecting data. This ‘real-time’ entry of the data allowed the study team to cross-check the quality of the data each day and quickly resolve any issues.

Socio-economic information, including: gender, age, years of education completed, religion, and employment status, was collected for each member of the household. Additional data on individual activities such as daily hours each household member (aged two years and more) usually watched television, videos or on the Internet and anthropometric information on weight, height and mid-upper-arm-circumference (MUAC) was also collected.

The survey also included important information on food and non-food expenditure and shopping behaviour. More specifically, the survey incorporated ten main types of food retail outlets—hyper-markets and supermarkets, minimarkets or convenience stores, specialty shops, formal wet markets, traditional family shops, semi-permanent stands, peddlers or mobile vendors, informal street markets, phone and order, and online shopping—and it collected a set of information on households’ expenditure on food and non-food consumption, and shopping attitudes.

Furthermore, the survey collected detailed information on household expenditures for 93 food products that include staples and animal products, fresh vegetables and fruits, processed foods, and beverages. For each product, respondents answered questions about their average expenditure in a typical month and the main type of retail outlet they used for purchasing each item. These 93 food product categories and related questions were determined after several focus-group discussions and piloting of the survey.

Information on household-level nutritional status was collected from questions concerning the consumption of different food groups (such as staples, protein, fruits and vegetables, sugar, oils and fat) and the frequency of their consumption during the past seven days. Additionally, information on food product certification and consumers' awareness in choosing certified food products, and their nutritional attitudes was also collected.

In addition to the survey, 24-hour food diaries were completed for each adult and child member of the household. The 24-hour food diary module was designed to collect detailed data on the food intake of each member living in the household. This allowed us to estimate the quantities of various food items consumed over a 24-hour period. Information was collected on both food eaten at home and FAFH. In both cities, enumerator training for the 24-hour food diary consisted of a formal classroom component as well as closely monitored 'practice' fieldwork. The person in the household with primary responsibility for food purchasing and meal preparation was asked about the recipes prepared, ingredients for these recipes, the sources of these ingredients (own-production, purchased in the market, collected, given by others), and the quantity of foods eaten by each family member.

The enumerators visited each household three times during the week of data collection. During the first visit, the enumerator conducted the face-to-face interviews to gather data for the survey discussed earlier. They also provided the respondent/interviewee with a hard copy of the 24-hour food recall diary, and a manual (in Vietnamese), which included photos of commonly used Vietnamese kitchen utensils and measuring instructions. The enumerator outlined what data needed to be recorded and explained that data would be collected on two consecutive weekdays and one non-consecutive weekend day, which would be chosen randomly within a week. Respondents were given sufficient time to recall and consider their responses and to clarify information with the enumerators when necessary. Dietary intake

information was collected on 743 food and beverage items (including drinking water) that were consumed by households in Hanoi and in Ho Chi Minh City during the study. To reduce measurement error, the 24-hour food diary data were checked by the team supervisors on a daily basis during the data collection phase. The paper-based information from the 24-hour food diary generated a large data set and data cleaning was needed. This entailed detailed and careful consideration, which was time consuming. Therefore, the analysis using the individual level 24-hour food diary has been done (**in Chapter 3**) after the household analysis from seven-day food recall in **Chapter 2**.

#### *The Bangladesh Integrated Household Survey 2011-2012*

The data required to analyse food security and nutrition in rural Bangladesh came from the 2011-2012 BIHS conducted by IFPRI researchers<sup>6</sup>. The BIHS is a nationally representative sample of rural Bangladesh and is appropriate for analysing the food security and the nutritional situation associated with negative shocks in rural Bangladesh. The total BIHS sample size is 6,500 households in 325 primary sampling units (PSUs), which are villages in Bangladesh.

Researchers used two stage stratified sampling—selection of PSUs and selection of households within each PSU—in the sample selection. Later, sampling weights were adjusted on the basis of the 2011 population census. Figure 1.1 in Appendix 1 provides a map of the covered area in the BIHS survey.

The BIHS questionnaire modules include detailed and disaggregated household level information that is capable of answering a variety of research questions related to agricultural production, household food and non-food consumption and expenditure, households' income

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<sup>6</sup> BIHS data is available online: <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/BXSYEL>. For a detailed report on BIHS data, see Akter et al. (2013).



and asset ownership, savings and access to loans, shocks and the related food security situation. This thesis used the disaggregated information from the BIHS data, particularly related to food security and nutrition, such as: households' food consumption from a seven day recall (quantity of food purchased, price of purchased food, quantity consumed from home production, food received from other sources); the share of household expenditure spent on food ; and households' coping strategies related to a set of health related and economic negative shocks (e.g. death of main earner, medical expenses, crop loss, food price hikes). Furthermore, information on households' socio-demographic characteristics have also been used in the analysis.

## **1.6 The Structure of the thesis**

The following paragraphs outline the main structure of the remaining chapters of this thesis.

**Chapter 2** investigates possible mechanisms through which a higher share of food expenditure in modern food markets may influence household dietary diversity and diet quality. This analysis is based on primary data from the Vietnam Urban Food Consumption and Expenditure Survey, which was conducted by the authors of the paper that is presented in Chapter 2. Data was collected during December 2016 and March 2017 from 1,700 urban households located in two large Vietnamese cities: Hanoi and Ho Chi Minh. The representativeness of different income groups in the survey was assured by comparison with other third-party household surveys (e.g. Nielsen 2013). The survey questionnaires provide integrated data capable of answering a variety of research questions on food types, food expenditure and shopping behaviour, seven-day food recall on frequencies of food and nutrient intake, alongside other socio-demographic information of the households.

In **Chapter 2**, the dependent variables used to measure dietary diversity and diet quality in this study include the Household Dietary Diversity Score (HDDS) and micronutrient (vitamin A and heme iron) and macronutrient (protein) adequacy. We found no direct relationship between modern market food expenditure shares and HDDS. However, the direct association of modern market food expenditure shares with household dietary quality suggested that it is positively and significantly associated with heme iron. Further results from a system of equations analysis showed that modern market food expenditure shares were significantly associated with dietary quality through the indirect linkage of dietary diversity.

In **Chapter 3**, the thesis explores the link between western food-away-from-home (FAFH) consumption and individual's daily calorie and macronutrient intake, using intra-household individual data (4,997 individuals) from the same primary survey conducted in Hanoi and Ho Chi Minh City. The dependent variables used in this analysis are individuals' total calorie intake (in kilocalories) and macronutrient shares (carbohydrate, fat and protein) defined as the percentage of calories. The calorie intake and macronutrient shares calculated in this study were based on 24-hour food diary data, that included food consumed at-home and away-from-home averaged over the three-days of food diary data collection, which was done to reduce measurement error due to day-to-day fluctuations in food intake. Overall, we find that western-style FAFH had a significant association with higher calorie intake. Our results for macronutrient shares show that western FAFH is associated with higher intake of fat among all adults and children.

In **Chapter 4** the focus shifts from urban Vietnam to rural Bangladesh. Using the Bangladesh Integrated Household Survey (BIHS) data, which includes a nationally representative sample of 3,448 rural farm households, we examine the relationship between household (health and economic) shocks and household food security. In contrast to the diet

quality measures (i.e. HDDS and micro- and macronutrient adequacies used in **Chapter 2** and daily calorie intake and macronutrient shares used in **Chapter 3**), the analysis in **Chapter 4** delves deeper into food security measures by constructing and evaluating a food security index that represents a combined snapshot of the targeted population's overall food security situation (e.g. households' current food consumption score, their economic vulnerability and coping capacity). This analysis is possible because of the uniqueness of the BIHS data.

In **Chapter 4** analyses, the dependent variable was a food security index (*FSI*), which was measured by using a suite of food security indicators: food consumption score (FCS); food expenditure share (FES), and a measure of livelihood coping strategies (LCS). To construct the *FSI*, we used the “Consolidated Approach for Reporting Indicators” (CARI) approach to measuring food security, that was introduced by the World Food Programme (WFP) in 2015. The main regression results from the ordered probit model show both health and economic shocks are significantly associated with household food insecurity and the magnitude of the impacts vary according to the existing level of household food insecurity. The study further reports that marginal and small farming households are more vulnerable to food insecurity when health and economic shocks impact their households.

The final chapter of the thesis, **Chapter 5**, provides a summary and general discussion of the findings and the possible implications of the results found in rural Bangladesh and urban Vietnam. This chapter also provides recommendations and prospects for future research on these topics.

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<sup>7</sup> FAO represents Food and Agriculture Organization, IFAD represents International Fund for Agricultural Development, UNICEF represents United Nations Children's Fund, WFP represents World Food Programme and WHO represents World Health Organization.

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## Chapter 2: Statement of Authorship

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### Principal Author

Name of Principal Author (Candidate)	Jesmin Ara Rupa		
Contribution to the Paper	Contributed to primary survey, data collection, data analysis and interpretation, wrote manuscript.		
Overall percentage (%)	60%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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### Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate’s stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate’s stated contribution.

Name of Co-Author	Professor Wendy J Umberger		
Contribution to the Paper	Project director of the primary survey and contributed to the design and IP of survey, guided data analysis, contributed in manuscript development and editing		
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## **Chapter 2: Does food market modernization lead to improved dietary diversity and diet quality for urban Vietnamese households?**

### **Abstract**

This study investigates the possible mechanisms through which modern food markets may affect Vietnamese households' dietary diversity and diet quality using data from a survey of 1,700 urban households with seven-day food recall. We calculate Household Dietary Diversity Scores to measure dietary diversity, and use consumption frequencies of micronutrients (vitamin A and heme iron) and a macronutrient (protein) to create a household measure of diet quality. Empirically, we estimate a Poisson regression model using a two-step control function approach to address the potential endogeneity of our key explanatory variable, modern market food expenditure shares. Higher modern market food expenditure shares are positively and significantly associated with consumption frequency of heme iron, but there are no significant associations with consumption of vitamin A and protein. We further explore indirect linkages between food expenditure shares and dietary diversity, which in turn, may be linked to household diet quality. Results from a system of equations show that the food expenditure shares variable has no significant relationship with dietary diversity, but dietary diversity is positively and significantly associated with diet quality. Our results indicate that alone, policies which encourage "food market modernisation" are not enough to improve diet quality in urban Vietnam.

**Key words:** diet quality, food market modernization, household dietary diversity, modern market food expenditure shares, Vietnam.

## 2.1 Introduction

Food systems in Asian developing countries are undergoing a rapid transformation (Mergenthaler *et al.* 2009; Pingali 2007; Reardon and Timmer 2014; Qaim 2017). Retail structures are changing and modern food retail formats (e.g. hypermarkets, supermarkets and mini-markets or convenience stores) are replacing traditional markets at a rapid pace (Reardon and Timmer 2012; Reardon *et al.* 2003; Trail 2006). Modernization of food retail outlets or ‘supermarketization’ has been considered as an important driver of the nutrition transition<sup>8</sup> that is taking place in some Asian emerging economies (Baker and Friel 2016; Kelly 2016; Kelly *et al.* 2014; Reardon *et al.* 2014, Umberger *et al.* 2015).

It is, however, not clear whether the net effects of ‘supermarketization’ on nutrition transition, will be positive (i.e. diets become healthier) or negative (i.e. diets become less healthy). Furthermore, the rising concern of a ‘double burden of malnutrition’, with undernutrition (stunting and nutrient deficiencies) and overnutrition (overweight and obesity) with the increasing prevalence of overweight among urban consumers in Asia, warrants a better understanding of how, and to what extent, the penetration of modern food retailers influences urban consumers’ diet quality (Ruel *et al.* 2017).

Literature on the impacts of food shopping at modern food retail outlets on diet quality in developing countries is still limited. Several existing studies in the literature show that usage of modern food markets is positively associated with increased consumption of energy-dense, processed foods, which are generally considered to be “unhealthy” (e.g. Asfaw 2008, 2011; Demmler *et al.* 2018; Hawkes 2008; Kelly *et al.* 2014; Rischke *et al.* 2015; Toiba *et al.* 2015).

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<sup>8</sup> Nutrition transition is a large shift in consumers’ diet and physical activity. Two historic processes of change occur simultaneously with, or precede, the ‘nutrition transition’. One is demographic transition—the shift from a pattern of high fertility and mortality to one of low fertility and mortality. The second is the epidemiological transition- the shift from a pattern of high prevalence of infectious disease—associated with malnutrition to one of high prevalence of chronic and degenerative disease associated with urban industrial lifestyles (Popkin 2002).

On the other hand, a Tunisia household study shows a slight improvement in diet quality among households who use supermarkets regularly (Tessier *et al.* 2008). Therefore, findings on the effects of shopping at modern outlets on household food consumption patterns and diet quality are mixed. One possible reason of such mixed findings may be the failure of identifying the contemporary confounding mechanisms through which these modern food markets are associated with households' dietary diversity and diet quality<sup>9</sup>. Understanding these mechanisms is important, especially in rapidly growing and increasingly “westernized” urban areas where frequent consumption of high calorie and energy dense foods and beverages may be linked to negative health outcomes including overweight and obesity, cardiovascular disease and burden of type 2 diabetes (e.g. Conklin *et al.* 2016; Kimenju *et al.* 2015; Popkin *et al.* 2012; Popkin 2014; Qaim 2017; Toiba *et al.* 2015; Umberger *et al.* 2015).

This study, therefore, intends to examine the association of modern market food expenditure share with household dietary diversity and diet quality in terms of nutrient adequacy. Similar to the World Food Programme (WFP 2015), we focus our analyses on only two micronutrients, vitamin A and heme iron, because these have the most widespread deficiencies in developing countries such as Vietnam. Additionally, heme iron (found in meat and fish only) is considered because it is generally better absorbed by the human body (10% to 30%) compared to non-heme iron (found in cereals, fruits and vegetables, dairy products), which only 1% to 5% is absorbed by the body. Likewise, we concentrate on one macronutrient, protein, as it is a nutrient crucial for the prevention of wasting and stunting (WFP 2015).

Intuitively, we hypothesize that a household's modern market food expenditure share is directly associated with household dietary diversity and diet quality. We further hypothesize

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<sup>9</sup> Diversity is not synonymous with quality as greater dietary diversity can be associated with greater energy intake from a variety of food (Leory *et al.* 2015; Ruel *et al.* 2013). On the other hand, diet quality, by definition refers to “nutrient adequacy”- a diet that meets requirements for both energy and essential nutrient (Ruel 2003).

that modern market food expenditure share is also associated with household dietary diversity through indirect linkages, which in turn, may be linked to household diet quality. To understand the possible direct and indirect mechanisms through which the usage of modern food markets may associate with household diet quality, we use data that we collected using a novel and comprehensive survey of 1,700 urban households, conducted in Hanoi and Ho Chi Minh City in Vietnam.

Vietnam is a country in transition with remarkable achievements in socioeconomic development and ongoing transformation in food systems (World Bank 2018). Despite these achievements, the economy is confronted with the significant double burden of malnutrition, resulting from imbalances in diet and diet-related non-communicable diseases (Chaparro *et al.* 2014; Ha *et al.* 2011; Khan and Khoi 2008; Le Ngyuen *et al.* 2013). While the stunting rate remains high at 29.3% and micronutrient deficiencies (e.g. vitamin A deficiency and iron deficiency) warrant attention, rates of overweight and obesity have been estimated in 4.8% of children and 6.6% of adults (Le Ngyuen *et al.* 2013; Ministry of Health 2012). In order to address the double burden of malnutrition, the Vietnamese government has committed to ensuring Vietnamese consumers have access to safe and high quality food and healthy diets by the year 2020 (Ministry of Health 2012).

Modern markets in Vietnam (e.g. supermarkets, hypermarkets and mini-markets) are generally considered by policymakers to be a source of high quality food products, particularly with respect to delivering services and food safety guarantees (Maruyama and Trung 2007; Wertheim-Heck *et al.* 2014, 2015). Although traditional markets (e.g. wet markets) remain the dominant means of purchasing fresh foods such as fruits, vegetables and meat (Wertheim-Heck *et al.* 2014, 2015), more rapid growth in the modern food retail sector is expected due to urban consumers' preferences for high quality and diverse food products (e.g. convenience

foods, western food brands), and a convenient and clean shopping environment (Smith and Vo 2017).

The Vietnamese government, therefore, has instigated policies to stimulate modern market expansion, particularly in inner city areas, where at least some of the development will be at the expense of traditional open-air food markets as these are ‘upgraded’ to multi-story shopping centres with modern food markets (Dries *et al.* 2013; Smith and Vo 2017; Wertheim-Heck and Spaargaren 2016; Wertheim-Heck *et al.* 2015, 2014).

Intuitively, extensive use of these modern markets may have some diet-related health implications as experienced by other developing countries in Asia (e.g. Kelly *et al.* 2014 in Thailand and Toiba *et al.* 2015 in Indonesia). Although food market modernization can have a positive impact on diets, for example, if consumption of nutrient-rich types of food products (e.g. dairy and imported fruits and vegetables) increases, the net impact on the Vietnamese diet is unclear. Possible negative dietary changes may include increasing consumption of processed foods at the expense of nutrient-rich fresh foods. Given the prominence of the modern food retail environment changes, it is therefore, important to understand the net impact of the use of modern versus traditional food outlets on diet quality. This insight may assist policy makers to better understand the implications of policies on stimulating modern food retail expansion on diet quality and the double burden of nutrition in Vietnam.

## **2.2 Materials and methods**

### **2.2.1 Data**

The analyses in the subsequent sections of this paper are based on data collected by the authors from December 2016 to April 2017 via a survey of 1,700 urban households located in Hanoi and Ho Chi Minh in Vietnam. Households were selected using a proportional sampling strategy considering ward-level populations in these two cities. To assure the

representativeness of our sample, we also considered the income distribution since household income reflects purchasing power, and previous studies suggest income is closely related to food purchasing decisions and consumption behaviour (Bouis 1994; Miller *et al.* 2016; Turrell and Kavanagh 2006). The income distribution of our sample is similar to estimates of the populations in each city based on data from large third-party household surveys<sup>10</sup>. Trained enumerators conducted face-to-face interviews with the household member who was considered to be the most knowledgeable about household food purchasing decisions. To improve data quality, tablets and real-time data entry using wireless networks were used during data collection.

The socio-economic part of the survey questionnaire was designed to collect information on household and individual characteristics such as gender, age, years of education completed, religion and physical activities of the household members etc. Household-level information was also collected with respect to ownership of assets, income, food and non-food expenditures and shopping behaviour such as preferred outlets for purchasing different types of food and access to outlets (distance and time taken by mode of transportation). Hypermarkets, supermarkets and mini-markets<sup>11</sup> are defined as modern markets in this study. Traditional outlets include: formal public markets organized by provincial or district level authorities; informal street markets without a permanent built structure and without any management board; and neighbourhood family-owned shops selling a small range of processed food, dry goods, drinks, toys, daily needs etc. (Maruyama and Trung 2007).

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<sup>10</sup>For further information, see into the Appendix 2 (Figure 2.2A and 2.2B). Also see [http://www.nielsen.com/content/dam/nielsen-global/vn/docs/Reports/2013/2013\\_VN\\_pocket\\_reference\\_book\\_low.pdf](http://www.nielsen.com/content/dam/nielsen-global/vn/docs/Reports/2013/2013_VN_pocket_reference_book_low.pdf)

<sup>11</sup> The term hypermarket in Vietnam is defined as a very large modern store which occupies over 12,000m<sup>2</sup> of total area, with more than 10 cash registers and selling a large variety of food and non-food consumer goods, both (Cadilhon *et al.* 2006). Supermarkets are medium to large-sized stores which are over 500 m<sup>2</sup> in size, with 3-9 cash registers and stock at least 4,000 different food and non-food consumer goods. Mini-markets or convenience stores are small, less than 100 m<sup>2</sup> in surface with 1-2 cash registers and selling food and non-food consumer goods (Cadilhon *et al.* 2006). Examples of hypermarkets and supermarkets in Vietnam include Aeon, Metro, Big C, Fivi Mart, Unimart, AC Mart and Citi supermarket. Examples of mini-market or convenience store in Vietnam includes Seven eleven, Vinmart, Shop & Go and Circle K.

Our household food consumption data include detailed information on consumption and expenditures for 92 different food products for a ‘typical’ month. Specifically, the data includes information on the type of food retail outlet where each of the 92 food products was purchased. For each product, respondents provided information on the number of times they purchased the product and the average expenditure on the product for a ‘typical’ month (this is similar to the method used by Umberger *et al.* 2015). The 92 food product categories and related questions were designed after conducting twelve focus-group discussions with between six to eight participants in each group. Focus group participants were the individuals primarily responsible for the food purchase and/or meal preparation for their household. We recruited participants with a range of household income levels (low, low-middle, upper-middle and high-income), however, we grouped respondents with similar household income levels in the same session. The survey instrument was pre-tested extensively with approximately 60 households during development of the instrument as well as during enumerator training.

We also collected data on household food frequency and diet quality adapting the 2015 Food Consumption Score and Nutritional Quality Analysis (2015 FCS\_N) questionnaire from the World Food Programme (WFP 2015). Thus, using the 2015 FCS\_N questionnaire, we assessed household consumption frequencies for 15 food groups over seven days, including particular foods rich in micronutrients and macronutrients. This data was used to calculate a household score to determine whether or not the intake of food groups rich in essential nutrients these nutrients is adequate (WFP 2015). The descriptive statistics in Table 2.1 provide detailed information of all variables used in this study. After the data cleaning and checking the outliers, our final sample consists of 1,695 households.

**Table 2.1 Descriptive statistics for all variables included in the estimated models**

Variable names	Description	Mean	SD	Min	Max
<u>Dependent variables</u>					
<i>Vitamin A</i>	Consumption frequencies from seven-day recall	6.9	0.63	0	7
<i>Heme Iron</i>	Consumption frequencies from seven-day recall	6.32	1.32	0	7
<i>Protein</i>	Consumption frequencies from seven-day recall	6.94	0.45	1	7
<i> HDDS</i>	Household dietary diversity score using seven-day recall	9.9	1.16	4	11
<u>Explanatory variable</u>					
<i>ModernMarket</i>	Average monthly expenditure share of modern food markets, continuous	0.13	0.16	0	1
<u>Other Covariates</u>					
<i>AgeMale</i>	Age of male household head	46.09	11.79	20	92
<i>AgeFemale</i>	Age of female household head	42.37	11.43	19	92
<i>EduMale</i>	Education completed (in years) by the male household head	11.19	3.3	0	23
<i>EduFemale</i>	Education completed (in years) by the female household head	10.89	3.19	0	19
<i>Buddhist</i>	(=1 if the household head is a Buddhist, 0 otherwise)	0.36	0.48	0	1
<i>Christian</i>	(=1 if the household head is a Christian, 0 otherwise)	0.06	0.25	0	1
<i>Income:</i>					
<i>Lower-middle income</i>	4.5 to 7.49 mil. VND/month	0.28	0.44	0	1
<i>Upper-middle income</i>	7.5 to 14.9 mil. VND/month	0.43	0.49	0	1
<i>High-income</i>	15 mil. or more VND/month	0.23	0.42	0	1
<i>Household size</i>	Size of the household	4.11	1.08	2	8
<i>Children</i>	Number of children less than 15 years of age in the household	1.27	0.86	0	4
<i>Microwave</i>	(=1 if the household owns a microwave, 0 otherwise)	0.41	0.49	0	1
<i>Ho Chi Minh City</i>	(=1 if household lives in Ho Chi Minh City, 0 otherwise)	0.58	0.49	0	1
<u>Instrumental variables</u>					
<i>OtherModernMarket</i>	Average food expenditure shares at modern outlets of all other surveyed households in the same ward	0.002	0.003	0	0.05
<i>ShoppingList</i>	(= 1 if the household uses a shopping list when shopping for food, 0 otherwise)	0.166	0.37	0	1
Number of households		1,695			

Notes: Authors' calculation. SD represents standard deviation and Min and Max represent minimum and maximum values of the sample statistics. VND/month is Vietnamese Dong per month. Reference income is *Low-income* in VND/month. 1 USD = 22318.00 VND on December 30, 2016.



### 2.2.2 Measurement of outcome variables

In the following paragraphs we discuss the outcome variables of household dietary diversity and diet quality that are used in this study, and the calculation process followed to create the variables.

#### **Household dietary diversity**

Household Dietary Diversity Score (*HDDS*) is a proxy indicator of dietary diversity, used to examine the direct and indirect linkages between the use of modern food markets and household diet diversity. Using equation (2.1) and following Kennedy *et al.* (2011), we calculate the *HDDS* for each household (*h*) living in city (*j*) using information regarding household *h*'s consumption of 12 food groups (1...*k*).

$$HDDS_{h,j} = \sum_{k=1}^{12} Food\ group_{k,h,j} \quad (2.1)$$

Thus, in equation (2.1), the variable *HDDS*<sub>*h,j*</sub> represents the dietary diversity score of household *h* living in city *j*. *Food group*<sub>*k,h,j*</sub> is a binary variable indicating whether household *h* living in city *j* consumed food group *k* in the past seven days. Food groups in FCS\_N questionnaire (WFP 2015) are categorized as follows: cereals; roots and tubers; pulses; vegetables; fruits; meat and poultry; eggs; fish; milk and milk products; sugars; oils and fats; and miscellaneous. Summary statistics for the *HDDS* variable are provided in Table 2.1. The mean for *HDDS* is 9.9, indicating that, on average, urban Vietnamese households have relatively diverse diets.

#### **Household diet quality**

In our analyses, we use three measures of diet quality to assess households' micronutrient (*Vitamin A* and *Heme Iron*) and macronutrient (*Protein*) adequacy. Equations (2.2-2.4) show how the diet quality variables: *Vitamin A*<sub>*h,j*</sub>, *Heme Iron*<sub>*h,j*</sub> and *Protein*<sub>*h,j*</sub> are calculated by adapting the 2015 FCS\_N methods (WFP 2015):

$$\text{Vitamin } A_{h,j} = \sum_{k=1}^6 V_k \quad (2.2)$$

$$\text{Heme Iron}_{h,j} = \sum_{k=1}^3 I_k \quad (2.3)$$

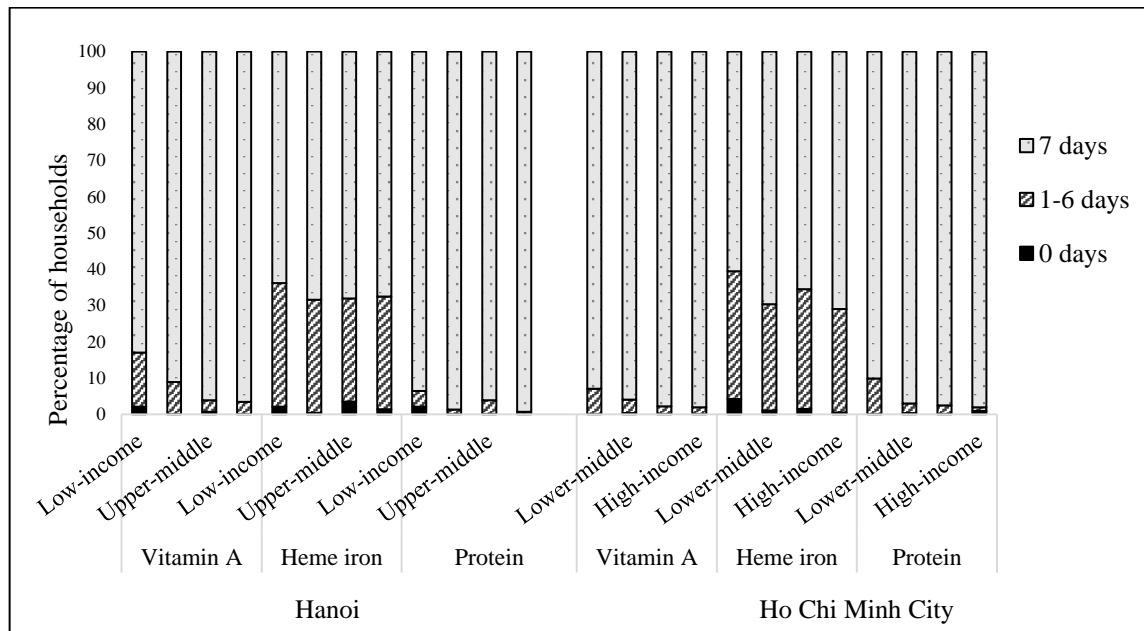
$$\text{Protein}_{h,j} = \sum_{k=1}^6 P_k \quad (2.4)$$

Specifically, we first use the household food recall data, and sum-up the consumption frequencies (over seven days) for three food sub-groups,  $V_k$ ,  $I_k$  and  $P_k$ , which each include specific foods rich in vitamin A, heme iron and protein, respectively. Foods high in vitamin A that are included in  $V_k$  are dairy, organ meats, eggs, orange vegetables, green vegetables and orange fruits. Foods high in heme iron, which are in the  $I_k$  subgroup, include: flesh meat, organ meat, and fish. Foods that are high in protein in the  $P_k$  subgroup include: pulses, dairy, flesh meat, organ meat, fish and eggs.

As the World Food Programme (WFP 2015) outlines, FCS\_N analyses attempt to provide a link between household food access and nutritional outcomes. Understanding the dynamics of this relationship can be helpful for the policy makers interested in designing nutrition-sensitive development programs and policies (WFP 2015).

It is evident from Table 2.1 that urban Vietnamese households are consuming food rich in vitamin A and protein almost seven (6.9) days a week and heme iron just over six (6.3) days a week on average. To gain a deeper understanding of households' micro- and macro-nutrient differences among income groups from seven-day food recall, Figure 2.1 represents the nutrient consumption of foods for four income groups: low, lower-middle, upper-middle and high for Hanoi and Ho Chi Minh City, respectively. This figure (Figure 2.1) shows that in both Hanoi and in Ho Chi Minh City, and for all income categories, consumption of foods rich in heme iron is lower than consumption of vitamin A and protein. In fact, almost one-third of the households in the sample data are facing risk of nutrient deficiencies with respect to heme iron.

Iron deficiency, is the most common cause of anaemia, which remains high in Vietnam, with 36.5% of the population iron deficient nationally (Ministry of Health 2012). Considering our food consumption and nutritional analyses in the sample data on heme iron closely matches the national statistics, the following analyses and results are aimed at providing insights into factors affecting food consumption behaviour that may contribute to deficiencies.



Notes: Gross income categories for Low-income range from 1.5 million to 4.49 million Vietnamese Dong per month; for Lower-middle is 4.5 million to 7.49 million; Upper-middle is 7.5 million to 14.9 million and High-income is 15 million or more Vietnamese Dong per month. 1 USD = 22318.00 VND on December 30, 2016.

Figure 2.1 Differences in nutrient consumption among income groups in Hanoi and Ho Chi Minh City

### 2.2.3 Variables explaining household dietary diversity and diet quality

#### Modern market food expenditure shares

The main explanatory variable in this study is the household share of total food expenditures made in modern food retail outlets, which include supermarkets, mini-markets and/or convenience stores in a typical average month. This is referred as *ModernMarket*, which is a continuous variable in our analyses. It is similar to the explanatory variable used in the related study by Umberger *et al.* (2015).

Thus, *ModernMarket* is calculated following Umberger *et al.* (2015) using responses to three relevant questions. First, “*During the past month, how many times did your household purchase [particular food product X]?*” Second, “*For each purchase, what is the normal value (in Vietnamese Dong) of [product X] bought for household consumption?*” Third, “*Where do you purchase most of the [product X]?*”. Using the responses to these questions, we, first calculate monthly total household food expenditures by calculating the product value of the first and second questions for each of the 92 food products in our data set and then summing the 92 values. Next, we use responses to the third question to calculate each household’s total monthly food expenditure at modern markets. Finally, we divide the household’s total monthly food expenditure at modern markets by the household’s total monthly food expenditure to get the household value for *ModernMarket*, which is the share of food expenditures at modern markets for each household in a typical month. The summary statistics of the sample data in our study show that, in on average, around 13% of urban Vietnamese households’ monthly food expenditures are made at modern retail outlets (Table 2.1).

### ***Other covariates***

We also incorporate other covariates in our empirical strategy which represent socio-demographic characteristics of the households and household members that previous studies have suggested may also influence household diet quality.

We include the ages of the male (*AgeMale*) and female (*AgeFemale*) heads of household to explore the possibility that individuals become more concerned about the healthfulness of their diet as they get older, as shown in other studies (e.g. Frazao and Allshouse 2003; Toiba *et al.* 2015). We also include covariates *EduMale* and *EduFemale*, which represent the years of education completed by the male and female household heads, respectively. More educated adults may purchase healthier foods for their family (Schroeter *et al.* 2012), therefore,

positively affecting diet quality. As shown in Table 2.1, the average age of male and female household head are 46 years and 42 years, respectively. On average, both male and female heads of household completed approximately 11 years of schooling.

We include two dummy variables *Buddhist* (equal to 1 if the household head is a Buddhist, 0 otherwise) and *Christian* (equal to 1 if the household head is a Christian, 0 otherwise) to examine if the main type of religion households practice influences their food consumption patterns (e.g. vegetarian vs. non-vegetarian) and diet quality. Previous studies in other Asian countries consider religion in their analyses. For example, Hossain *et al.* (2012) and Umberger *et al.* (2015) show in Bangladesh and Indonesia, respectively, that religion (i.e. Muslim) has a significant impact on the weight outcomes of the household members. In our sample, roughly 36% of households report that they are Buddhist and 6% report they are Christian/Catholic (Table 2.1). The remaining 58% of the Vietnamese households practice another religion (e.g. Cao Dai, Dao Dua) or are unaffiliated with any religion.

The variable *Children* represents the total number of children that are less than 15 years of age living in the household. Umberger *et al.* (2015) show a potential link between the use of supermarkets and the probability of a child being overweight or obese in high-income households, which might be as a result of increased consumption of food high in energy, such as sugary milk, juice and processed products.

We also include the variables *Income*, *Household size*, and *Microwave*. *Income* represents a household's gross monthly income. Asfaw (2008) shows that expansion of supermarkets can have a negative impact on the diet quality of the poor since they are more likely to buy cheap, filling and tasty processed food items than the rich. Furthermore, Umberger *et al.* (2015) show in their Indonesian study that children from low-income urban

households have significantly higher body mass index (BMI) compared to those from middle- and high-income households. *Household size* is the family size, which may affect the overall diet quality of the household. For example, large household size is widely regarded as a risk factor for malnutrition in developing countries (Pelto *et al.* 1991). *Microwave*, is a binary variable equal to 1 if the household owns a microwave and 0 otherwise. Households who own a microwave may have more options of preparing different food items that might affect their food consumption patterns (Asfaw 2011). Around 41% of the urban households own a microwave as reported in Table 2.1.

Finally, *Ho Chi Minh City* is a dummy variable included to control for unobservable city-level social norms and cultural traditions (Umberger *et al.* 2015). Around 58% of the households are from Ho Chi Minh City in our study shown Table 2.1.

#### 2.2.4 Empirical estimation

Outcome variables for dietary diversity and diet quality in this study are count data and take-on only non-negative values. Therefore, we use the Poisson model, which accommodates the discrete nature of the data (Cameron and Trivedi 2009), to estimate the following:

$$\mathbf{D}_{h,j} = \exp(\beta_0 + \beta_1 \text{ModernMarket}_{h,j} + \beta_2 \mathbf{X}'_{h,j}) + \varepsilon_{h,j} \quad (2.5)$$

Here,  $\mathbf{D}_{h,j}$  is the diet outcome measure for dietary diversity and diet quality for household  $h$  in city  $j$ . We use Household Dietary Diversity Score (*HDSS*) to measure dietary diversity. Three diet quality measures, *Vitamin A*, *Protein* and *Heme Iron*, are employed to capture the consumption frequencies of vitamin A, protein and heme iron, respectively. The right-hand side variable,  $\text{ModernMarket}_{h,j}$  measures household  $h$ 's share of total food expenditures made at modern markets.  $\mathbf{X}_{h,j}$  is a vector of covariates which include socio-

demographic characteristics of both households ( $h$ ) and individuals in household  $h$ , and  $\varepsilon_{h,j}$  is a random error term.

The equi-dispersion property of equal mean and variance in the Poisson model is commonly violated in applied work due to overdispersion (Dean 1992). Therefore, we test for overdispersion in our model and the outcome indicates no significant presence of overdispersion<sup>12</sup>, suggesting our use of Poisson model is appropriate.

The explanatory variable of interest  $ModernMarket_{h,j}$  is potentially endogenous as there may exist some unobservable factors omitted in the model that affect both the outcome variables and share of expenditures at modern markets. For example, households may desire to purchase food with certain quality certifications, which may result in more frequent use of modern markets (Umberger *et al.* 2015). In this case, a simple Poisson regression estimation is likely to produce a biased and inconsistent result. To minimize endogeneity, we apply a two-step control function (CF) approach to the Poisson model with appropriate Instrumental Variable (IV) in the first analysis. Models with count data and endogenous explanatory variables can most easily be estimated using the CF approach since it requires fewer assumptions than maximum likelihood and it is computationally simpler (Wooldridge 2015). The endogenous regressor  $ModernMarket_{h,j}$  (in equation 2.5) is first estimated as a function of instruments, and then, the second step involves including the error from the first step as an additional regressor in the main model (equation 2.5).

Finding valid IVs is difficult, and they could potentially give estimations inferior to OLS if used inappropriately. We use a variable  $OtherModernMarket$  as an instrument, which represents average food expenditure share at modern outlets of all other surveyed households in the same ward. We predict that the instrument may have a high correlation with the modern

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<sup>12</sup> The test for overdispersion is presented in Table 2.2 with the empirical results. The residual  $lpuhat$  is not significant in our analyses at 5% level which indicates that our use of Poisson model is appropriate.

market food expenditure share of the individual household (i.e.  $ModernMarket_{h,j}$ ) as it captures both the general shopping pattern(s) of the community and possible neighbourhood effects in food purchasing behaviour. For instance, women are usually responsible for shopping for foods and preparing meals for their families in Vietnam (Van Dinh *et al.* 2013). It is possible that these women may share information on food price, food quality and food safety issues with their neighbours in the same community or ward. At the same time, it may not have any effect on the dietary diversity or diet quality of the individual households other than through possible changes in the food purchasing behaviour of the latter<sup>13</sup>.

Our second objective is to examine if there are any indirect linkages between food expenditure shares at modern markets and household diet quality through dietary diversity. To examine whether the association is negative or positive, we estimate a system of equations through which modern market food expenditure share correlates to households' diet quality. Our systems of equations are as follows:

$$ModernMarket_{h,j} = \alpha_0 + \alpha_1 \mathbf{Z}_{h,j} + \alpha_2 \mathbf{X}_{h,j} + e_{1h,j} \quad (2.6)$$

$$HDDS_{h,j} = \beta_0 + \beta_1 ModernMarket_{h,j} + \beta_2 \mathbf{X}_{h,j} + e_{2h,j} \quad (2.7)$$

$$\mathbf{D}_{h,j} = \gamma_0 + \gamma_1 HDDS_{h,j} + \gamma_2 ModernMarket_{h,j} + \gamma_3 \mathbf{X}_{h,j} + e_{3h,j} \quad (2.8)$$

Here,  $ModernMarket_{h,j}$  measures household  $h$ 's share of food expenditures made at modern markets;  $\mathbf{Z}_{h,j}$  is a vector of instrumental variables for choosing modern markets for food shopping in city  $j$ ;  $HDDS_{h,j}$  represents household dietary diversity score of the same household in city  $j$ ; and  $\mathbf{D}_{h,j}$  indicates the three diet quality measures discussed above. The term  $\mathbf{X}_{h,j}$  represents the vector of individual and household characteristics, while  $e_{1h,j}$  to  $e_{3h,j}$

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<sup>13</sup> Pearson correlation coefficients between the instrumental variable *OtherModernMarket* and dietary diversity and diet quality measures are very low (<0.04).



are random error terms which are assumed to be independent and identically distributed in the model. We also secure model identification by rank and order conditions.

To investigate the indirect linkages, we apply the three-stage least squares method (3SLS) to estimate a system of structural equations where some equations have endogenous variables. In many cases, these endogenous variables are dependent variables of other equations in the system. Therefore, the error term is correlated with the endogenous variables which violates the assumptions of OLS (Greene 2012). 3SLS obtains instrumental variable estimates, taking into account the covariance across equation disturbances (Davidson and MacKinnon 1995). In our systems of equations (2.6-2.8), the variables *ModernMarket* and *HDDS* are used on both the left and right sides and therefore they potentially suffer from endogeneity. Therefore, we apply this method to produce consistent estimates and Generalized Least Squares (GLS) to account for the correlation structure in the disturbances across the equations.

To address possible endogeneity, we use the variable *OtherModernMarket* which is the average expenditure share on food at modern markets for all other surveyed households in the same ward as an instrument for the possibly endogenous explanatory variable, *ModernMarket*. For the other endogenous variable, *HDDS* we use another IV, *ShoppingList* (with a value of 1 if the household uses a shopping list when shopping for food). A study by Crawford *et al.* (2007) shows that a shopping list can help the household plan meals for the households and is often used when the household is trying new recipes, which may involve new types of foods. Therefore, it is possible that having a shopping list may increase household dietary diversity. To ensure that shopping list is not correlated to household diet quality, we check Pearson

correlation coefficient test and find very low correlations between the variable *ShoppingList* and measures of diet quality.<sup>14</sup>

## 2.3 Results and discussion

### 2.3.1 Direct estimates of household diet quality

Table 2.2 reports the results of the estimation of the direct relationship between household food expenditure shares at modern markets (*ModernMarket*) and measures of household dietary diversity (*HDDS*), and diet quality i.e. the consumption frequencies of food rich in *Vitamin A*, *Heme Iron*, and *Protein*. We find no statistically significant relationship between *ModernMarket* and *HDDS*. Further, the direct estimates of household diet quality in Table 2.2 show no significant association between *ModernMarket* and consumption frequencies of foods rich in *Vitamin A* and *Protein*. However, we find a positive and significant association between *ModernMarket* and consumption frequencies of *Heme Iron*. More specifically, *ModernMarket* is associated with 2.1% increase in the consumption frequency of *Heme Iron* for a household. The first-stage coefficient on the *OtherModernMarket* variable indicates a positive and statistically significant association with *ModernMarket* (at 1% level of significance). The first stage F-statistic is 106.02 which satisfies the conventional “rule of thumb” for F-statistics (Staiger and Stock 1997).

The second stage regression fits a Poisson model that includes the first-step residual (variable *lpuhat* shown in Table 2.2). The z-statistic for the coefficient of the residual *lpuhat* in Table 2.2 provides the basis for a robust Wald test of the null hypothesis:  $H_0: \rho = 0$  of exogeneity (Cameron and Trivedi 2009). Our results show that the z statistic has a non-

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<sup>14</sup> The respective Pearson correlation coefficients between *ShoppingList* and *Protein* and *Heme Iron* are <0.05 and that between *ShoppingList* and consumption frequencies of *Vitamin A* is -0.007.

significant p-value against the alternative hypothesis:  $H_1: \rho \neq 0$ , thereby, failing to reject the null hypothesis.

**Table 2.2 Direct estimates of household dietary diversity and diet quality (Two-step CF approach)**

	<i>HDDS</i>	<i>Vitamin A</i>	<i>Heme Iron</i>	<i>Protein</i>
<i>ModernMarket</i>	-0.0781 (-0.0528)	-0.0626 (0.0442)	0.2140*** (0.0721)	0.0228 (0.0211)
<i>AgeMale</i>	0.0005 (0.0003)	0.0006** (0.0002)	0.0004 (0.0007)	0.0002 (0.0002)
<i>AgeFemale</i>	-0.0003 (0.0004)	-0.0008*** (0.0002)	-0.0008 (0.0007)	-0.0004* (0.0002)
<i>EduMale</i>	-0.0021*** (0.0007)	0.0004 (0.0007)	-0.0065*** (0.0017)	-0.0009* (0.0004)
<i>EduFemale</i>	0.0016 (0.0019)	0.0043*** (0.0011)	0.0056*** (0.0018)	0.0012** (0.0005)
<i>Buddhist</i>	-0.0139*** (0.0050)	-0.0046* (0.0026)	-0.0213** (0.0104)	-0.0119*** (0.0021)
<i>Christian</i>	0.0112* (0.0069)	-0.0038 (0.0032)	0.0348*** (0.0129)	-0.0015 (0.0017)
<i>Income:</i>				
<i>Lower-middle income</i>	0.0359*** (0.0112)	0.0216* (0.0116)	0.0356* (0.0200)	0.0012 (0.0040)
<i>Upper-middle income</i>	0.0463*** (0.0111)	0.0264** (0.0113)	0.0190 (0.0204)	-0.0024 (0.0048)
<i>High-income</i>	0.0504*** (0.0126)	0.0290*** (0.0112)	0.0342 (0.0216)	-0.0018 (0.0054)
<i>Household size</i>	0.0073*** (0.0021)	0.0035* (0.0018)	-0.0027 (0.0038)	0.0031** (0.0014)
<i>Children</i>	0.0052** (0.0024)	0.0111*** (0.0019)	0.0070 (0.0044)	0.0028* (0.0011)
<i>Microwave</i>	0.0366*** (0.0036)	0.0022 (0.0029)	0.0173** (0.0072)	0.0062*** (0.0022)
<i>Ho Chi Minh City</i>	0.0185*** (0.0036)	0.0123*** (0.0029)	-0.0057 (0.0042)	0.0033*** (0.0012)
<i>Ipuhat (Residual)</i>	-0.0102 (0.0547)	0.0731* (0.0434)	-0.0570 (0.0746)	0.0067 (0.0215)
<i>Constant</i>	2.197*** (0.0200)	1.810*** (0.0203)	1.832*** (0.0352)	1.918*** (0.0076)
<u>First stage regression</u>				
<i>OtherModernMarket</i>		9.642*** (1.326)		
F-test		106.02***		
Mean VIF		3.68		
Deviance goodness of fit(Prob>ch2)	678.94(1.00)	452.32(1.00)	2048.54(1.00)	201.60(1.00)
Pearson goodness of fit(Prob>ch2)	650.20(1.00)	289.65(1.00)	1397.12(1.00)	147.80(1.00)
Number of households		1,695		

Notes: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are reported in the parenthesis. VND/month is Vietnamese Dong per month. 1 USD = 22318.00 VND on December 30, 2016. Reference income is *Low-income* in VND/month. Instrumental variable: *OtherModernMarket* represents average modern market food expenditure share of other surveyed households in the same ward.

The Deviance and Pearson goodness of fit statistics indicate the model is appropriate for the analysis.

Among the other covariates, the significant coefficient on the variable *EduMale* shows a negative association with *HDSD* and diet quality measures such as *Heme Iron* and *Protein* (Table 2.2). However, the associations between *EduFemale* and measures of diet quality (*Vitamin A*, *Heme Iron* and *Protein*) are positive and statistically significant (1% level). Perhaps, higher educated female household heads are more knowledgeable about the health benefits of nutrient-rich food; and therefore, female household heads encourage family members to consume more nutritious types of food.

We find a negative and statistically significant association between the variable *Buddhist* and dietary diversity and diet quality, with *Heme Iron* and *Protein* strongly significant at the 5% and 1% level, respectively. This is as expected as Vietnamese Buddhists are generally vegetarians; and meat consumption, which is a good source of heme iron and protein, is generally low among them (Nam *et al.* 2010). On the other hand, we find a positive and statistically significant relationship between the variables *Heme Iron* and *Christian*. These results suggest that urban Vietnamese household's religious practices affect their diet quality.

The coefficients on the income dummy variables show positive and statistically significant associations with higher levels of household income and household dietary diversity (Panel (1) of Table 2.2). However, income effects for households in upper-middle (7.5 million to 14.9 million VND/month) and high (15 million or higher VND/month) income ranges show stronger levels of significance in explaining consumption frequencies of Vitamin A compared to lower-middle income. Not surprisingly, household income appears to play an important role in explaining diet quality of urban Vietnamese households. Further detailed analysis of the data

revealed that the urban households with higher socioeconomic status are more likely to consume nutrient rich foods that are good sources of nutrients such as *Vitamin A*, such as tropical fruits, fish and dairy products.

Somewhat surprisingly, *Household size* has a positive and significant correlation with the variables *HDDS*, *Vitamin A* and *Protein* (Table 2.2). This could be because larger households may consume a greater variety of food due to heterogeneous demand for food by the members. The variable *Children* is positively associated with *HDDS* and nutrient adequacies (*Vitamin A* and *Protein*). This is an interesting result and may suggest that households are consciously selecting foods that are higher in these nutrients to ensure that their children have higher quality diets. Further research is needed to look at the intra-household food consumption behaviour of the children versus the adults in these households and also compare the diet quality of adults in household with children to adults in households without children, but with other similar socio-economic characteristics.

Finally, we find that Ho Chi Minh City households, compared to Hanoi households, have a significantly higher overall diet diversity and diet quality, particularly with respect to adequacy of vitamin A and protein. This could be because the eating habits and availability of food items vary greatly due to cultural, ethnic, geographical and economic development differences between the two cities (Van Dinh *et al.* 2013). For example, Hanoi, which is in the northern part of Vietnam, has operated under socialism since the 1940s (Ralston *et al.* 1999), and modern market growth has been relatively slower in Hanoi (Wertheim-Heck *et al.* 2015). On the other hand, Ho Chi Minh City, which is located to the southern part of Vietnam, has been influenced by the U.S. and other Western cultures for several decades (Engholm 1995). Van Dinh *et al.* (2013) reported that the traditional diet and eating habits of households in the Northern part of Vietnam differed from the southern households in Ho Chi Minh City, due in

part to food availability as a result of differences in climatic conditions, as well as cultural differences and eating habits. Therefore, it is not surprising that we found regional differences in this study.

### 2.3.2 Indirect estimates of household diet quality through household dietary diversity

Results of the estimation (using the system of equations (2.6-2.8)) of indirect linkages between modern market food expenditure shares and household diet quality through household dietary diversity are summarized in Table 2.3<sup>15</sup>. The results suggest that *ModernMarket* may have a significant association with household diet quality indirectly through *HDDS*. More specifically, we find a positive (coefficients: 2.709 for *Heme Iron* and 0.4850 for *Protein*) and significant (1% level) association of modern market expenditure shares (*ModernMarket*) with the consumption frequencies of both heme iron and protein, and a negative (coefficient: -0.8250 for *Vitamin A*) and weakly significant (10% level) between modern market expenditure shares (*ModernMarket*) and the consumption frequency of vitamin A.

**Table 2.3 Indirect estimates of household diet quality through household dietary diversity (3SLS)**

	(1)		(2)		(3)	
	<i>Vitamin A</i>	<i>HDDS</i>	<i>Heme Iron</i>	<i>HDDS</i>	<i>Protein</i>	<i>HDDS</i>
<i>ModernMarket</i>	-0.8250*	-0.7090	2.7090***	-0.7090	0.4850***	-0.7090
	(0.4750)	(0.4670)	(0.9750)	(0.4670)	(0.2790)	(0.4670)
<i>HDDS</i>	-0.5160		1.6850**		0.4260**	
	(0.3440)		(0.7060)		(0.2020)	
Hansen J statistic (p-value):	0.1550 (0.694)					
Individual attributes	Yes	Yes	Yes	Yes	Yes	Yes
Household attributes	Yes	Yes	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of households	1,695					
Chi-square	124.23***	365.38***	43.12***	365.38***	47.03***	365.38***

Notes: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are presented in parentheses.

<sup>15</sup> Full results are presented in Table 2.3A for micronutrients (vitamin A and heme iron) and in Table 2.3B for macronutrient (protein) in Appendix 3.

Conversely, for all three measures of diet quality, the impact of *ModernMarket* on  *HDDS* is not statistically significant. Yet, when we use  *HDDS* as an explanatory variable in our analyses to explain  *Vitamin A*,  *Heme Iron* and  *Protein*, an increase in  *HDDS* is statistically significant (5% level) and positive with respect to estimates of the consumption frequencies of  *Heme Iron* (micronutrient) and  *Protein* (macronutrient). These results indicate that increased household dietary diversity significantly contributes to higher consumption of nutrient-rich foods in urban Vietnamese households.

The coefficients on the instrumental variables  *OtherModernMarket* and  *ShoppingList* are positive and statistically significant in explaining the endogenous variables  *ModernMarket* and  *HDDS*, respectively, thus, they appear to satisfy the relevance condition. The first stage F-statistics report that the instruments are valid as the rule of thumb of exceeding the value 10 is satisfied (Staiger and Stock 1997). In all three cases, based on the over identification test using the Sargen and Hansen J statistic, we fail to reject the null hypotheses (at the 5% level) and can conclude that the over-identifying restriction is valid. These results jointly lend credence to the overall set of instruments used in the 3SLS estimation.

### **2.3.3 Discussion**

In general, there is no conclusive evidence of a statistically significant direct relationship between modern market food expenditure shares and measures of household dietary diversity and diet quality. Rather, we found that modern market food expenditure shares may have a significant association with diet quality through indirect linkages. More specifically, modern market expenditure share is positively associated with consumption of foods rich in heme iron and protein, which could occur through purchases that result in increased consumption of certain foods rich in these nutrients, such as meat, fish and dairy products. Households may prefer to purchase these perishable food items from modern markets

rather than wet markets because as Wertheim-Heck *et al.* (2015) discussed, modern markets are perceived by some Vietnamese consumers to be safer. However, Wertheim-Heck *et al.* (2015) also reported that shoppers at modern markets have a specific socio-demographic profile such as higher income and/or younger.

On the other hand, modern markets may have a negative impact on household diet quality in terms of offering food rich in vitamin A such as leafy green vegetables, orange and yellow vegetables and fruits. This may be because in Vietnam, traditional wet markets as well as street vendors largely dominate the market for fresh fruits and vegetables. For example, supermarkets in Hanoi account for only 2% of total vegetable consumption (Wertheim-Heck *et al.* 2014, 2015).

Further, as expected, household dietary diversity plays an important role in diet quality, through increasing consumption of micronutrients (e.g. heme iron) and macronutrients (e.g. protein). This is not surprising as diet quality is likely to improve if the household consumes a more diversified diet, rich in fresh and relatively unprocessed food.

These findings imply that policies, which encourage food market modernization as a way of stimulating economic development in Vietnam, may need to be re-evaluated if household diet quality improvement is also a policy goal. A comprehensive set of factors can affect diet quality. For example, more work is needed to understand drivers of heterogeneous consumer shopping and food purchase behaviour (e.g. perceptions and concerns regarding food safety and quality, nutrition knowledge, socio-demographics) in Vietnam, particularly as they relate to the use of different food retail outlet formats; and the association between these factors and diet quality. Further, Vietnamese consumers' food demand patterns are changing. While per capita consumption of nutrient-dense meat, fish and seafood, eggs and dairy products is



increasing in Vietnam, demand is also growing for relatively less nutritious processed foods (Hoang 2018). Thus, it is important to understand the various food products (fresh and processed) that are offered in different food retail outlets and consumers' purchasing behaviour and preferences with respect to food outlets and food products.

Alternatively, policies that directly promote and encourage consumption of fresh, unprocessed and diverse healthy foods may be more efficient mechanisms for improving the diet quality of the urban Vietnamese population. Further, increasing education and rising awareness of nutrition may also have a positive impact on the diet quality of Vietnamese households, which in turn, may contribute to reducing the double burden of malnutrition. Thus, the Vietnamese government may consider promoting complementary policies focused on improving the general knowledge and awareness of nutrition.

## **2.4 Conclusions**

This study explores the relationship between the share of household food expenditures at modern food retail outlets and diet quality in terms of diet diversity and nutrient adequacy with respect to vitamin A, heme iron and protein. To the best of our knowledge, this is the first study that explicitly examines the relationship between modern market food expenditure shares, household dietary diversity, and diet quality in order to shed light on the implications of food market modernisation on Vietnamese diets.

This current study has several limitations. First, the study is cross-sectional in nature and therefore, findings of this study cannot infer causal relationships. Also, this study is based on household data from only two cities in Vietnam: Hanoi and Ho Chi Minh City; thus our study may not be representative of the whole country. Future research in this direction should include households from more urban and peri-urban areas. Moreover, the conceptual links among

modern food retail outlet usage, dietary diversity and diet quality will need to be established without loss of generality, which is beyond the scope of the current study which focuses on a specific transition economy.

Additionally, the data on food consumption behaviour, dietary diversity and diet quality in this study are at the household level. Collecting individual-level diet quality data may be expensive and time consuming. However, inequalities in the intra-household distribution of food and calories are common in developing countries, and there is growing concern that estimates based on household-level data may not accurately identify the nutritional status of individual household members. Thus, it is important to examine the effect of modern market usage on the diet quality of individuals, including children, adolescents and adults. Future studies may also consider using food diaries to measure the food consumption behaviour of individuals in households considering various age groups and gender to obtain improved estimates of diet quality.

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### Chapter 3: Statement of Authorship

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Contribution to the Paper	Contributed to primary survey, data collection, calorie conversion from 24 hour food diaries, data analysis and interpretation, wrote manuscript			
Overall percentage (%)	65%			
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.			
Signature	<table border="1" style="width: 100%;"> <tr> <td style="width: 60%;"></td> <td style="width: 10%; text-align: center;">Date</td> <td style="width: 30%;">30/11/2018</td> </tr> </table>		Date	30/11/2018
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#### Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Professor Wendy J umberger		
Contribution to the Paper	Project director of the primary survey and contributed to the design and IP of survey, guided data analysis, contributed in manuscript development and editing		
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### **Chapter 3: Understanding food westernization and other contemporary drivers of adult, adolescent and child diet quality in urban Vietnam**

#### **Abstract**

The aim of this study was to examine the association between consumption of western foods, particularly food products consumed away-from-home and diet quality of urban consumers using intra-household data from a cross-sectional study of 1,685 households and 4,997 individuals in Hanoi and Ho Chi Minh City in Vietnam. Dependent variables explored in this study were individual daily caloric intake and macronutrient shares. These variables were calculated using 24-hour food diary data which included information on food consumed both at-home and away-from-home by each individual (adults, adolescents and children) living in the household. After testing for potential endogeneity of the key independent variable, daily calorie shares of western food-away-from-home for individuals, and using an ordinary least square approach, we found that western food-away-from-home has a significant association with high calorie intake (p-values < 0.01 for adults and children). Our results for macronutrient shares showed that western food-away-from home was associated with high intake of fat among all adults and children (p-values < 0.01). Collectively these results indicated that there is a need for policymakers to be aware of factors which can lead to ‘obesogenic food environments’ and to consider relevant interventions if nutrition improvement is a long-term goal.

**Keywords:** diet quality; nutrition transition, food-away-from home; Vietnam, westernization, food market environment.

### **3.1. Introduction**

In Vietnam, like many countries across Asia, lifestyles are changing as a result of a combined set of factors, including: industrialization, globalization, increasing disposable incomes, and urbanization (Kelly 2016; Pingali 2007; Reardon et al. 2014; Reardon and Timmer 2014). Together, these factors are leading to changes in consumer demand for food products, and are influencing where consumers purchase, and how they consume food (Reardon et al. 2003; Reardon and Timmer 2012; Trail 2006). Several studies have found that these changes in the food environment in emerging economies, particularly in Asia, are contributing to a diet and nutrition transition, characterized by increasing consumption of energy-dense western foods, which are often high in saturated and trans-fats, salt and sugar, and relatively low in dietary fiber and nutrients (Kelly 2016; Pingali 2007; Reardon et al. 2014; Toiba et al. 2015). Consumption of these foods often comes at the expense of relatively unprocessed traditional staples, which for Vietnam have included rice as well as nutrient dense fish, seafood, meat and vegetables.

A set of studies (Baker and Friel 2016; Gómez et al. 2011; Reardon and Timmer 2012) contend that the aforementioned factors, especially increasing disposable incomes and urbanization, have stimulated foreign investment into the food retail and food service sectors across Asia. These studies suggest that new investment in largely western-style food outlets and shopping centres, has created a new food market ‘environment’. For example, now in most urban areas across Asia, traditional food markets (e.g. wet markets, food carts or peddlers and ‘street food’) exist alongside modern food retailers (e.g. supermarkets, hypermarkets and convenience stores), and ‘western’ foodservice establishments, including: multi-national fast food chains (e.g. McDonalds, KFC, and Burger King), family-style restaurants (e.g. Pizza Hut, TGI Fridays) and coffee shops/cafés (e.g. Starbucks, Dunkin Donuts) (Baker and Friel 2016).

The literature looking at the impact of changes in the food environment on diets, has largely focused on the association between the ‘supermarket revolution,’ (i.e. increasing market penetration of supermarkets and the related growth in the use of supermarkets as a source of food) and changing diet quality and diet-related health outcomes such as obesity, type 2 diabetes and heart disease (Asfaw 2008; 2011; Conklin et al. 2016; Demmler et al. 2018; Hawkes 2008; Kelly et al. 2014; Kimenju et al. 2015; Popkin 2014; Popkin et al. 2012; Rischke et al. 2015; Toiba et al. 2015; Umberger et al. 2015). This body of work has found some evidence of a link between poor diets, high in fat, sugar and salt, non-communicable diseases (NCDs) and increasing use of modern food retailers, such as supermarkets (Ali and Abdullah 2017; Kelly et al. 2014; Toiba et al. 2015; Umberger et al. 2015) However, the literature on this topic also suggests that other factors related to the changing food environment may also contribute to poor diets and diet-related health issues. These include other cotemporary factors, such as increasing access to western food service establishments that offer various types of fast, ready-to-eat meal options, as well as changing lifestyles which increase demand for food-away-from home (Lachat et al. 2009; Seguin et al. 2016).

Food-away-from-home (FAFH) includes meals and beverages prepared and eaten outside of the home. Food outlets offering FAFH options are abundant in Western countries and offer convenient, and sometimes inexpensive meal solutions for time-pressed consumers. However, these FAFH outlets offering customers convenience generally market food products and meal options that are highly processed and relatively lower in nutritional value, containing relatively high amounts of saturated and trans-fats, salt and/or sugar, and relatively lower amounts of dietary fiber and nutrients (Janssen et al. 2018; Todd et al. 2010). Thus, concerns are raised when a large share of the diet is made up of FAFH from ‘western-style fast-food’ outlets.

In high-income countries, such as the US and some parts of European, an association between high shares of dietary intake from FAFH, poor diet quality and diet-related health issues has been recently documented in the literature (Adams et al. 2015; Bowma et al. 2004; Bowman and Vinyard 2004; Guthrie et al. 2002; Orfanos et al. 2007; Paeratakul et al. 2003). Further, previous research has found that frequent consumption of FAFH from fast-food outlets has been linked to negative diet outcomes (Bezerra and Sichieri 2009; Drichoutis et al. 2012). Thus, FAFH, particularly from western-style fast-food outlets, has been shown to be one factor contributing to increasing levels of diet-related NCDs such as obesity (Binkley 2008; Bowman and Vinyard 2004; Cunha 2018; Jaworowska et al. 2013; Paeratakul et al. 2003; Seguin et al. 2016; Schröder et al. 2007), cardiovascular disease, type 2 diabetes and some types of cancer (Stender et al. 2006; Webster et al. 2009). In high income countries, due to growing concerns about the link between fast-food consumption and diet-related health issues, there has been growing pressure on the food industry to increase the number of healthier meal options offered at western FAFH outlets.

‘Western-style fast-food’ outlets, are progressively penetrating food markets in Vietnam and throughout Asia. However, the association between FAFH from western outlets (western FAFH) and diet quality of urban consumers in emerging Asian economies, such as Vietnam, is not well understood. In contrast to most developed countries, in emerging economies, such as Vietnam, FAFH options often include a vast variety of both traditional and modern formats offering a wide array of food products and meal solutions. Traditional retailers of FAFH – often called “street food” – generally offer food products that have long been part of the local food culture. The nutritional quality of “street food” is varied in Vietnam. For example, the popular Vietnamese “street food” dish, pho, usually contains lean sources of protein, herbs and vegetables, and can be of relatively high nutritional value.



On the other hand, FAFH purchased from western-style food vendors, including multinational fast-food outlets, coffee shops, and ‘family-style’ restaurants, are not only convenient for time-poor consumers in rapidly urbanizing Asia, but they may also be a sign of affluence and status for the growing middle-class consumers (Reardon et al. 2014). Urban consumers, may be attracted by the promotional offers and the appealing look of these modern foods, as well as concerns about food safety. Eventually, consumers may develop preferences for western over traditional FAFH.

Understanding the association between the consumption of FAFH and diet quality in this rapidly developing region is equally important as in developed countries because increasing abundance of unhealthy and energy-dense food may disrupt an individual’s ability to make healthy food choices (Maguire et al. 2015) throughout their life. This is particularly alarming for younger groups as the shifts to a western diet may eventually extend to permanent changes in their food consumption habits, which in turn, may contribute to an increased burden of non-communicable diseases in these developing countries.

This paper, therefore, tests the hypothesis that increased consumption of FAFH from western-style food outlets has a negative association with diet quality in Vietnam, while controlling for other contemporary factors related to lifestyle, which may also impact diet quality. We specifically focus on western FAFH rather than traditional FAFH or ‘street food’ because previous research has suggested it is a critical part of ‘obesogenic food environments,’ which already exist in developed countries and is growing in emerging economies, particularly throughout Asia.

### ***3.1.1. Transformation of food markets and diet-related health issues in Vietnam***

Vietnamese food markets are currently transforming (Smith and Vo 2017; Wertheim-Heck et al. 2015; Wertheim-Heck and Spaargaren 2016). These changes are likely to influence

consumption patterns, in addition to the food environment, especially in urban Vietnam where consumers have already started to adapt a more westernized diet (Baker and Friel 2016; Dien et al. 2004; Mergenthaler et al. 2009; Mishra and Ray 2009; Reardon et al. 2014; Thang and Popkin 2003; Trinh et al. 2018). Additionally, in Vietnam, the trend towards western FAFH from fast-food outlets, restaurants, cafes and kiosks is emerging, and the share total food expenditures on FAFH is relatively large (21%) (Reardon et al. 2014). The changes in the food environment provide an ideal opportunity to study food westernization and other contemporary factors that might be associated with Vietnamese diet and nutrition quality.

The negative health impacts of increased consumption of western foods are already evident in other emerging Asian countries such as Thailand (Kelly et al. 2014), Indonesia (Toiba et al. 2015; Umberger et al. 2015), Malaysia (Ali and Abdullah 2017) and China (Zhang et al. 2012). However, in the literature for Vietnam, there has been less attention paid to the possible association between modernization of food markets, increasing consumption of westernized food products and reduced diet quality. However, overweight, obesity and other non-communicable diseases among the urban Vietnamese population are on the rise in recent years (Do et al. 2017; Ha et al. 2011; Khan and Khoi 2008; Le Nguyen et al. 2013), which may put additional burden to the health sector and interrupt the ongoing overall economic growth. Therefore, the challenges in the present context require a clear understanding of whether growth in access to and consumption of western food is putting healthy Vietnamese diets at risks, and if so, to what extent is it associated with the nutrition and diet quality of urban Vietnamese consumers.

Existing studies on Vietnamese dietary intake have used data from the Vietnam Household Living Standard Surveys (VHLSS) which includes information on households' monthly income and expenditure on foods. The VHLSS, does not contain information on

individual household members' diet (Dien et al. 2004; Hoang 2018; Hoang 2009; Mishra and Ray 2009; Thang and Popkin 2003). However, food can be allocated inequitably in households (Barrett 2010; Haddad et al. 1996; Sen et al. 1988) due to social and cultural differences, gender discrimination and religious practices (Osella 2007; Sen et al. 1988). Therefore, dietary assessments based on the assumption that all members share the same amount of foods can be misleading (D'Souza and Tandon 2015). To the best of our knowledge, only one paper has examined individual level energy and macronutrient consumption (only for women of reproductive age in Northern Vietnam) using a semi-quantitative food frequency questionnaire (Nguyen 2013). One of the major concerns of their study was the weak correlation between actual energy intakes and estimated energy requirements which limited their ability to make conclusions on the adequacy of energy intakes in the studied population. This may be due to the need for better methods to estimate energy requirement such as 24-hour diary methods to assess daily dietary.

Thus, a significant point of departure of this study from previous literature on the Vietnamese diet is to provide a comprehensive set of results on the contemporary drivers of diets, using individual-level 24-hour food diaries. This is the only study known to examine this association using a wide range of food items (743 food items) that are commonly consumed by urban Vietnamese adults and children.

## **3.2. Materials and Methods**

### ***3.2.1 Data collection: household surveys and 24-hour food diaries***

The current analyses are based on a novel primary data set, that was collected as part of a large study (led by the authors) of 1,685 urban households located in Hanoi and in Ho Chi Minh City (HCMC) in Vietnam. After receiving ethics approval<sup>16</sup>, and conducting significant

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<sup>16</sup> The study received ethics approval from the university of Adelaide (HREC approval number: H-2015-159).

pre-testing in the field, the cross-sectional study was implemented between late 2016 and early 2017 (with a four-week break to avoid any atypical food consumption fluctuations around Tet, the Vietnamese lunar New Year). Household consent was also gained prior to the infield deployment.

Households were selected using a proportional random sampling strategy considering ward-level population for each city. The household income distribution of our sample is comparable to other large third-party household surveys conducted in HCMC and Hanoi<sup>17</sup>, thereby assuring the representativeness of our data. Household income generally reflects purchasing power and is usually closely related to the food purchasing/consumption decisions of households (Bouis 1994; Miller et al. 2016; Turrell and Kavanagh 2006).

Data collection methods included 1) a household survey, which was designed to collect data on socio-economics (both household and individual-level), lifestyle, food purchasing behavior, food expenditures, and attitudes for the household; and 2) a 24-hour food diary method, where households kept records (diaries) of what was consumed by each member of the household over a 24-hour period.

The household surveys were conducted by trained and experienced professional enumerators, through face-to-face interviews with the household member who was determined to be the most knowledgeable about food purchasing decisions for the household. To ensure data quality, while conducting the interviews the enumerators entered data into a tablet-based application, which allowed the data to be uploaded to a server via wireless networks while enumerators were still ‘in the field’ collecting data. This ‘real-time’ entry of the data allowed the study team to cross-check the quality of the data each day and quickly resolve any issues. Socio-economic information, including: gender, age, years of education completed, religion,

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<sup>17</sup> For further information, see “2013 Vietnam Pocket Reference Book-Nielsen”, [http://www.nielsen.com/content/dam/nielsen-global/vn/docs/Reports/2013/2013\\_VN\\_pocket\\_reference\\_book\\_low.pdf](http://www.nielsen.com/content/dam/nielsen-global/vn/docs/Reports/2013/2013_VN_pocket_reference_book_low.pdf)

and employment status, was collected for each member of the household. Additional data on individual activities such as daily hours each household member (aged two years and more) usually watched television, videos or on the Internet, was also collected.

Additionally, household-level information was obtained, including: family size, number of children in the household, household income, food and non-food expenditure, and households' shopping behavior with respect to the retail formats where an extensive list of food items were purchased. The descriptive statistics in Table 3.1A and Table 3.1B provide detailed information for all variables used in this study, for households, adults and for children, respectively. After data cleaning, our final sample consists of 3,534 adults and 1,461 children and adolescents from 1,685 households out of 1,700 surveyed, who had all relevant information appropriately recorded.

In addition to the survey, 24-food diaries were completed for each adult and child member of the household. The 24-hour food diary module was designed to collect detailed data on the food intake of each member living in the household. This allowed us to estimate the quantities of various food items consumed over a 24-hour period. Information was collected on both food eaten at home and FAFH. In both cities, enumerator training for the 24-hour food diary consisted of a formal classroom component as well as closely monitored 'practice' fieldwork. The person in the household with primary responsibility for food purchasing and meal preparation was asked about the recipes prepared, ingredients for these recipes, the sources of these ingredients (own-production, purchased in the market, collected, given by others), and the quantity of foods eaten by each family member.

**Table 3.1A Descriptive statistics (Adults)**

<u>Dependent variables</u>	<u>Description</u>	<u>Male</u>				<u>Female</u>			
		Mean	SD	Min	Max	Mean	SD	Min	Max
<i>Calorie</i>	Daily average calorie intake (Kcal) per person	2221	448	726.3	5394	2273	443	658	4698
<i>Carbohydrate</i>	Daily average carbohydrate share (%)	63.53	7.10	40.05	86.21	64.91	7.00	42.50	89.86
<i>Fat</i>	Daily average Fat share (%)	23.30	4.23	10.18	38.09	22.98	4.40	8.46	38.03
<i>Protein</i>	Daily average Protein share (%)	18.25	2.97	9.25	34.79	17.82	2.87	8.29	29.22
<u>Key explanatory variable</u>									
<i>WesternFAFH</i>	Share (%) of calories on western food consumed away from home/bought from outside	6.63	9.52	0	54.63	6.60	8.82	0	64.08
<u>Other covariates</u>									
<i>Age (Adults: ref age group is Age18-25Yrs)</i>									
<i>Age26-35Yrs</i>	(%) of age group between 26 to 35 years	0.27	0.45	0	1	0.32	0.47	0	1
<i>Age36-45Yrs</i>	(%) of age group between 36 to 45 years	0.23	0.42	0	1	0.24	0.43	0	1
<i>Age46-55Yrs</i>	(%) of age group between 46 to 55 years	0.21	0.41	0	1	0.17	0.38	0	1
<i>Age56-64Yrs</i>	(%) of age group between 56 to 64 years	0.12	0.32	0	1	0.08	0.27	0	1
<i>Age65Yrs&amp;Plus</i>	(%) of age group equal to or more than 65 years	0.04	0.20	0	1	0.04	0.20	0	1
<i>EduMale</i>	Highest years of schooling completed by male household head	10.97	3.33	0	23	11.03	3.33	0	23
<i>EduFemale</i>	Highest years of schooling completed by female household head	10.68	3.22	1	19	10.67	3.24	1	19
<i>FemaleWork</i>	Average hours of weekly work by female head in the household	25.42	26.11	0	100	26.08	26.14	0	100
<i>Buddhist</i>	(= 1 if the household head is Buddhist, 0 otherwise)	0.38	0.49	0	1	0.37	0.48	0	1
<i>Christian</i>	(= 1 if the household head is Christian, 0 otherwise)	0.07	0.26	0	1	0.08	0.26	0	1
<i>ConsFreq</i>	Number of eating occasions per day (three-day average)	4.87	1.12	2	7	5.03	1.08	2.7	7
<i>WatchTV</i>	Number of hours per day the individual watches television	1.97	1.56	0	10	2.11	1.61	0	10
<i>Income:</i> Monthly household income levels									
<i>Low income</i>	Less than 4.49 mil VND/month	0.06	0.17	0	1	0.05	0.16	0	1
<i>Lower-middle income</i>	4.5 to 7.49mil VND/month	0.27	0.45	0	1	0.27	0.44	0	1
<i>Upper-middle income</i>	7.5 to 14.9mil VND/month	0.43	0.50	0	1	0.43	0.50	0	1
<i>High income</i>	15 mil or more VND/month	0.24	0.43	0	1	0.25	0.43	0	1
<i>Household size</i>	Household size (number of children and adults in the family)	4.03	1.13	2	8	4.07	1.15	2	8
<i>Children</i>	Number of children living in the household	1.04	0.86	0	4	1.07	0.85	0	4
<i>Ho Chi Minh City</i>	(City =1 if Ho Chi Minh City, otherwise 0)	0.56	0.50	0	1	0.55	0.50	0	1
<u>Instrumental variable (for 2SLS)</u>									
<i>OtherWesternFAFH</i>	The average calorie share of Western FAFH of all other surveyed individuals in the same ward.	0.15	0.57	0.004	23.50	0.15	0.44	0.004	19.16
<i>Number of individuals</i>		1,750				1,784			
<i>Number of households</i>		1,685							

Source: Authors' estimation from Vietnam Urban Food Consumption and Expenditure Study. VND/month represents Vietnamese dong per month. 1 USD = 22,318 VND on December 30, 2016.

**Table 3.1B Descriptive statistics (Children)**

Dependent variables	Description	Male				Female			
		Mean	SD	Min	Max	Mean	SD	Min	Max
<i>Calorie</i>	Daily average calorie intake (Kcal) per person	2275	543.3	685.7	4984	2250	623	425	6787
<i>Carbohydrate</i>	Daily average carbohydrate share (%)	61.70	7.99	32.61	83.23	61.43	8.62	29.53	86.28
<i>Fat</i>	Daily average Fat share (%)	25.58	5.78	9.62	57.88	25.48	5.81	11.74	57.81
<i>Protein</i>	Daily average Protein share (%)	18.30	3.07	9.46	32.15	18.53	3.70	7.05	44.24
<b>Key explanatory variable</b>									
<i>WesternFAFH</i>	Share (%) of calories on western food consumed away from home/bought from outside	13.08	10.44	0	87.96	12.71	9.77	0	100
<b>Other covariates</b>									
<i>Age (Children: ref age group is Age&lt;4Yrs)</i>									
<i>Age4-6Yrs</i>	(%) of age group between 4 to 6 years	0.22	0.41	0	1	0.21	0.41	0	1
<i>Age7-9Yrs</i>	(%) of age group between 7 to 9 years	0.17	0.37	0	1	0.19	0.39	0	1
<i>Age10-12Yrs</i>	(%) of age group between 10 to 12 years	0.14	0.35	0	1	0.13	0.34	0	1
<i>Age13-15Yrs</i>	(%) of age group between 13 to 15 years	0.14	0.35	0	1	0.14	0.35	0	1
<i>Age16-17Yrs</i>	(%) of age group between 16 to 17 years	0.10	0.30	0	1	0.09	0.29	0	1
<i>EduMale</i>	Highest years of schooling completed by male household head	11.69	3.13	1	18	11.54	3.28	0	23
<i>EduFemale</i>	Highest years of schooling completed by female household head	11.45	3.02	2	19	11.23	3.16	1	19
<i>FemaleWork</i>	Average hours of work per week by female head in the household	29.03	26.30	0	84	29.69	25.83	0	84
<i>Buddhist</i>	(= 1 if the household head is Buddhist, 0 otherwise)	0.34	0.47	0	1	0.36	0.48	0	1
<i>Christian</i>	(= 1 if the household head is Christian, 0 otherwise)	0.06	0.24	0	1	0.05	0.23	0	1
<i>ConsFreq</i>	Number of eating occasions per day (three-day average)	5.30	1.01	2.7	7	5.32	0.98	2.7	7
<i>WatchTV</i>	Daily hours the individual (aged 2 years and more) watch television	2.22	1.36	0	8	2.17	1.36	0	8
<b>Income:</b>	Monthly household income categories								
<i>Low income</i>	Less than 4.49 mil VND/month	0.03	0.16	0	1	0.03	0.18	0	1
<i>Lower-middle income</i>	4.5 to 7.49mil VND/month	0.26	0.44	0	1	0.27	0.44	0	1
<i>Upper-middle income</i>	7.5 to 14.9mil VND/month	0.45	0.50	0	1	0.46	0.50	0	1
<i>High income</i>	15 mil or more VND/month	0.26	0.44	0	1	0.24	0.43	0	1
<i>Household size</i>	Household size (number of children and adults in the family)	4.21	0.92	3	8	4.29	0.92	3	8
<i>Children</i>	Number of children living in the household	1.76	0.62	1	4	1.81	0.64	1	4
<i>Ho Chi Minh City</i>	(City =1 if Ho Chi Minh City, otherwise 0)	0.50	0.50	0	1	0.52	0.50	0	1
<b>Instrumental variables(for 2SLS)</b>									
<i>OtherWesternFAFH</i>	The average calorie share of Western FAFH of all other surveyed individuals in the same ward.	0.16	0.24	0.004	4.90	0.15	0.20	0.004	3.69
<i>Number of individuals</i>				732				731	
<i>Number of households</i>					1,685				

Source: Authors' estimation from Vietnam Urban Food Consumption and Expenditure Study. VND/month represents Vietnamese dong per month. 1 USD = 22,318 VND in December 30, 2016.

The enumerators visited each household three times during the week of data collection. During the first visit, the enumerator conducted the face-to-face interviews to gather data for the survey discussed earlier. They also provided the respondent/interviewee with a hard copy of the 24-hour food diary, and a manual (in Vietnamese), which included photos of commonly used Vietnamese kitchen utensils and measuring instructions.

The enumerators outlined what data needed to be recorded and explained that data would be collected on two consecutive weekdays and one non-consecutive weekend day, which would be chosen randomly within a week. Respondents were given sufficient time to recall and consider their responses and to clarify information with the enumerators when necessary. Dietary intake information was collected on 743 food and beverage items (including drinking water) that were consumed by households in Hanoi and in Ho Chi Minh City during the study. To reduce measurement error, the 24-hour food diary data were checked by the team supervisors on a daily basis during the data collection phase.

### **3.2.2 Measures of dietary outcomes and diet quality**

In this study, the outcome (dependent) variables used to measure diet quality are an individual's total calorie intake (in kilocalories), and their share of total calories from each macronutrient (carbohydrates, fat and protein). A detailed explanation of the calculation process for each dependent variable follows.

#### ***3.2.2.1 Individual total energy (kcal) intake***

The first dependent variable, *Calorie*, is a continuous variable representing daily average total energy intake (i.e. calorie intake measured in kilocalories) consumed by each individual member (*i*) of household (*j*) during the preceding 24-hour time period. Energy intake or calorie consumption is considered as it is one of the most widely used indicators of malnutrition in developing countries (Tian and Yu 2015). The calorie intake data used in this study was



collected on three different days and then averaged to reduce measurement error due to day-to-day fluctuations in food intake. Therefore, daily average calorie intake per capita is measured as follows:

$$PC_{ij} = FC_{ij} \cdot M \quad (3.1)$$

In equation (3.1),  $PC_{ij}$  is the daily average calorie intake per day calculated from all sources of food by the individual  $i$ , living in household  $j$ .  $FC_{ij}$  represents the food consumption vector for individual  $i$ , living in household  $j$ . The food calorie conversion vector, which converts the quantities of daily food intake into gram equivalence for all food items using the Food and Agriculture Organization (FAO) ‘INFOODS’ databases (Charrondiere et al. 2012), is represented by the notation  $M$ . For example, we converted liquid amounts to grams using the density of the liquid provided in the ‘INFOODS’ database. After calculating the weight equivalents, all food items (in grams) were converted into daily calorie intakes (in kilocalories) using the 2007 Vietnamese Food Composition Table (NIN, MoH 2007) and other online standard nutrition conversion calculators<sup>18</sup>. The nutrient contents of mixed dishes that were not included in the database were calculated by identifying the component ingredients from common Vietnamese recipes.

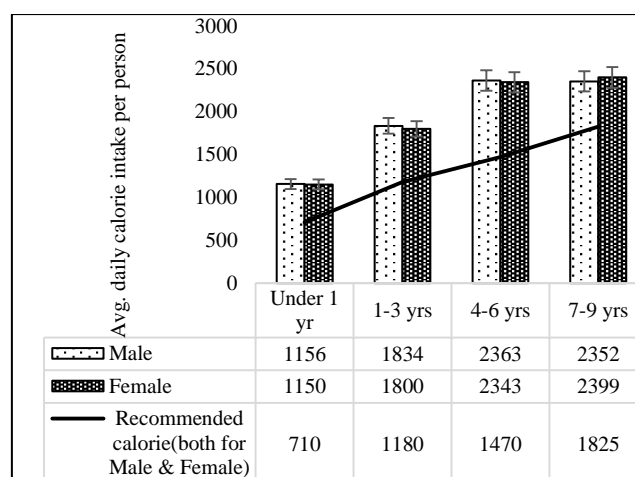
In this study, the median number of calories consumed per person per day was estimated at 2,223 kcal, which is similar to the median found in other relevant studies (Gibson and Kim 2013; Hoang 2018). Our data was disaggregated by age for adults, adolescents and children, as well as gender. Mean caloric intake for adult males and females as 2,221 and 2,273, respectively (Table 3.1A). This indicates that daily average caloric consumption among female adults is higher than that of adult males. On the other hand, male children consume slightly

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<sup>18</sup> The source of online food composition values include <https://www.aqua-calc.com/calculate/food-volume-to-weight> and <https://www.fatsecret.com.au/calories-nutrition/>.

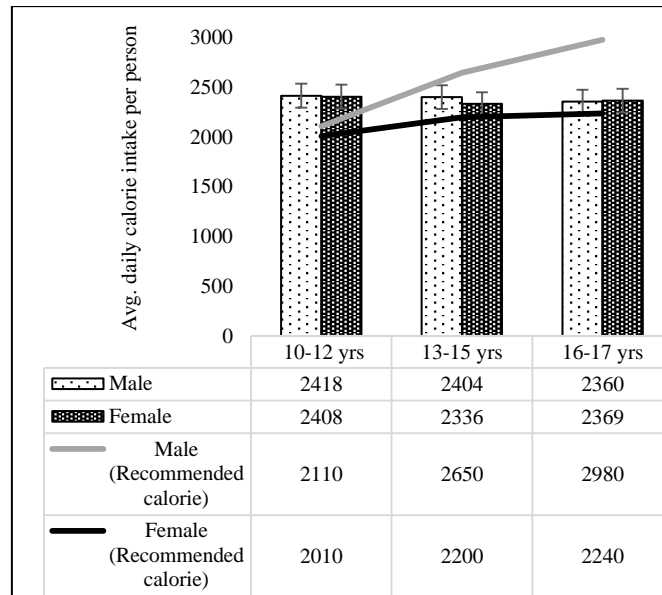
more calories on average per day (2,275 kcal) compared to female children (2,250 kcal) reported in Table 3.1B.

Figures 3.1(A)-3.1(C) provide insights on how caloric intakes for adults, adolescents and children differ by gender and age group, and further allow us to consider how each group’s caloric intake compares with relevant Vietnamese recommended dietary allowances (Khan and Hoan 2008). Consuming below or above the recommended ranges suggests individuals are at increased risk of deficiency or over-consumption, respectively. Figure 3.1(A) shows that caloric intakes are high and above the recommended level for children (age 9 and below) for all age groups. On the other hand, considering Figure 3.1(B) it appears that male adolescents aged from 13 to 17 years, are not getting enough calories as their total calorie intake is below the recommended level reported. Daily calorie consumption of both adult males and adult females between the ages of 18 to 60 years are close to the recommended daily allowances, however, adults over 60 years of age appear to be consuming more calories per day than recommended (Figure 3.1(C)). The error bars of the standard deviation are also reported in the three panels of Figure 3.1 in order to show the variation of the sample data computed as average distance of each observation to the mean daily caloric intake.



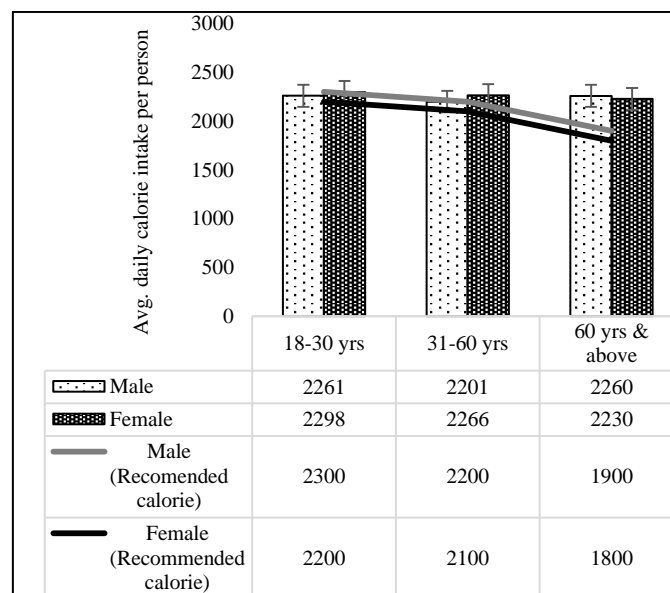
**Figure 3.1A Mean Daily Caloric (Kcal) Intake of Urban Vietnamese Children**

Source: Authors’ calculation. Note: ‘yrs’ represent age of individuals in years. Avg. represents average. Recommended calorie represents estimated (recommended) calorie needs per person per day by age. Calorie for children up to 9 years old is the same for males and females.



**Figure 3.1B Mean Daily Caloric (Kcal) Intake of Urban Vietnamese Adolescents**

Source: Authors' calculation. Note: 'yrs' represent age of individuals in years. Avg. represents average. Recommended calorie represents estimated (recommended) calorie needs per person per day by age.



**Figure 3.1C Mean Daily Caloric (Kcal) Intake of Urban Vietnamese Adults**

Source: Authors' calculation. Note: 'yrs' represent age of individuals in years. Avg. represents average. Recommended calorie represents estimated (recommended) calorie needs per person per day by age.

### 3.2.2.2 *Macronutrient calorie shares*

Individuals' three-day average macronutrient (carbohydrates, fat and protein) shares from 24-hour food diaries as a percentage of the total calories consumed are also calculated and used as dependent variables in this study. These macronutrients play an important role in both providing energy and maintaining body functions to carry out the activities of daily life.

For each household, first we compute the three-day average of carbohydrates, fat and protein intake (in grams). Then, we use the following formulae to determine the share or percentage of calories from these macronutrients:

$$Carbohydrates_{ij} = \frac{FC_{ij} \cdot M_{carb} * 4}{PC_{ij}} * 100 \quad (3.2)$$

$$Fat_{ij} = \frac{FC_{ij} \cdot M_{Fat} * 9}{PC_{ij}} * 100 \quad (3.3)$$

$$Protein_{ij} = \frac{FC_{ij} \cdot M_{Protein} * 4}{PC_{ij}} * 100 \quad (3.4)$$

In equations (3.2) to (3.4),  $Carbohydrates_{ij}$ ,  $Fat_{ij}$  and  $Protein_{ij}$  represent for individual  $i$ , living in household  $j$ , the daily average macronutrient shares of calories obtained from consumption of carbohydrates, fat and protein.  $FC_{ij}$  is the food consumption vector for individual  $i$ , living in household  $j$ .  $M_{carb}$ ,  $M_{Fat}$  and  $M_{Protein}$  represent the food calorie conversion vector of carbohydrate, fat and protein, respectively.  $PC_{ij}$  is the daily average calorie intake of individual  $i$ , living in household  $j$ . We also multiply the numerators of equations (3.2) and (3.4) by four and equation (3.3) by nine because the energy values for carbohydrate and protein each contain four kilocalories, while fat has nine kilocalories per gram (Maclean et al. 2003).

The descriptive statistics provided in Table 3.1A show that adult females' energy share from carbohydrates is slightly higher (64.9%) compared to that of males (63.5%). Conversely, females' energy shares from fat (22.9%) and protein (17.8%) are slightly lower than that of adult males (fat 23.3% and protein 18.3%). Carbohydrate share of male and female children are reported in Table 3.1B as 61.7% and 61.4% respectively. The calorie share from protein

for male and female children are similar (males 18.3% and females 18.5%). Finally, the share of fat consumption accounts for just over one-quarter of calories for children (25.6% for males and 25.5% for females).

### **3.2.3 Explaining dietary outcomes**

#### ***3.2.3.1 Share of total calories from western share of food-away-from home***

Examples of the types of food products included in the calculation of the variable *WesternFAFH* in this study are pizzas, baked and deep-fried snacks, burgers, sandwiches, French fries, instant fried noodles, sausages and soft and sugary drinks.

Considering the data collected using the 24-hour food diaries, more than one-third (39.6%) of the share of daily calories consumed by our urban Vietnamese sample were from FAFH, which includes both traditional and western foods. We further examined FAFH and calculated *WesternFAFH*. Compared to traditional FAFH, the share of total calories from *WesternFAFH* was 6.6% for both adult males and females as reported in Table 3.1A. Interestingly, the share of *WesternFAFH* for children (both male and female) was double that of adults, with 13.1% and 12.7% of male and female children's total daily calories coming from western FAFH, as shown in Table 3.1B. This may suggest that the popularity of western FAFH is on the rise in younger generations of urban Vietnamese. This increasing popularity of western FAFH may have an impact on the diet quality and health outcome of younger generation in near future.

#### ***3.2.3.2 Other covariates used to explain dietary outcomes***

We also selected and considered other individual and household level characteristics as covariates in our analyses. These were chosen after conducting an extensive review of relevant on diet quality, daily calorie consumption and nutrient intake (Mishra and Ray 2009; Nguyen et al. 2013; Thang and Popkin 2003).

We include *Age* categories of different age groups (in percentage) from birth to 92 years old. As shown in Table 3.1A, one-half of adult males and females are 26 to 45 years of age. For children, Table 3.1B shows that the two age categories: *Age 4-6Yrs* and *Age 7-9Yrs*, together have the highest share of boys (39%) and girls (40%). On average, both male and female household heads have completed approximately 11 years of education (Table 3.1A).

We include the variable *FemaleWork* (average hours of weekly work by the female household head) in order to examine whether women's paid work participation affects the calorie and nutrient intake of the household members. Previous studies have found that women's participation in paid work outside of the home is associated with an increasing prevalence of overweight and a decreasing prevalence of undernutrition among women and children, respectively (Black et al. 2013; De Onis et al. 2010).

Two dummy variables, *Buddhist* (equal to 1 if the household head is a Buddhist, 0 otherwise) and *Christian* (equal to 1 if the household head is a Christian, 0 otherwise), were included to consider if religion influenced food consumption patterns of the household members, and thus, their caloric intake and nutrient shares. More than one-third of the sample population were Buddhist, as reported in Table 3.1A (adults) and in Table 3.1B (children).

Another variable *ConsFreq* represents the average number of times that food was consumed each day. The variable was included because the number of eating events per day has grown (Hawkes and Popkin 2015). The average number of occasions the foods and beverages that were consumed by adults and children in our study vary from four to five times per day (Table 3.1A and in Table 3.1B).

The variable *WatchTV* is the average number of hours per day that the household members (aged two years or more) watch television per day. Television watching exposes individuals to food advertising, particularly for western food products, it may also lead to less physical activity. Previous research has shown that exposure to food advertisements via

television can increase individuals' preference for foods (e.g. packaged chips or western FAFH) that contain high amounts of carbohydrates and fat (Boyland and Halford 2013). On average, children in the sample data watched television more than two hours a day (Table 3.1B).

Previous studies found that calorie intake often increases with household income (Bouis and Haddad 1992; Drewnowski and Popkin 1997; Popkin et al. 2012). Furthermore, as income level rises, the proportion of calories from starches and plant-source proteins declines, and the proportion of calories from animal fats and proteins and from sweeteners increases (Drewnowski and Popkin 1997). Therefore, for Income, we included categories which represent four mutually-exclusive categorical variables for gross monthly household income (in thousands of Vietnamese Dong). The income categories include: *Low income*, *Lower-middle income*, *Upper-middle income* and *High income*.

Finally, the variable *Household size* was included since a large household size is widely regarded as a risk factor for malnutrition in developing countries (Pelto et al. 1991). The variable *Children* (number of children in the household) was included to examine whether having more children is associated with the intra-household food allocation and nutrient intake. Finally, the dummy variable *Ho Chi Minh City* was included to control for unobservable city-level social norms and cultural traditions (Umberger et al. 2015). In this study, more than half of the sample population were from Ho Chi Minh City (Table 3.1A and Table 3.1B).

### 3.2.4 Empirical estimation

The main regression equation was specified as:

$$Calorie_{ijk} = \alpha + \beta WesternFAFH_{ijk} + \gamma X_{ijk} + \delta H_{jk} + c_k + u_{ijk} \quad (3.5)$$

In equation (3.5), the subscripts stand for individual ( $i$ ), household ( $j$ ) and city ( $k$ ), respectively.  $Calorie_{ijk}$  is the individual caloric intake. Our key variable of interest,

$WesternFAFH_{ijk}$ , represents an individual's calorie share of western food-away-from-home;  $X_{ijk}$  is a vector of other individual level drivers.  $H_{jk}$  is a vector of household characteristics. The term  $c_k$  is a city indicator that captured by a city dummy indicating if the household lives in Ho Chi Minh City.  $\alpha$  is a constant and  $u_{ijk}$  is the error term.

Ordinary Least Square (OLS) multiple regression analysis was carried out to identify variables that have a significant effect on the daily per capita calorie intake of household members. We also tested for endogeneity of the variable *WesternFAFH* as we were concerned that it may be endogenous because it is a choice variable, i.e. a food consumption decision is made by the household members. If the variable was endogenous, then direct estimation of the coefficients by ordinary least squares (OLS) regression could produce biased and inconsistent results. To test the potential endogeneity bias of the variable *WesternFAFH*, we used an instrumental variable (IV) approach in our analyses.

Finding a valid IV that is strongly correlated with the endogenous variable but uncorrelated with the error term is difficult. If IVs are used inappropriately, then the estimations may be inferior to OLS (Staiger and Stock 1997). We, therefore, used a novel IV, *OtherWesternFAFH*, which represents the average *WesternFAFH* for all other surveyed individuals in the same ward. The reason behind using this IV is that it should be correlated with the calorie share of *WesternFAFH* as it captures individuals' eating pattern(s) away from home and food outlets/restaurants in the neighborhood community at the same time. In addition, it should not affect the caloric intake of the individuals in our sample data.

The endogeneity test (implemented by `ivreg2` in our analysis) is defined as the difference between the two Sargan-Hansen statistics: one for the equation with the smaller set of instruments where, the suspect regressor (the variable *WesternFAFH* in this case) is treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous (equivalence of Hausman endogeneity test (Hayashi



2000)). The endogeneity test indicated that *WesternFAFH* could be treated as exogenous. Therefore, the results from OLS are reported in the results section.

In the second analysis, we examine the main factors associated with the percent energy from macronutrients using a system of equations as follows:

$$Carb_{ijk} = \alpha + \beta WesternFAFH_{ijk} + \gamma X_{ijk} + \delta H_{jk} + c_k + u_{ijk} \quad (3.6)$$

$$Fat_{ijk} = \alpha + \beta WesternFAFH_{ijk} + \gamma X_{ijk} + \delta H_{jk} + c_k + u_{ijk} \quad (3.7)$$

$$Protein_{ijk} = \alpha + \beta WesternFAFH_{ijk} + \gamma X_{ijk} + \delta H_{jk} + c_k + u_{ijk} \quad (3.8)$$

In equations (3.6) to (3.8), the variables  $Carb_{ijk}$ ,  $Fat_{ijk}$  and  $Protein_{ijk}$  represent the share of carbohydrates, fat and protein as a percentage of the daily average caloric intake of each individual ( $i$ ) in household ( $j$ ), living in city ( $k$ ), respectively. The key variable of interest is  $WesternFAFH_{ijk}$ ;  $X_{ijk}$  measures individual-level factors and  $H_{jk}$  is a vector of household-level factors that may be associated with the outcome variables.  $c_k$  is city indicator and  $\alpha$  represents the constant term. Finally,  $u_{ijk}$  represents the vector of error terms assumed to be independent and identically distributed in the model.

Multivariate regression analysis (Härdle and Simar 2015) was used to estimate equations (3.6)-(3.8) as we have three dependent variables that are jointly regressed on the same independent variables. Multivariate regression also allows estimation of the between-equation co-variances, so one can test coefficients across equations. Regression results from multivariate regression analysis are identical to those produced by Seemingly Unrelated Regression (SUR) when the same list of independent variables is specified repeatedly which is the situation in this study. The Breusch–Pagan test (Breusch and Pagan 1979) was also used to test for heteroscedasticity in our model.

### 3.3. Results

#### 3.3.1 Estimation of energy intake

Our first analysis examined the link between *WesternFAFH* and average daily calorie (energy) intake of urban Vietnamese consumers. OLS regression results for the estimation of adult and child calorie intake are reported in Table 3.2. All models were correctly identified. Robust standard errors are also reported in parentheses.

The full results from the IV regression approach, used to test for endogeneity, are provided in Table 3.2B of the Appendix 4. The F-statistic from the IV regression suggested that our instrument, *OtherWesternFAFH*, was relatively weak as it did not exceed the conventional “rule of thumb” for F-statistics of at least ten (Staiger and Stock 1997). However, the first-stage coefficient on *OtherWesternFAFH* variable was statistically significant (p-value<0.01) and had a positive association with the variable *WesternFAFH* for adults and children (female) (see Table 3.2B of Appendix 4). Similar to an Indonesian study, which examined the relationship between supermarket use and diet-related health outcomes, this result provides evidence that the instrument has reasonable explanatory power in the first stage (Umberger et al. 2015). Therefore, the proposed instrument is believed to be able to satisfy the relevance condition. After checking the potential endogeneity and controlling for other individual and household level covariates, our results in Table 3.2B (in Appendix 4) report that *WesternFAFH* may be treated as exogenous in our model. For this reason, we focus our discussion on the results from the OLS estimation, which are provided in Table 3.2.

Among the 3,534 adults, we find a positive and significant association between *WesternFAFH* and *Calorie*, for both adult males (p-value <0.01) and females (p-value <0.01) in Table 3.2. The coefficients on *WesternFAFH* are 0.018 for adult males and 0.014 for adult females, respectively. This means that a one percent increase in *WesternFAFH* is associated with 1.8% and 1.4% rise in *Calorie*, for adult males and females, respectively. This association

is also positive and statistically significant for the analysis of the 1,463 children (Table 3.2). More specifically, a one percent increase in *WesternFAFH* is associated with 1.1% and 0.07% rise, in *Calorie*, for boys and girls, respectively (Table 3.2).

**Table 3.2 Regression Results for Estimation of Calorie intake (OLS)**

	<i>Adults</i>		<i>Children</i>	
	Male	Female	Male	Female
<i>WesternFAFH</i>	0.018***	0.014***	0.011***	0.007***
<i>Age (Children: ref. Age&lt;4Yrs)</i>				
<i>Age4-6Yrs</i>			0.848***	0.895***
<i>Age7-9Yrs</i>			0.834***	0.919***
<i>Age10-12Yrs</i>			0.897***	0.977***
<i>Age13-15Yrs</i>			0.898***	0.912***
<i>Age16-17Yrs</i>			0.856***	0.921***
<i>Age (Adults: ref. Age18-25Yrs)</i>				
<i>Age26-35Yrs</i>	-0.045	0.012		
<i>Age36-45Yrs</i>	-0.074*	0.019		
<i>Age46-55Yrs</i>	-0.030	0.068*		
<i>Age56-64Yrs</i>	0.005	0.067		
<i>Age65Yrs&amp;Plus</i>	-0.001	-0.003		
<i>EduMale</i>	-0.012***	-0.007	0.005	0.001
<i>EduFemale</i>	0.002	0.002	0.002	-0.006
<i>FemaleWork</i>	-0.001	0.000	0.002**	-0.000
<i>Buddhist</i>	-0.221***	-0.246***	-0.147**	-0.322***
<i>Christian</i>	-0.213***	-0.180***	-0.003	-0.176
<i>ConsFreq</i>	0.028***	0.027***	0.072***	0.063***
<i>WatchTV</i>	0.001	-0.010	0.055***	0.052***
<i>Income (ref: Low income)</i>				
<i>Lower-middle income</i>	-0.011	-0.035	-0.075	0.093
<i>Upper-middle income</i>	0.018	0.006	-0.126	0.162
<i>High income</i>	0.069	0.068	-0.092	0.199
<i>Household size</i>	-0.019	-0.012	0.036	0.009
<i>Children</i>	0.015	0.016	0.001	0.024
<i>Ho Chi Minh City</i>	0.218***	0.252***	0.212***	0.292***
<i>Constant</i>	2.117***	2.063***	0.596**	0.721**
<i>Mean VIF</i>			4.42	
<i>R-squared</i>	0.195	0.139	0.224	0.230
<i>Observations</i>	1,750	1,784	732	731
<i>Number of households</i>			1,685	

*Note:* Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors presented in parentheses. Calorie intake is measured as daily kilo calorie per person. 1 USD = 22,318 VND in December 30, 2016. Full results with robust standard errors are shown in Table 3.2A in Appendix 4.

Therefore, overall, *WesternFAFH* has a high association with the total calorie intake in urban Vietnamese population considered in this study. This suggests that changes in the food environment which result in more western-style food-away-from-home retail options, may

encourage the consumption of high calorie and energy dense food, which could lead to future diet-related health issues.

We also report several other variables that may have an association with an individual's daily average calorie intake. It is reported in Table 3.2 that calorie intake is lower among men aged between 36 to 45 years and higher among women aged 46 to 55 years old, compared to all other age groups in Table 3.2. On the other hand, children in different age groups from four to 17 years of age, have a significantly ( $p$ -value  $< 0.01$ ) high daily calorie intake. The magnitude of the coefficient estimates tends to increase among children aged between four to 15 years of age and is higher among female children compared to male children in this study (Table 3.2).

For adult males, the coefficient on the variable *EduMale* has a negative and significant association (coefficient  $-0.012$  and  $p$ -value  $< 0.01$ ) with daily calorie intake. Educated males who are knowledgeable about calorie consumption, may choose lower calorie, nutrient-dense foods such as fresh vegetables and fruits compared to less-educated males.

For male children, the variable *FemaleWork* has a positive and significant association (coefficient  $0.002$  and  $p$ -value  $< 0.01$ ) with daily calorie intake. Working mothers who are likely to have less time to devote to food preparation may purchase more processed food for their children. The variable *ConsFreq* is significantly ( $p$ -values are  $< 0.01$  for both adults and children) associated with high calorie intake across all adults and children in this study (Table 3.2). However, the magnitude of the coefficient estimates are higher in the children model results ( $0.072$  for male children and  $0.063$  for female children) compared to the adult model ( $0.028$  for male adults and  $0.027$  for female adults).

Adults and children from Buddhist households have significantly lower daily calorie intake compared to those from households practicing other religion or no religion. This is possible since Vietnamese Buddhists have a strong vegetarian tradition (Nam et al. 2010).

Interestingly, daily average calorie intake of Christian adults was also found to be low even though we found no significant association in the children models.

Watching more hours of television (increase in the variable *WatchTV*) is significantly associated with high calorie intake in urban Vietnamese children (coefficient estimates are 0.055 and 0.052 for male and female children, respectively, with p-values < 0.01). More hours watching TV may lead to increased exposure to food advertising, which has been shown in previous research to be associated with a significant increase in total food intake in young children (Halford et al. 2007) and higher intake of high calorie soft drinks in adolescents (Feldman et al. 2007). Finally, individuals in Ho Chi Minh City are more likely to have higher calorie intake than those in Hanoi.

### ***3.3.2 Estimation of macronutrients as a share of total calories***

Next, we examine the association of *WesternFAFH* with shares of total calories from carbohydrates, fat and protein in order to better understand its potential association with diet quality. Multivariate regression analyses are used to jointly estimate the same independent variables.<sup>19</sup> Results for adult and children (males and females) are reported separately in Tables (3.3) and (3.4), respectively. The Breusch-Pagan  $\chi^2$  is sufficiently large to reject the null hypothesis of homoscedasticity of the error terms from equations (3.6-3.8), thus confirming that the estimated variance of the residuals is dependent on the values of the independent variables.

For adult males and females, the variable *WesternFAFH* is negatively and significantly associated with carbohydrate and protein shares (p-values are < 0.05 for adult males and < 0.01

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<sup>19</sup> We also test for endogeneity of *WesternFAFH* in the analysis of carbohydrate, fat and protein shares and found that considering the null hypothesis, the potential endogenous regressor *WesternFAFH* can be treated as exogenous since the p-value is not significant in any of the models (for adults and children) in estimating macronutrients. See Appendix 4.

for adults females), but it is positively and significantly (p-values are <0.01) associated with the calorie shares from fat as reported in Table 3.3.

**Table 3.3 Three Stage Multivariate Regression Results for Estimation of Adults Macronutrient shares (Carbohydrate, Fat and Protein)**

	Male			Female		
	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>
<i>WesternFAFH</i>	-0.106**	0.138***	-0.019**	-0.072***	0.128***	-0.027***
<i>Age: Adults (ref:18-25Yrs)</i>						
<i>Age26-35Yrs</i>	-0.935	0.204	0.500**	0.598	-0.520	-0.036
<i>Age36-45Yrs</i>	-0.330	-0.123	0.353	0.359	-0.193	-0.133
<i>Age46-55Yrs</i>	-0.677	0.159	0.347	-0.427	-0.006	0.206
<i>Age56-64Yrs</i>	-1.895**	0.810*	0.958***	-0.760	0.487	0.312
<i>Age65Yrs&amp;Plus</i>	-1.408	1.032*	0.761*	-0.074	-0.253	0.552
<i>EduMale</i>	0.140*	-0.086**	-0.025	0.029	-0.064	0.036
<i>EduFemale</i>	-0.293***	0.112**	0.092***	-0.129	0.062	0.018
<i>FemaleWork</i>	-0.008	0.004	0.001	-0.008	0.004	0.002
<i>Buddhist</i>	-0.818	0.072	0.115	0.556	-0.448	-0.225
<i>Christian</i>	-0.128	-0.542	0.254	0.129	-0.470	0.026
<i>ConsFreq</i>	-0.124	0.138	-0.0376	0.212	0.0512	-0.091
<i>WatchTV</i>	0.348***	-0.124*	-0.126**	0.274**	-0.093	-0.091*
<i>Income (ref: Low income)</i>						
<i>Lower-middle income</i>	0.649	0.0882	-0.131	0.049	-0.103	0.111
<i>Upper-middle income</i>	0.663	0.079	-0.310	-0.949	0.593	0.209
<i>High income</i>	-0.325	0.646	0.0771	-1.390	0.864*	0.388
<i>Household size</i>	0.095	-0.0583	-0.124	0.330	-0.169	-0.121
<i>Children</i>	-0.371	0.046	0.258**	-0.343	0.0185	0.143
<i>Ho Chi Minh City</i>	0.494	-1.383***	0.214	1.108*	-1.485***	0.314
<i>Constant</i>	66.40***	22.16***	17.82***	63.82***	23.43***	17.99***
<i>Breusch-Pagan Chi-sq.</i>		1957.4 (0.00)			779.7(0.00)	
<i>(p-value)</i>						
<i>R-squared</i>	0.044	0.130	0.025	0.038	0.119	0.020
<i>Observations</i>	1,750	1,750	1,750	1,784	1,784	1,784
<i>Number of households</i>	1,685					

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Full results with standard errors are presented in Table 3.3A in Appendix 4. 1 USD = 22,318 VND in December 30, 2016.

These results show that a one percent increase in *WesternFAFH* is associated with a 1.06% and 0.72% decrease in *Carbohydrate*, for adult males and females, respectively; and a 0.19% and 0.27% decrease in *Protein*, for adult males and females, respectively. On the other hand, a one percent increase in *WesternFAFH* is associated with 1.38% and 1.28% increase in *Fat*, for adult males and females, respectively. More importantly, the magnitude of the coefficient estimates

for *Fat* are higher for males and females compared to those for *Carbohydrate* and *Protein* for both males and females reported in Table 3.3.

Compared to all other adult male age groups, males between 26 to 35 years and over 56 years of age, have a higher share of total calories from protein (*Protein* coefficient 0.50). Interestingly, the share of carbohydrates (*Carbohydrate* coefficient -1.895) is significantly lower among the age group 56 to 64 years while fat share (coefficient 0.958) is significantly higher in the same group, compared to all other male age groups.

Education of the male household head (*EduMale*) is positively and significantly (p-value < 0.10) associated with the carbohydrate intake of adult males while the same variable has no association with adult females. On the other hand, calorie share from fat significantly (p-value < 0.05) declines with the variable *EduMale*. It is interesting that another variable related to economic development, the education level of the female head of household (*EduFemale*), is negatively and significantly (p-value < 0.01) associated with the calorie shares from carbohydrate in adult males (Table 3.3). On the other hand, we find that the same variable (*EduFemale*) has positive and significant (p-value < 0.01) association with the calorie share from protein intake for adult males. Additionally, there is also a positive and significant (p-value < 0.05 in Table 3.3) association of the calorie shares from fat in adult males with the variable *EduFemale*. These results indicate strong substitution effects, that is, adult males are consuming fewer carbohydrates, but more protein and fat when the female household head is more educated in general.

While looking at the income effect, we find a weak but significant (p-value < 0.10) and positive association of fat intake with adult females in high income group. A study on nutrition transition in developing countries showed that diets usually shifts away from carbohydrates to include higher amounts of fats and protein as income increases (Popkin 2003). However, we

find no further significant associations across other income groups for adult males and females (Table 3.3).

The coefficient on the variable *WatchTV* is relatively large, positive and statistically significant in explaining carbohydrate share (p-values are  $< 0.01$  for male adults and  $< 0.05$  for female adults in Table 3.3) and negative in explaining fats (p-value  $< 0.10$  for male adults in Table 3.3) and proteins (p-values are  $< 0.05$  for male adults and  $< 0.10$  for female adults, in Table 3.3). This may suggest that individuals' food consumption is influenced by advertisements promoting highly processed, energy dense food and drinks on the TV.

Finally, the city effect reported in Table 3.3 shows that the fat intake of adults in Ho Chi Minh City is lower (p-values  $< 0.01$  for male and female adults, both) compared to those in Hanoi. On the other hand, carbohydrate share is higher (p-value  $< 0.10$ ) among females in Ho Chi Minh City compared to those in Hanoi.

Table 3.4 provides the results of estimations of macronutrient shares for children. The variable *WesternFAFH* is negatively (coefficient -0.087) and significantly (p-value  $< 0.01$ ) associated with the daily share of carbohydrate intake of male children (boys). This means that a one percent increase in the calorie from *WesternFAFH* is associated with 0.87% decrease in the daily share of carbohydrate intake for boys. However, the association is positive (coefficient 0.125) and statistically significant (p-value  $< 0.01$ ) with the share of fat intake. For girls, a substitution effect of protein intake with fat intake is observed. More specifically, a one percentage point increase in *WesternFAFH* is associated with 0.66% increase in *Fat* and 0.25% increase in *Protein*, for girls. These results indicate that the share of calories coming from fat is increasing with increasing intake of western FAFH among Vietnamese children. The magnitudes of the coefficient estimates are larger in boys compared to girls. However, the share of fat intake declines and carbohydrate intake increases significantly among all children as they grow older (see the variables for age groups in Table 3.4).



**Table 3.4 Three Stage Multivariate Regression Results for Estimation of Children Macronutrient shares (Carbohydrate, Fat and Protein)**

	Male			Female		
	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>
<i>WesternFAFH</i>	-0.087***	0.125***	-0.018	-0.019	0.066***	-0.025*
<i>Age (Children: ref. Age&lt;4Yrs)</i>						
<i>Age4-6Yrs</i>	12.38***	-12.96***	-0.0427	4.787**	-7.643***	2.075**
<i>Age7-9Yrs</i>	11.31***	-12.18***	-0.301	4.495**	-7.663***	2.134**
<i>Age10-12Yrs</i>	12.39***	-12.46***	-0.508	5.490**	-8.672***	2.264**
<i>Age13-15Yrs</i>	13.95***	-13.65***	-0.868	8.178***	-8.810***	0.755
<i>Age16-17Yrs</i>	13.67***	-13.42***	-0.792	8.186***	-8.536***	0.331
<i>EduMale</i>	-0.058	0.019	0.002	-0.020	0.063	-0.025
<i>EduFemale</i>	-0.049	0.017	-0.014	-0.077	-0.064	0.049
<i>FemaleWork</i>	0.006	-0.010	0.000	-0.009	-0.002	0.018*
<i>Buddhist</i>	0.137	-0.288	-0.014	-0.545	0.362	-0.142
<i>Christian</i>	0.840	-0.508	-0.237	-0.380	-0.160	0.0827
<i>ConsFreq</i>	0.346	0.077	-0.095	0.284	0.303	0.007
<i>WatchTV</i>	0.391*	-0.352**	-0.095	0.877***	-0.609***	-0.224**
<i>Income (ref: Low income)</i>						
<i>Lower-middle income</i>	0.316	0.383	-0.658	1.329	0.467	-1.841**
<i>Upper-middle income</i>	-0.337	0.850	-0.573	0.725	1.310	-2.155***
<i>High income</i>	-0.176	0.851	-0.386	0.340	1.718	-2.150***
<i>Household size</i>	0.0703	0.215	-0.335**	-0.119	0.035	0.037
<i>Children</i>	-0.188	-0.463	0.424*	-0.128	-0.081	-0.040
<i>Ho Chi Minh City</i>	1.888*	-2.237***	0.349	3.033***	-3.123***	0.390
<i>Constant</i>	48.88***	36.51***	20.63***	53.59***	31.93***	18.49***
<i>Breusch-Pagan Chi-sq.(p-value)</i>		779.7 (0.00)			762.5 (0.00)	
<i>R-squared</i>	0.178	0.342	0.050	0.166	0.239	0.109
<i>Observations</i>	732	732	732	731	731	731
<i>Number of households</i>	1,685					

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Full results with standard errors are presented in Table 3.4A in Appendix 4. 1 USD = 22,318 VND in December 30, 2016.

The income effect for children in Table 3.4 shows that the calorie intake from protein decreases with increases in the level of household income, however, the income coefficients are only statistically significant for children (p-values are < 0.05 in lower middle-income group and < 0.01 in upper middle- and high-income groups). This is an interesting result, households tend to consume more diversified food as income increases (Tian and Yu 2015), however, for female children, and it appears that diversification happens at the expense of protein

consumption. This could be due to a higher share of calories coming from processed ‘western-style’ foods, both at-home and away-from-home.

For male children, a larger household size has a negative and significant (p-value < 0.05 in Table 3.4) association with share of calories from protein, which may be due to low per capita income available in larger households to buy foods, such as meat, which are rich in protein. The number of children in the family (*Children*) is weakly significant (p-value < 0.10 in Table 3.4) and positively associated with a higher share of protein in the diet for male children. However, the same result was not found for female children. This suggests the possibility of unequal intra-household allocation of food among children in the household.

Similar to the results found in the analysis of adult data, watching more hours of television (*WatchTV*) is significantly associated with a high share of calories from carbohydrates (p-values are < 0.10 for male children and < 0.01 for female children in Table 3.4) and a low fat intake (p-values are < 0.01 in Table 3.4) for all children in the study. Finally, children living in Ho Chi Minh City consume a higher share of carbohydrates (p-values are < 0.10 for male children and < 0.01 for female children) and lower share of fat (p-values are < 0.01) compared to children in Hanoi, reported in Table 3.4.

### **3.4 Summary and conclusions**

The current study aims to understand the association between higher consumption of western-style food products, particularly highly processed and convenient food-away-from-home products (*WesternFAFH*), and diet outcomes. We examine this association for two diet outcome measures: 1) total energy or calories (kcal) consumed per day, and 2) macronutrient shares (e.g. the share of calories from carbohydrates, fat and protein), used as proxies for individuals’ diet quality. We analyze data collected during 2016 and 2017 from 1685 households and 4,997 individuals living in Hanoi and Ho Chi Minh City. In our empirical

analyses, we control for a number of other socio-economic and lifestyle factors that previous literature has suggested contribute to diet quality

The results from our first empirical analyses suggest that overall (for both adults and children), an individual's share of calories from western food-away-from-home is significantly associated with high energy intake. In the second empirical analysis, we use multivariate regression analysis to understand the impact of a similar set of variables on macronutrient shares as a percentage of total calories (energy) consumed. Our results suggest that *WesternFAFH* is associated with higher consumption of fat among all adults and children compared to other macronutrients. In addition, watching more hours of television has significant and positive association with carbohydrate intake among adults and children both. We also find that age plays an important role in the share of calories from carbohydrates, fats, protein, especially for children, with older children consuming significantly less fat and significantly more carbohydrates.

We conclude that increasing penetration of western-style fast food outlets in Vietnam, which sell primarily highly processed foods, is likely to negatively impact the diet quality of urban Vietnamese, which in turn, may lead to increasing rates of diet-related non-communicable diseases, including overweight and obesity and type 2 diabetes. This is alarming, especially for children to whom westernized foods are becoming increasingly popular.

Our findings suggest that policy makers need to pay attention to factors which result in 'obesogenic food environments' in order to ensure the diet quality of the Vietnamese population does not decline significantly with increasing economic development. As such, the Vietnamese government may want to develop initiatives to tackle the impacts of westernized food on diet quality and diet-related health outcomes. For example, these could include public health programs, perhaps targeted at school-aged children and their parents, which focus on

raising awareness of the nutritive value (or lack thereof) of various types of western foods compared to traditional foods; and improving knowledge and understanding of the individuals' and households' eating practices, lifestyles and long-term health outcomes.

Policymakers may also consider working with the food industry to reformulate food products and menu offerings at restaurants. Other interventions to consider could include encouraging the food industry, e.g. food processors, retailers and food service businesses, to provide information regarding the energy and macronutrient content of food options on menus in order to raise consumer awareness – an intervention that has already been introduced in many high-income countries. The merits of these strategies need further validation, yet our results suggest there is a need for policy intervention if nutrition improvement is among the Vietnamese Governments' long-term goals.

This paper is the first known study to examine the contemporary drivers of calorie intake and macronutrient shares in urban Vietnam. However, there are several limitations which future research might address. Firstly, empirical findings in this study are based on a cross-sectional survey of Vietnamese urban households, which cannot lend strong support to causal inferences about the hypothesized associations. Secondly, it is also possible that our data may have measurement errors due to food recall bias even though we tried to minimize this bias by calculating average calorie intake using 24-hour food diaries on three different days. Thirdly, our data which is from the two largest Vietnamese cities, Hanoi and Ho Chi Minh City, may not be fully representative of all Vietnamese urban households. Finally, there is scope to analyse the association between food westernization and the health outcomes (e.g. BMI z-scores) of urban Vietnamese adults and children in order to understand how food westernization is linked with individual health status. This would be interesting considering that overweight and obesity are on the rise in transitional economies, such as Vietnam. Future

work on this may provide a complete picture of Vietnamese individuals' nutrient consumption and health status.

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### Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

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## **Chapter 4: The impact of health and economic shocks on food security in rural farm households in Bangladesh**

### **Abstract**

We examine the relationship between rural farm households' food security status, and health and economic shocks using the Bangladesh Integrated Household Survey, which includes a nationally representative sample of 3,448 farm households. The dependent variable is a consolidated Food Security Index (FSI) that captures rural farm households' overall food security in terms of food consumption and economic vulnerability. To construct the FSI, we use a suite of food security indicators: food consumption score, food expenditure share and livelihood coping strategies. By estimating an ordered probit model that controls for village-level unobservables, we find that both health and economic shocks are significantly associated with household food insecurity. However, the magnitude of the impacts varies with the degree of household food insecurity and by farm household size. Marginal and small farming households are more vulnerable to food insecurity when health and/or economic shocks impact their households. This insight is useful for policymakers because there may be a need to prioritize vulnerable groups when designing food security interventions following these shocks.

**Key words:** Bangladesh; food security; health and economic shocks; rural farm households

## 4.1 Introduction

It is a paradox that rural farm households in developing countries produce 80 per cent or more of the world's food supply (FAO 2017; Kuwornu et al. 2013; Lowder et al. 2014; Wolfenson and Rome 2013), yet they are one of the most food insecure groups (FAO 2014; FAO 2015)<sup>20</sup> In Asia's developing countries, food insecurity and undernutrition continue to take a large toll, with 235.9 million people severely food insecure and another 271.6 million who are undernourished, particularly in South Asia where most people's livelihood depends on agriculture (FAO 2017). The question around what drives this large share of the global population still experiencing food insecurity, despite global measures that have significantly increased food availability, remains unsolved, and is in need of timely policy attention.

Recent studies have documented that rural households are often vulnerable to negative macro- and micro-level shocks that may adversely affect their total consumption of goods and services (Heltberg et al. 2015). Many of these shocks are health-related, such as the death of a main earner, or loss of income due to sudden illness and related medical expenses (Alam and Mahal 2014; Genoni 2012; Islam and Maitra 2012; Mitra et al. 2015; Skoufias and Quisumbing 2005; Sparrow et al. 2014; Wagstaff and Lindelow 2014). However, they also may be agricultural and food-related economic shocks, such as crop loss due to natural calamities, pest-attacks and diseases (Dercon 2004; Tibesigwa et al. 2016; Wineman 2016), or dramatic increases in food prices (Akter and Basher 2014; Hill and Porter 2017).

Although most of these previous studies show that shocks are negatively associated with household economic conditions and/or food security, other studies have found no evidence of an association (e.g. Kochar 1995). One possible reason for these mixed findings may be

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<sup>20</sup> Food and Agriculture Organization (FAO).

because the food security indicators used in previous studies were not comprehensive enough to account for households' economic vulnerability and coping capacity, given the situation in which their food consumption occurs (Headey and Ecker 2013). For example, dietary diversity score and food consumption score are two of the most commonly used indicators of household food security in developing countries (Cribb 2011; Carletto et al. 2013; Dewey et al. 2005; Hossain et al. 2016; Maxwell et al. 2008; Sraboni et al. 2014; Tiwari et al. 2013; Weismann et al. 2009). However, these measures provide no information on the economic burden faced by farm households attempting to improve their diets. In such contexts, it is important to consider coping mechanisms, because households that can cope better with negative shocks are likely to be more resilient when facing various factors that may cause food insecurity. In a seminal study, Carletto et al. (2013) found that household coping indicators were useful in identifying vulnerabilities and exploring the trade-offs made by households when acquiring food, thus recommending their use as key measures complementary to the more traditional benchmarks of food security.

Understanding how households cope when faced with household shocks may help policy makers design more effective strategies to improve households' risk management skills (Adger et al. 2007). Thus, this study aims to: 1) construct and evaluate a Food Security Index (FSI) that represents a snapshot of the targeted population's overall food security situation (e.g. food consumption and economic vulnerability) and 2) examine the impact of health and economic shocks on the FSI. To construct the FSI, we use the standardize "Consolidated Approach for Reporting Indicators" (CARI) of food security introduced by the World Food Programme (WFP) in 2015.

Secondary household data from the Bangladesh Integrated Household Survey (2011-2012)<sup>21</sup>, a nationally representative cross-sectional study, is used to empirically examine the association between health and economic shocks and the food security of rural farm households. Although Bangladesh has experienced a steady increase in food availability in recent decades, food insecurity remains a chronic issue. More than a quarter of the population (40 million), who mostly belong to rural farming households, are still on a food security knife-edge (WFP 2018). One plausible reason for food insecurity in rural Bangladesh is that rural populations do not have sufficient purchasing power to secure access to adequate food (Ahmed and Kashem 2015). The situation may worsen when households encounter negative shock(s), which may force them to adopt undesirable coping strategies, such as resorting to selling their assets at reduced prices, reducing their food intake etc., all of which may further lead to acute poverty and food insecurity (Akter et al. 2013).

To the best of our knowledge, this study is the first to construct an FSI index using CARI methodology and to empirically examine the association between health and economic shocks and the food security of rural farm households.

## **4.2 Materials and Methods**

### **4.2.1 Data**

Data used in this study are cross-sectional data from the Bangladesh Integrated Household Survey (BIHS), which was conducted between October 2011 and March 2012. The BIHS is a nationally representative sample of rural areas in each of the seven administrative divisions of Bangladesh (Sraboni et al. 2014). The BIHS contains information of interest for this paper: namely, household and individual level demographic characteristics; educational

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<sup>21</sup> The data set from the second round of the Bangladesh Integrated Household Survey (BIHS) was available after the completion of the current study's analysis.

attainment; occupation; household-level agricultural production and livestock holdings; household assets; food and non-food consumption and expenditures; information on the household's negative shocks and data from a seven-day food consumption recall. From the BIHS, we extracted information related to rural farm households, including agricultural workers; specifically, we analyse data from 3,845 farm households that responded to all the survey questions considered in this study.

#### **4.2.2 Descriptive statistics**

##### **Measurement of the Food Security Index (FSI)**

The main outcome variable in this study is the Food Security Index (*FSI*), which is calculated using the CARI methodology, as follows (WFP 2015):

$$FSI = \text{Mean}\{\text{FCS}, \text{Mean}(\text{FES}, \text{LCS})\} \quad (4.1)$$

Equation (4.1) shows that the calculation process of the variable *FSI* has two domains: i) households' current consumption status, which is captured by the indicator food consumption score (FCS) and ii) economic vulnerability and coping capacity, which are calculated by taking the mean value of food expenditure share (FES) and livelihood coping strategy (LCS) at the household level. The CARI methodology (WFP 2015) suggests calculating the mean value of these two domains together to measure the *FSI*. The construction of each of these food security indicators is discussed in the following sub-sections.

##### *i) Measuring households' current consumption status*

###### *Food Consumption Score (FCS)*

The FCS is a valid score<sup>22</sup> introduced by the WFP in 2008 to measure the frequency weighted dietary diversity score by using the frequency of households' consumption of nine

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<sup>22</sup> See Wiesmann et al. 2009 for more information on the validity of the FCS.

food groups over the past seven days. The food groups include: main staples; pulses; vegetables; fruit; meat and fish; milk; oil; sugar; and condiments (WFP 2008). We have followed and adopted the CARI methodology (WFP 2015) to calculate the FCS, shown as follows:

$$FCS = \sum_{i=1}^9 Food\ group_i \cdot W_i \quad (4.2)$$

In equation (4.2), the FCS represents a household's food consumption score, which is calculated by summing the consumption frequencies of food items of the same group; any value over seven in each group is top-coded as seven (WFP 2008). Following the WFP's FCS technical guidelines (WFP 2008), we then assign a weight ( $W$ ) for each recoded food group ( $i$ ), that reflects its nutrient density (WFP 2008)<sup>23</sup>. For example, meat and fish are rich in protein and iron, while milk is more energy-dense and rich in vitamin A. These food groups have the highest weight (weighted as four). On the other hand, food groups such as sugar and oil, which contain fewer micronutrients, have the lowest weight (weighted as 0.5). Like the WFP's (2008; 2015) food consumption analysis, the weighted score of the FCS in our analysis has a range of 14 to 112.<sup>24</sup>

Next, each household is categorized into one of the four food consumption groups by following food consumption cut off points, specifically devised for Bangladesh (WFP 2009): 'Poor' food consumption ( $FCS \leq 28$ ); 'Borderline' food consumption ( $28 < FCS \leq 42$ ); 'Low acceptable' food consumption ( $42 < FCS \leq 52$ ); and 'High acceptable' food consumption ( $FCS > 52$ ). Following the CARI methodology (WFP 2015), we have created a FCS that converts each household's Bangladesh consumption group category into the following four-

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<sup>23</sup> The determination of the food group weights in the FCS technical guidelines (WFP 2008) is as follows: weight for main staples (=2), pulses (=3); vegetables (=1), fruit (=1), meat and fish (=4), milk (=4), sugar (=0.5), oil (=0.5) and condiments (=0).

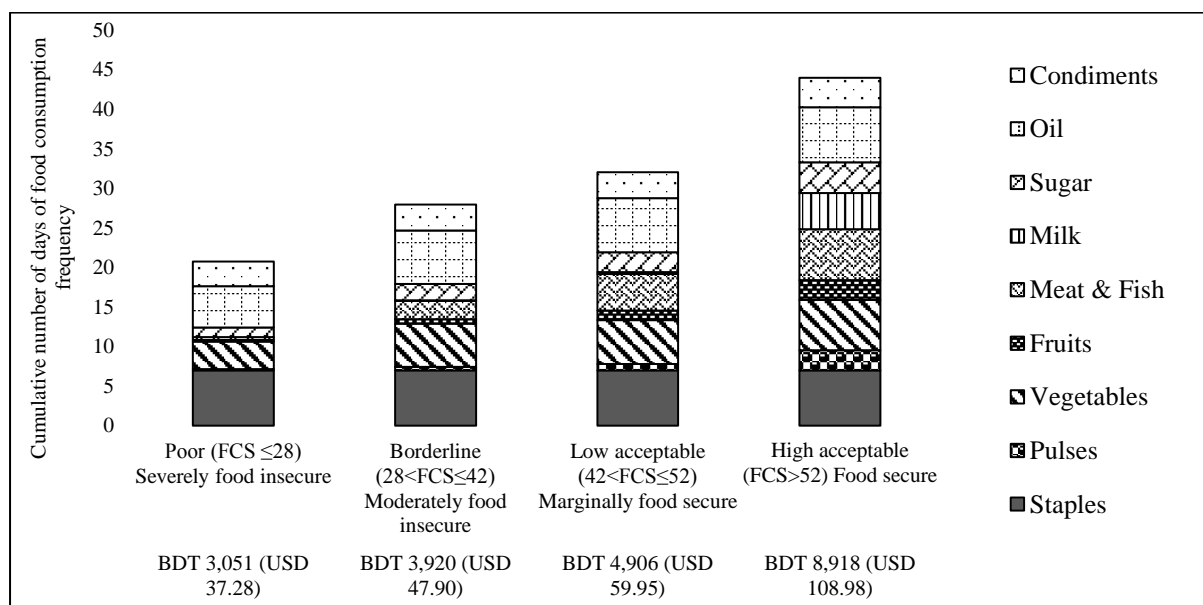
<sup>24</sup> The maximum weighted score of FCS according to WFP (2008; 2015) food consumption analysis should not exceed the score of 112.



point food security classification to facilitate the empirical estimation of the *FSI* in a subsequent section of this study:

1. Households are ‘Food secure’ (with a score of one) if they are in the group ‘High acceptable’;
2. Households are ‘Marginally food secure’ (with a score of two) if they are in the group ‘Low acceptable’;
3. Households are ‘Moderately food insecure’ (with a score of three) if they are in the group ‘Borderline’; and
4. Households are ‘Severely food insecure’ (with a score of four) if they are in the group ‘Poor’.

In Figure (4.1), we show diet composition for each of the four FCS categories. For each food consumption category, we show the cumulative number of days that each food group was consumed over the seven-day recording period.



Source: Author’s calculation from the sample BIHS data. Note: The four cut-off points Poor, Borderline, Low acceptable and High acceptable are calculated by following World Food Programme food consumption cut off points for Bangladesh (WFP 2009; 2015); The amount with BDT represents household’s monthly average total expenditure in Bangladeshi Taka (also in US dollar). USD 1 = BDT 81.83 in the survey year.

**Figure 4.1 The weighted food frequency of the food groups by average monthly consumption expenditure of rural farm households in Bangladesh**

In Figure 4.1, we also illustrate the relationship between FCS and average household income (BDT/month). We first calculate households' average monthly expenditures (food and non-food) and we use this as a proxy for household income to understand the relationship between diet composition and household income. Households' average monthly expenditures are used in order to minimize measurement problems which are a common concern when respondents are asked directly about their household income (Grosh and Glewwe 2000; McKay 2000). We then calculate, for households in each FCS category, the average monthly expenditures. As can be seen in Figure 4.1, 'Severely food insecure' households have the lowest mean income (total average monthly household expenditures) and the mean household income of households in the 'High acceptable' and 'Food secure' category are 2.9 times (BDT<sup>25</sup> 8,918 versus BDT 3,051) that of the lowest FCS category.

As can be seen in Figure (4.1), households with low average monthly expenditure (for example, <BDT 4,906) have a 'Poor' or 'Borderline' FCS. This is because of less frequent consumption of food rich in micro and macronutrients (e.g. protein, milk, pulses and fruits), even though they consume staple foods, such as rice, nearly every day.

*ii) Measuring households' economic vulnerability and coping capacity*

*a) Food Expenditure Share (FES)*

The same CARI methodology (WFP 2015) is followed to construct the FES, which measures households' economic vulnerability. The FES indicator is based on the premise that the greater the spending on food within a household's overall budget (relative to other consumer goods or services) the more economically vulnerable the household is. The calculation of FES is as follows:

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<sup>25</sup> BDT represents Bangladeshi Taka; USD 1 = BDT 81.83 in the survey year.

$$FES = \frac{\sum_{j=1}^n FoodExpen_j}{\sum_{j=1}^n FoodExpen_j + \sum_{l=1}^r NonfoodExpen_l + \sum_{s=1}^z NonfoodExpen_s} \quad (4.3)$$

The FES in equation (4.3) is the ratio of total monthly food expenditure to total monthly household expenditure, for both food and non-food items. The term  $FoodExpen_j$  represents household's average monthly total food expenditure for each food item ( $j$ ). The other two terms  $NonfoodExpen_l$  and  $NonfoodExpen_s$  represent average monthly total non-food expenditure from each non-food long-term (e.g. non-food item bought in the past 12 months) item ( $l$ ) and each non-food short-term (e.g. non-food items bought in the past 30-days) item ( $s$ ), respectively (equation (4.3)).

To calculate a household's monthly food expenditure, we included the total value of its consumption of purchased food and food from its own production consumed in the past 30 days<sup>26</sup>. The BIHS data do not have information on the market price of food from household's own production. In such cases, we followed the calculation process outlined in Arndt et al. (2016) where the median unit price from its cluster of purchased food items has been suggested to calculate the cost of a food item produced by the household is consumed.

We then calculate monthly non-food expenditure from both long-term and short-term expenses, excluding savings. To convert a year's expenses to monthly expenditure, we divide the latter by 12, as suggested in the CARI module. All the values of food and non-food consumption are calculated using Bangladesh's local currency (BDT). Finally, using the FES, the following four-point food security classification is created, following CARI methodology (WFP 2015):

1. 'Food secure' households score one when the FES is less than 50%;
2. 'Marginally food secure' households score two when the FES is 50% to less than 65%;

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<sup>26</sup> CARI technical guide sheet by WFP (2015) suggested multiplying the reported food consumption amount by 4.5 if the survey data has 7 days food recall instead of 30 days, which we have followed in our calculation.

3. 'Moderately food insecure' households score three when the FES is 65% to less than 75%;
4. 'Severely food insecure' households score four when the FES is 75% or greater.<sup>27</sup>

*b) Livelihood Coping Strategies (LCS)*

In the CARI - livelihood coping strategy approach, a 30-day recall period is used. However, due to data availability, our LCS indicator is a descriptor of household coping capacity over the past 12 months. A 12-month measure of LCS may be more useful for both research and policy purposes because it covers a wider range of food security levels and hunger over a longer time frame (Hamilton and Cook 1997). The LCS indicator is classified into three broad strategies: 'stress', 'crisis' and 'emergency' strategies (WFP 2015). 'Stress' strategies include: borrowing money, spending savings, selling household assets, purchasing food on credit and / or borrowing food. 'Crisis' strategies include: withdrawing children from school, selling productive assets, and reducing expenditures, for example on health and education. 'Emergency' strategies include: selling one's land, begging, selling of productive livestock (such as dairy cows). Finally, a four-point food security classification is created using the LCS indicator, and following CARI methodology (WFP 2015), to measure households' asset depletion:

1. Households doing day-to-day economic activities without adopting any coping strategies are 'Food secure', with a score of one;
2. Households adopting stress strategies are 'Marginally food secure', with a score of two;
3. Households adopting crisis strategies are 'Moderately food insecure', with a score of three;
4. Households adopting emergency strategies are 'Severely food insecure', with a score of four.

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<sup>27</sup> For more information, see Table 9 of CARI technical guide sheet (WFP 2015), p.18.

Once all the above-mentioned food security indicators are converted into four-point food security classifications, we then calculate the FSI by averaging household's current status domain (i.e. the four-point scores from the FCS) and coping capacity domain (i.e. mean value of the four-point scores of FES and LCS) together (equation (4.1)).

According to the WFP's (2015) CARI methodology, the rounded number of the calculated FSI also varies between one (Food secure) and four (Severely food secure), representing the household's overall food security status. However, in the empirical estimation of this study, we combined 'Severely food insecure' and 'Moderately food insecure' households as 'Food insecure' due to few observations for 'Severely food insecure' households in our sample. Therefore, our calculated FSI has been re-categorized into a three-point food security classification: 'Food secure' (with a score of one); 'Marginally food secure' (with a score of two) and 'Food insecure' (with a score of three).

In Table 4.1, a breakdown of the calculated FSI for the study's rural farm households is shown. Our calculation (see Table 4.1) shows that only 29.7% (column I) of the sampled households are 'Food secure' and have not adopted any coping strategies. By contrast, about 55% (column II) of the households that are 'Marginally food secure' have adopted one or more stress strategies such as borrowed money or spent from savings, sold household assets, purchased on credit/borrowed food. This means that households from the 'Marginally food secure' group, who are capable of only spending less than a dollar per day per capita (or USD \$2 to \$2.50 per household)<sup>28</sup> on daily consumption, may be forced to move into the 'Food insecure' group if faced with a sudden health or economic shock. Descriptive statistics (see Table 4.1) show that 15.2% of the rural Bangladeshi farm households in this study are 'Food insecure'.

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<sup>28</sup> Daily consumption expenditure has been calculated from the sample BIHS data and converted to US dollars (USD 1 = BDT 81.83) in the survey year.

**Table 4.1 Food Security Index (FSI) for rural farm households in Bangladesh**

Domain	(I)	(II)	(III)
	Food secure (With no coping strategies)	Marginally food secure (With stress strategies)	Food insecure (With crisis and emergency strategies)
Food Security Index (FSI)	29.73%	55.03%	15.24%

*Source:* Author's calculation from BIHS data 2011-2012

### *Negative shocks explaining farm households' food security*

As discussed earlier, BIHS's 2011-2012 data reports a range of negative health and economic shocks faced by the studied rural households in Bangladesh over the five year period prior to the survey. These negative shocks may be covariate (e.g. income loss due to natural disaster or macroeconomic crisis) or idiosyncratic (e.g. illness among primary income earners). While they may have widespread effects, they have greater impact on the poor because they have fewer resources with which to withstand these shocks. In this study, we have included these shocks because they are the most common cause of crises identified in the BIHS 2011-2012 survey.

### *Health shocks*

Previous research indicates that health shocks are more concentrated among the poor and can have significant negative impacts on households' food consumption behaviour (Wagstaff and Lindow 2014). For example, using panel data, Wagstaff (2007) showed that Vietnamese households spent less on food following an adverse health shock. In addition, health shocks tend to be more expensive than non-health shocks because they may have multiple hidden costs, such as diagnostic costs, visits to doctors, transportation costs, medical admission costs and other related medical expenses (Wagstaff and Lindelow 2014).

Considering the data available for our analysis, we use two variables related to health shocks: i) *Death main earner* indicates whether there has been a sudden death of the main income earner in household during the past five years; and ii) *Medical expenses*, which captures if there has been an increase in medical expenses during the previous 12 months. In Table 4.2, we present a summary of households that have experienced one or more negative health or economic shocks in previous years, and perceive and report that these shocks still affect their household economic status.

**Table 4.2 Percentage of rural farm households reporting at least one specific shock by shock types**

Shock types	Percentage of reported rural farm households affected by at least one shock by shock type
<i>Health Shocks</i>	
Death of main earner (Death of main earner in the past five years)	2.6%
Medical expenses (Increase in medical expenses in the past 12 months)	13.20%
<i>Economic Shocks</i>	
Crop loss (Major crop loss in the past five years)	9.84%
Food price increase (last five years)	12.77%
Dowry (Dowry, wedding and divorce related shocks in the last five years)	8.97%

*Source:* Authors' calculation from BIHS data 2011-2012; Note: multiple shocks per household are possible.

Approximately 13% of the farm households that experienced an increase in medical spending in the last twelve months are still affected by the shock; and about 3% of the farm households that reported the death of the main household earner in the past 5 years are still affected by the shock.

#### *Economic shocks*

In this study, we have included three major and commonly reported negative economic shock variables: *Crop loss*, *Food price increase* and *Dowry*. Any sudden negative economic shocks confronting households may have long-term adverse effects and may further force the households to adopt undesirable coping strategies. These coping strategies include reducing

their daily food intake, discrimination in the allocation of food to household members, withdrawing children from school, the sale of dairy cows, borrowing money from a lender or bank with high interest rate, or even begging for food. Any of these coping strategies may compromise future earning capacity and deepen poverty and food insecurity.

The BIHS survey inquired about major loss of crops due to droughts, storms, floods, disease, etc., in the past five years and 9.8% of the sampled farm households indicated the existence of crop loss. However, the economic shock that has affected rural farm households the most is the increase in food prices in the past five years (reported by 12.8% of households, as shown in Table 4.2). This is the second most common shock after the increase in medical spending according to the survey report of BIHS.

Our last economic shock variable, *Dowry*, arises from various family events in the last five years, such as family wedding expenses, dowry payments, or divorce-related expenses. In a longitudinal study, Quisumbing (2011) reports that dowry and wedding-related expenses are one of the greatest self-reported expenses experienced by rural Bangladeshi households. Dowry, a wedding gift from the bride's family to the groom or his family, is a common practice in rural Bangladesh, even though it is illegal following a law passed in 1985. The damage caused by dowries in Bangladesh is well-recognised and it mostly affects brides and their families (Amin and Huq 2008; Davis 2011; Johnston and Naved 2008). In a focus group study, Davis (2011) ranked dowry and wedding expenses, together with illness and medical expenses, as the most important causes of impoverishment in Bangladesh. To meet the demands of the dowry, it is common in rural Bangladesh for the poor to sell their valuable assets, including land and livestock. In Table 4.2, it is reported that 9% of rural farm households reported dowry, wedding-related and divorce-related expenses as the major causes of economic loss.



**Table 4.3 Descriptive statistics for all dependent and independent variables**

Variables	Description of the variables	Mean	Standard deviation	Min	Max
Dependent variable					
<i>FSI:</i>	Food Security Index (Categorical variable)				
<i>Food secure</i>	=1 if the households are in “Food secure” group 1 of <i>FSI</i> , 0 otherwise	0.2973	0.457	0	1
<i>Marginally food secure</i>	=1 if the households are in “Marginally food secure” group 2 of <i>FSI</i> , 0 otherwise	0.5503	0.494	0	1
<i>Food insecure</i>	=1 if the households are in “Food insecure” group 3 of <i>FSI</i> , 0 otherwise	0.1524	0.336	0	1
Shock variables					
<i>Death main earner</i>	=1 if there is a death of main earner in the past 5 years, 0 otherwise	0.011	0.105	0	1
<i>Medical expenses</i>	=1 if there is a sudden increase in medical expenses in the past 12 months, 0 otherwise	0.055	0.228	0	1
<i>Crop loss</i>	=1 if major loss of crops in the past 5 years, 0 otherwise	0.041	0.198	0	1
<i>Food price increase</i>	=1 if food prices increased in the past 5 years, 0 otherwise	0.053	0.224	0	1
<i>Dowry</i>	=1 if sudden shocks related to dowry, wedding and divorce in the past 5 years, 0 otherwise	0.037	0.189	0	1
Other covariates					
<i>Age</i>	Age of household head	45.141	13.882	16	95
<i>Age-squared</i>	Squared age of household head	2230.40	1333.735	256	9025
<i>Education</i>	Education level of household head (categorical variable and descriptive statistics represent code number only)	2.921	4.049	0	67
<i>Household size</i>	Household size	4.594	1.784	1	17
<i>Children</i>	Number of children less than 15 years of age	1.552	1.203	0	10
<i>Female head</i>	=1 if female-headed household, 0 otherwise	0.111	0.314	0	1
<i>Total expenditure</i>	Household’s total monthly consumption expenditure (in ten thousands Bangladeshi Taka)	0.598	0.528	0.044	11.782
<i>Cultivable land</i>	Amount of owned cultivable land (In decimal)	1.944	2.114	0	7.403
<i>Home grown food</i>	Number of food items consumed from home production	1.281	1.157	0	7
<i>Electricity</i>	=1 if household has access to electricity, 0 otherwise	0.407	0.490	0	1
<i>Dairy cows</i>	Number of dairy cows owned by household	0.640	1.115	0	12
<i>Mobile phone</i>	=1 if household member has mobile phone, 0 otherwise	0.702	0.457	0	1
<i>Agri-sale location</i>	=1 if sale of the agricultural product is household’s own village, 0 otherwise	0.300	0.458	0	1
<i>Loan access</i>	=1 if household has access to loan, 0 otherwise	0.679	0.466	0	1
<i>Extension</i>	=1 if any agricultural extension worker visited the farm in the past 12 months, 0 otherwise	0.068	0.252	0	1
<i>Marginal farmer</i>	=1 if household head is a marginal farmer, 0 otherwise	0.422	0.494	0	1
<i>Small farmer</i>	=1 if household head is a small farmer, 0 otherwise	0.351	0.477	0	1
<i>Medium farmer</i>	=1 if household head is a medium farmer, 0 otherwise	0.133	0.340	0	1
<i>Large farmer</i>	=1 if household head is a large farmer, 0 otherwise	0.091	0.288	0	1
Number of farm households			3,845		

Source: Author’s calculation from BIHS data 2011-2012.

Table 4.3 provides descriptive statistics for the dependent variable, *FSI*, and the main explanatory variables of interest related to health shocks (*Death main earner* and *Medical*

*expenses*) and economic shocks (*Medical expenses, Crop loss, Food price increase, and Dowry*) explained above.

#### Other covariates

The descriptive statistics for the other socioeconomic and demographic covariates used as control variables in the analyses are also provided in Table 4.3. These additional variables include: age and education level of the household head, household size, and number of children in the household. We also include a dummy variable to indicate if the household is female-headed to consider the one aspect of gender. Total monthly household consumption expenditure (food and non-food) is used as a proxy for income. Additionally, to understand the relationship between food security, productive assets and wealth, we consider the amount of cultivable land, access to electricity, ownership of mobile phones, and the number of dairy cows owned by a household as independent variables (Sraboni et al. 2014). We further include the number of food items consumed from home production as Galhena et al. (2013) find that the inclusion and promotion of home gardens as an agricultural practice will improve food security and promote economic growth.

We also include the variable, *Agri-sale location* to capture households' access to local markets since local village markets may provide farmers low transaction cost access to markets for selling products such as fresh fruits, vegetables and dairy products (Koppmair et al. 2017). Next, we include another variable *Loan access* since access to loan may have a link with increased access to food (Sraboni et al. 2014). The variable *Extension* is included because agriculture extension workers can provide farmers information about cropping methods, optimal input use, new high-yield varieties and efficient methods of production (Birkhaeuser et al. 1991).

Finally, to see if farm size has any influence on the effect size of economic and health shocks on households' food security, we further implement our regression analysis using four subsamples based on four different farm sizes of households. The BIHS survey report (2013) considers four farm size groups: (i) marginal farmers operating less than 0.5 acre of land; (ii) small farmers (operating 0.5 to 1.49 acres of land; (iii) medium farmers operating 1.5 to 2.49 acres of land; and large farmers operating 2.5 acres or more land. Summary statistics in Table 3 show that more than two-thirds of all farmers in rural Bangladesh are marginal and small farm households.

#### 4.2.3 The estimation strategy of health and economic shocks on household food security

The outcome variable ( $FSI$ ) in the regression analysis is ordered (1-3). We therefore, use an ordered probit model (Greene and Hensher 2010; Long and Freese 2006; McKelvey and Zavoina 1975; Mullahy 2016) to estimate equation 4.4 as follows:

$$FSI_{hv}^* = \mathbf{S}'_{hv}\boldsymbol{\beta} + \alpha_v + \varepsilon_{hv} \quad (4.4)$$

Here, the dependent variable  $FSI_{hv}^*$  is a vector of food security indicators of household  $h$  in village  $v$ . The variable  $\alpha_v$  represents contemporaneous influences at the village level. Since  $FSI_{hv}^*$  is a continuous latent index, it is unobservable. Therefore, we do observe the categorical outcome variable  $FSI_{hv}$  in the form of censoring, where

$$FSI_{hv} = \begin{cases} 1, & \text{if } FSI_{hv}^* \leq \mu_1 \\ 2, & \text{if } \mu_1 < FSI_{hv}^* \leq \mu_2 \\ 3, & \text{if } FSI_{hv}^* > \mu_2 \end{cases} \quad (4.5)$$

The explanatory variable of interest is  $\mathbf{S}'_{hv}$  which is a vector of all observed variables;  $\boldsymbol{\beta}$  represents a vector of coefficients;  $\alpha_v$  capturing contemporaneous influences at the village

level and  $\varepsilon_{hv}$  is the error term capturing the unobserved components, which is assumed to be normally distributed across observations with mean 0 and variance 1.

Therefore, our main empirical model is

$$FSI_{hv} = \alpha_v + \beta_1 S_{c,hv} + \beta_2 S_{e,hv} + \beta_3 S_{b,hv} + \varepsilon_{hv} \quad (4.6)$$

In equation (4.6), the variable  $S_{c,hv}$  and  $S_{e,hv}$  are the vectors of household's health and economic shocks, respectively, if they faced any of these in the past years. The vector  $S_{b,hv}$  represents household and individual characteristics. The variable  $\alpha_v$  represents village level fixed effects. To reduce the risk of endogeneity, the shocks included into equation (4.5) are previous year's shocks that occurred in the past 12 months and/or in the past five years which is similar to the seminal study by Wagstaff (2007).

As mentioned, the ordered probit model is implemented as  $FSI_{hv}$  is an ordered measure of food insecurity based on three-point scale indicating the probability of a household being 'Food secure', 'Marginally food secure' or 'Food insecure'. For these three probabilities, we calculate the marginal effects of changes of the regressors with clustered standard errors at the village level, since some shocks (e.g. crop loss from natural disaster) may affect households in the same village (e.g. economic loss from natural disaster).

### 4.3 Results

#### 4.3.1 Effects of health and economic shocks on food security

In Table 4.4, we report the effects of health and economic shocks as well as the other covariates on the overall food security of rural farm households in Bangladesh. Table 4.4 shows the marginal effects, or the likelihood of rural farm households being *Food secure* compared to the likelihood of them being *Marginally food secure* and *Food insecure*, given the influence of previous health and/or economic shocks and controlling for other factors.

In general, our results offer some new insights on the variables affecting the overall household food security of rural farming households in Bangladesh. The results show that the probability of being food secure reduces significantly if households encounter any increase in medical expenses and/or economic shocks the economic shocks *Crop loss*, *Food price increase*, or *Dowry* in previous years. The results do not show any significant relationship between the death of the main earner in the last 5 years and households' overall food security, but this finding may reflect the fact that only 41 households in our sample reported this event. Our consolidated FSI is negatively and significantly correlated to food price increase in the past five years (2006-2010). This result is in-line with Akter and Basher (2014), who used macro-level food price data and showed that soaring food prices during 2007-2009 caused a sharp rise in food insecurity in Bangladesh's rural areas.

While looking at the impact of wedding-related expenses, such as dowry payments, we find that dowry not only reduces the probability of being in the *Food secure* group (column (I)), but also significantly increases the probability of begin in the *Food insecure* group (column (III)). To arrange money for a dowry, vulnerable households may have few options other than borrowing from sources that charge high interest rates. Often loans are paid back by adopting coping strategies with serious consequences, such as selling land or livestock (Ahmed and Kashem 2015) and/ or cutting back on household food consumption. These strategies further affect their overall health status and earning ability, leading these households to become even more food insecure than previously. Our results support Hossain and Nargis' findings (2009) which demonstrate that dowry expenses are a major factor contributing to downward economic mobility among rural Bangladeshi households.

**Table 4.4 Regression results (marginal effects) for estimation of rural Bangladesh farm households' overall food security in response to health and economic shocks (Ordered probit model)**

Dependent Variable: <i>FSI</i>	(I) Probability of being ' <i>Food secure</i> '	(II) Probability of being ' <i>Marginally food secure</i> '	(III) Probability of being ' <i>Food insecure</i> '
<b>Health Shocks:</b>			
<i>Death main earner</i>	-0.027 (0.050)	0.014 (0.024)	0.013 (0.034)
<i>Medical expenses</i>	-0.088*** (0.023)	0.036*** (0.006)	0.052*** (0.020)
<b>Economic Shocks:</b>			
<i>Crop loss</i>	-0.045* (0.026)	0.022** (0.011)	0.023 (0.018)
<i>Food price increase</i>	-0.087*** (0.028)	0.036*** (0.007)	0.051** (0.025)
<i>Dowry</i>	-0.110*** (0.026)	0.038*** (0.005)	0.072*** (0.030)
<b>Other covariates:</b>			
<i>Age</i>	0.002 (0.003)	-0.001 (0.002)	-0.001 (0.002)
<i>Age-squared</i>	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
<i>Education</i>	0.007*** (0.002)	-0.004*** (0.001)	-0.003*** (0.001)
<i>Household size</i>	0.000 (0.006)	-0.001 (0.004)	0.002 (0.004)
<i>Children</i>	-0.018** (0.008)	0.011** (0.005)	0.008* (0.004)
<i>Female head</i>	0.0810** (0.026)	-0.0522* (0.019)	-0.028** (0.010)
<i>Total expenditure</i>	0.207*** (0.026)	-0.117*** (0.017)	-0.120*** (0.015)
<i>Cultivable land</i>	0.014*** (0.005)	-0.008*** (0.003)	-0.006*** (0.002)
<i>Home grown food</i>	0.116*** (0.008)	-0.066*** (0.006)	-0.061*** (0.005)
<i>Electricity</i>	0.094*** (0.016)	-0.055*** (0.010)	-0.049*** (0.008)
<i>Dairy cows</i>	0.022*** (0.007)	-0.012*** (0.004)	-0.011*** (0.004)
<i>Mobile phone</i>	0.102*** (0.015)	-0.059*** (0.007)	-0.058*** (0.011)
<i>Agri-sale location</i>	0.036** (0.016)	-0.021** (0.010)	-0.021*** (0.007)
<i>Loan access</i>	0.036** (0.014)	-0.019** (0.008)	-0.023** (0.008)
<i>Extension</i>	0.029 (0.032)	-0.017 (0.020)	-0.013 (0.014)
Village level fixed effects	Yes	Yes	Yes
Number of households		3,845	
Pseudo R-Square		0.200	
Likelihood ratio Chi-square		811.841***	

*Note:* Results show marginal effects computed based on regression coefficient estimates. Asterisks \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively. Clustered Standard errors are in the parenthesis

Concerning the other explanatory variables, Table 4.4 shows that the probability of being *Food secure* increases and the probability of being *Marginally food secure* or *Food insecure* decreases if the household head has higher level of education. The relationship between the number of children less than 15 years of age and food security in column (I) suggests that households are more likely to become *Food secure* if they have fewer young dependents in the household.

Interestingly, there is also a positive impact on rural farm households' overall food security if the household head is a female. This may be because women have been shown to spend a significantly higher proportion of income than men do on food for their family (Ruel et al. 2013), which may contribute to increased household food security. In our sample data, the food expenditure share is also higher among female-headed households (61.75%) compared to male-headed households (58.88%). Our results also show that the greater the diversity in home food production (*Home grown food*), the greater the probability of the household being *Food secure*.

Not surprisingly, indicators of household income (*Total expenditure*) and wealth, such as cultivable land owned, mobile phone ownership, number of dairy cows owned and access to electricity and other facilities, are positively and significantly associated with the probability of being *Food secure*. Furthermore, better access to loans (*Loan access*, column (I) of Table 4.4) increases the likelihood of being in the *Food secure* category, which implies that access to credit may have mitigating impacts on food security. This observation is consistent with that of Islam and Maitra (2012), who have found that the more access to credit the household has, the greater its ability to insure against health shocks.

Finally, the positive and statistically significant relationship between *Agri-sale location* and the probability of being *Food secure* (column (I) of Table 4.4) implies that farmers who

have access to their local market, with little or no transaction costs, may have a chance to improve their economic circumstances – assuming they get a competitive price for their products.

#### ***4.3.2 Health and economic shocks and food security by farm size in rural Bangladesh***

Food security is a major problem in rural agrarian regions where many households are marginal small farmers (Behera and France 2016; Cruz 2010; Valdés et al. 2010). Any sudden shocks (e.g. agricultural price shocks, weather-related shocks) may affect the food security of these vulnerable groups. For this reason, we further explore whether farm size has any influence on the extent of the effect size of economic and health shocks on households' food security. Table 4.5 reports the regression results for the estimation of the probability of marginal, small, medium and large farm households' food security status.

Overall, the results indicate that the adverse effect of some health and economic shocks on the food security status of farm households differs by household size. For example, for marginal households, increased medical expenses and crop losses decreased the probability of a household being food insecure by 5.9 and 4.3 percentage points, respectively (column (I), Table 4.5). However, these shocks did have a significant effect on the food security of small, medium and large farmers. Further, while food price increases and dowry expenses decreased the probability of marginal households being *Food secure* by 3.2 and 4.9 percentage points, the negative impact of these economic shocks was much larger for other households. Specifically, the negative effect of *Dowry* on food security was largest for small farmers (17.4 percentage points) and the negative effect of *Food price increase* was largest for medium farmers (20.8 percentage points). Additionally, it is interesting to note that *Death main earner* was only significant and relatively large for medium-sized farmers (column (III), Table 4.5).



**Table 4.5 Regression results for estimation of households' food security by farm size in response to health and economic shocks in rural Bangladesh (Ordered Probit Model)**

Dependent Variable: <i>FSI</i>	Marginal Effects : Probability of being <i>Food secure</i>			
	(I) <i>Marginal farmers</i>	(II) <i>Small farmers</i>	(III) <i>Medium farmers</i>	(IV) <i>Large farmers</i>
<b>Health Shocks:</b>				
<i>Death main earner</i>	0.021 (0.040)	-0.124 (0.101)	-0.329*** (0.078)	0.047 (0.199)
<i>Medical expenses</i>	-0.059*** (0.011)	-0.043 (0.057)	-0.065 (0.094)	-0.034 (0.145)
<b>Economic Shocks:</b>				
<i>Crop loss</i>	-0.043** (0.020)	-0.052 (0.051)	-0.071 (0.080)	-0.030 (0.088)
<i>Food price increase</i>	-0.032** (0.015)	-0.088 (0.065)	-0.208*** (0.066)	-0.132 (0.207)
<i>Dowry</i>	-0.049*** (0.014)	-0.174*** (0.046)	-0.100 (0.134)	0.190 (0.161)
<b>Other covariates:</b>				
<i>Age</i>	-0.001 (0.002)	0.003 (0.005)	-0.001 (0.010)	0.033** (0.013)
<i>Age-squared</i>	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.001** (0.000)
<i>Education</i>	0.004* (0.002)	0.007** (0.003)	0.004 (0.006)	0.002 (0.007)
<i>Household size</i>	-0.001 (0.006)	-0.002 (0.012)	0.011 (0.019)	-0.027 (0.024)
<i>Children</i>	-0.014* (0.007)	-0.014 (0.016)	-0.018 (0.027)	-0.002 (0.036)
<i>Female head</i>	0.047*** (0.018)	0.175*** (0.0667)	0.096 (0.174)	-0.290* (0.176)
<i>Total expenditure</i>	0.190*** (0.026)	0.208*** (0.047)	0.094 (0.064)	0.197*** (0.0512)
<i>Cultivable land</i>	0.005 (0.005)	0.022*** (0.007)	0.005 (0.011)	0.012 (0.015)
<i>Home grown food</i>	0.074*** (0.008)	0.115*** (0.013)	0.132*** (0.021)	0.093*** (0.027)
<i>Electricity</i>	0.044*** (0.0121)	0.084*** (0.030)	0.178*** (0.052)	-0.013 (0.065)
<i>Dairy cows</i>	0.013** (0.007)	0.034*** (0.012)	0.013 (0.021)	0.012 (0.019)
<i>Mobile phone</i>	0.048*** (0.011)	0.121*** (0.031)	0.107* (0.061)	0.251** (0.103)
<i>Agri-sale location</i>	0.037*** (0.014)	-0.003 (0.028)	0.051 (0.045)	0.082 (0.061)
<i>Loan access</i>	0.017* (0.010)	0.086*** (0.027)	-0.029 (0.051)	-0.030 (0.075)
<i>Extension</i>	0.087 (0.063)	0.016 (0.053)	-0.046 (0.066)	0.150** (0.072)
Village level fixed effects	Yes	Yes	Yes	Yes
Number of households	1,424	1,253	418	353
Pseudo R-square	0.190	0.120	0.110	0.140

Note: Asterisks \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively. Standard errors are clustered for 318 villages. Marginal farmers operate < 0.5 acre of land, small farmers operate 0.5 to 1.49 acres of land, medium farmers operate 1.5 to 2.49 acres of land and large farmers operate 2.5 acres or more land (BIHS 2013).

Looking at the results of other covariates in this analysis that incorporates farm size, we find that the education of the household head has a positive and statistically significant effect on the probability of being Food secure among marginal and small farm households.

Also, female-headed marginal and small farm households are more likely to be *Food secure* in rural Bangladesh, while female-headed large farming households are less likely to be *Food secure*. This could be because of migration of husbands or the main earning member(s) which is often considered as a pathway out of rural poverty (Kent and Poulton 2008). Therefore, it is possible that de facto female-headed marginal and small farming households in receipt of regular remittances from absent husbands may be better able to respond to food insecurity.

Household income (proxied by *Total expenditure*) is positively associated with household food security for marginal, small and large households, however, it is not statistically significant for medium farming households.

There are also differences in the significance of measures of wealth and household assets across the size categories. For example, Cultivable land is statistically significant for small farm households, but not for other size households. Electricity is positive and statistically significant for marginal, small, and medium-sized households, but it is not significant for large households. Ownership of dairy cows appears to significantly influence marginal and small farming households' capacity to become more *Food secure*, but Dairy cows is not significant for medium and large households.

The variable *Mobile phone* is significant for farms of all sizes, thus ownership of mobile phones may play a significant role in helping different types of farm households being connected to useful sources of information and networks, which help them to plan and prevent food insecurity. For example, marginal and small farm households may develop work-related networking by having mobile phones, which may help them to find work quickly and easily. Medium and large farm households may use them to get correct information about the market price for their products. *Agri-sale location* is only significant in explaining food security for

marginal farming households, thus for these farmers, access to a local market at low transaction costs, appears to be especially important for maintaining food security. Additionally, food security status for marginal, and particularly small farm households is improved when they have access to loan facilities.

Finally, farmers' contact with agricultural extension workers (*Extension*) is positively and significantly associated with food security for large farming households, as shown in column (IV) of Table 4.5. In Bangladesh, agricultural extension workers provide information on new technology and farming practices, as well as offer advice, this may play a vital role in improving the productivity of large farms, and can reduce the agency problem in agriculture (Owens et al. 2003).

#### **4.4 Discussion and conclusions**

Using a large and nationally representative data from rural farming households in Bangladesh, this study explores the association between household health and economic shocks and food security, while controlling for a number of relevant socio-demographic variables. We estimate the probabilities of households being in the 'Food secure', 'Marginally food secure' and 'Food insecure' categories in response to health and economic shocks. To measure food security, we constructed a consolidated food security index (FSI) for rural farm households in Bangladesh using the CARI methodology (WFP 2015). For empirical analyses, we employ an ordered probit model with clustered standard errors adjusted for 318 villages. Our results show that rural farm households, which are experiencing the ongoing effects of past health and/or economic shocks, are significantly less likely to be in the 'Food secure' category.

We also found some important insights in the subsample analysis which accounted for farm size. Marginal farming households are more vulnerable to food insecurity relative to larger households when shocks such as medical expenses and crop losses affect them. Medium-

sized farming households' food security is relatively more susceptible to shocks such as the death of the main earner in the household and increases in food prices. Furthermore, the relative impact of dowry-related expenses on food insecurity is largest for small farming households.

Other covariates provide a clear view of other plausible drivers of overall food security status in terms of food consumption and economic vulnerability in rural Bangladesh. For example, and not surprisingly, increasing education, income and wealth are all associated with an increased probability of households being food secure. The gender of the head-of-household is also important, and interestingly, female-headed marginal and small farming households are more likely to be food secure. Access to loans is also associated with improved food security for marginal and small household, and access to extension services increases the food security of large farming households.

These results may be useful for policymakers interested in improving food security programs and addressing the underlying forces delaying the goal of achieving food security. For example, identification of potential health shocks (e.g. medical expenses) can help policymakers design effective health policy in rural Bangladesh which, in turn, may help reduce the incidence of illness resulting from food insecurity. Improvement of health status may further help these vulnerable groups to become more productive at work and, therefore, increase their earnings and enhance their socio-economic well-being, ultimately driving economic growth in Bangladesh.

Our results for dowries suggest that in a society where income and consumption levels are already low; the government should promote social awareness of the detrimental impacts of the practice of dowry to remove its financial burden from society.

As one of the first studies of this type, the current analysis does have weaknesses. The cross-sectional data we used to associate health and economic shocks with farming households' food security prevents us from inferring major causal relationships between these variables. However, further analyses in this regard may be possible since the second round of the BIHS, conducted in 2015, has recently been published by the International Food Policy Research Institute.

Another concern with using a consolidated approach, such as what we used to calculate the FSI considered in our regressions, is that some information may be lost when multiple data, with different dimensions, is summarized. Last, but not least, this study did not measure intra-household food consumption patterns due to insufficient data. Nevertheless, our current study does confirm the linkages between negative health and economic shocks and household food security in rural Bangladesh. Our study is useful both for enhancing food security and mitigating the economic vulnerability of the targeted population and for understanding the underlying factors trapping rural farm households in food insecurity.

#### **4.5 References**

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## **Chapter 5: Conclusions, discussion and policy implications and future work**

### **5.1 Summary of the thesis and findings**

This thesis explored the possible drivers of dietary diversity, diet quality and overall food security of individuals and households using data from two different Asian settings: urban Vietnam and rural Bangladesh. Firstly, household and individual level data were used from the Vietnam Urban Food Consumption and Expenditure Study, conducted by the researchers (including the author of the thesis) from University of Adelaide between December 2016 and March 2017. Secondly, the rural Bangladeshi farm household analysis examined the relationship between household shocks (health and economic) and food security using the 2011-2012 Bangladesh Integrated Household Survey (Akter et al. 2013). The following paragraphs summarize the key findings from the three analytical chapters (**Chapter 2-4**):

Given the recent focus on food market modernization and its relationship with nutritional transition in Asia's emerging economies, we investigated the first research question in **Chapter 2**: "Does food market modernization lead to improved dietary quality in urban households?"

Data from the novel primary household survey, conducted in Vietnam's two largest cities, Hanoi and Ho Chi Minh, were used in the empirical analysis to explore this first research question. We estimated a Poisson regression model using a two-step control function approach. We found no direct relationship between modern market food expenditure shares and households' dietary diversity score (the variable *HDDS*). Our analysis on the direct association of modern market food expenditure shares and its association with household dietary quality (in terms of nutrients) showed a positive and significant association with heme iron but there were no significant associations with the consumption frequencies of vitamin A and protein. Further analyses were done to explore the indirect linkages between food expenditure shares and household dietary diversity, which, in turn, may be linked to household dietary quality.

Results from the system of equations and three stage least squares using instrumental variables (IVs) showed that households' modern market food expenditure shares has no significant relationship with *HDDS*, but that *HDDS* was positively and significantly associated with dietary quality. The study also found that the share of expenditure on food at modern markets was significantly associated with dietary quality through indirect linkages, namely diet diversity.

The following research question was addressed in **Chapter 3**: “Does consumption of western style food-away-from-home (western FAFH) affect the diet quality of urban adult, adolescent and child of different age groups?”

Using the same household data as what was used in **Chapter 2**, but also using individual-level food consumption data collected using 24-hour food recall data, the study examined the relationship between increased consumption of western style food-away-from-home (*Western FAFH*) and diet quality in Vietnam, while controlling for other contemporary factors, related to socio-demographics and lifestyle, which may also impact diet quality. The dependent variables used in this study were individual daily caloric intake and macronutrient shares (percent of total calories from consumption of carbohydrates, fat and protein). These variables were calculated using the 24-hour food recall data which includes information on food consumed by each individual (adults, adolescents and children) living in the household, both at-home and away-from-home. After testing for potential endogeneity of the key independent variable, daily calorie shares of western food-away-from-home (*Western FAFH*) by the individuals and using ordinary least square approach, we found that western food-away-from-home had a significant association with high calorie intake. Further, our results for macronutrient shares showed that *Western FAFH* was significantly associated with high intake of fat among all adults and children in the study.

Finally, in **Chapter 4**'s empirical analysis, we addressed the following research question; "To what extent are negative shocks (health and economic shocks) associated with the level of food insecurity, and with economic vulnerability, in rural households?"

We empirically addressed this issue by calculating and analysing a consolidated food security index (FSI). To measure the FSI for rural Bangladeshi farm households, we used the CARI methodology (WFP 2015), where the FSI is a combination of a set of indicators: food consumption score (FCS); food expenditure share (FES); and livelihood coping strategies (LCS).

Empirically, the study estimated the probability of rural Bangladeshi farm households being categorized as 'Food secure', 'Marginally food secure' and 'Food insecure' in response to health and economic shocks. The main empirical results from ordered probit regression analyses showed that rural farm households, which were experiencing ongoing effects from past health and/or economic shocks, were significantly less likely to be in the 'Food secure' category. Furthermore, we found that marginal farm households are more vulnerable to food insecurity if confronted by health and/or economic shocks. Regression results for other covariates also provided a clear view of the plausible drivers associated with the overall food security status of rural Bangladeshi households in terms of food consumption and economic vulnerability.

## **5.2 Discussion and policy implications**

The results from the empirical studies in Vietnam, detailed in **Chapters 2** and **3**, intend to identify the contemporary drivers of diet quality which may be linked with the recent nutrition transition in urban Vietnam. Findings from **Chapter 2** indicated that the impacts of modern food market shopping behaviour on diet quality, in terms of nutrient adequacy, may be heterogeneous. Although the rising number of supermarkets and convenience stores are



overshadowing traditional outlets almost everywhere in urban Vietnam, it is necessary to also understand the shopping preferences and perceptions of Vietnamese consumers.

In addition, policies that encourage food market modernization, believed to stimulate economic development and the transformation of the food retail system in Vietnam, may demand a re-evaluation if improvement of household's dietary quality is among the policy goals. The Vietnamese Government, aiming to improve dietary quality, may also need to comprehensively consider the other factors affecting diet quality, along with food market modernization and dietary diversity. For example, consumers' knowledge and awareness of the nutritional content of food (fresh or processed) offered in modern stores may have an important impact on food choice, and, therefore, on dietary quality.

Findings from **Chapter 3** suggest that the changing food environment in Vietnam, with its notable and increasing presence of westernized, fast food outlets, is likely to negatively impact the dietary quality of consumers, which, in turn, may lead to longer-run negative diet-related health outcomes. This is alarming, especially for children, among whom westernized foods are becoming increasingly popular. Therefore, our findings may be helpful for policy makers paying attention to 'obesogenic food environments' and interested in improving the dietary quality of Vietnam's urban population.

The Vietnamese government may want to develop initiatives to tackle the impacts of westernized food on diet quality and diet-related health outcomes. For example, these could include public health programs, perhaps targeted at school-aged children and their parents, which focus on raising awareness of the nutritive value (or lack thereof) of various types of western foods compared to traditional foods, and improving knowledge and understanding of the relationship between eating practices, lifestyles and long-term health outcomes. Policy makers may also consider working with the food industry to reformulate food products and

menu offerings at restaurants. Other interventions to consider could include encouraging the food industry, including food processors, retailers and food service businesses, to provide information regarding the energy and macronutrient content of food options on menus in order to raise consumer awareness – an intervention that has already been introduced in many high-income countries. The merits of these strategies need further validation, yet our results suggest there is a need for policy intervention if nutrition improvement is among the Vietnamese governments' long-term goals.

The empirical results from the study of rural Bangladeshi farm households (**Chapter 4**) provided clear insight on the possible drivers associated with overall food security status in terms of food consumption and economic vulnerability. These results may be useful for policymakers interested in identifying underlying factors contributing to the delay in Bangladesh and similar economies achieving higher rates of food security. For example, identification of potential health shocks may be helpful in designing effective health policy for marginal farm households in rural Bangladesh. Implementation of appropriate health policies may improve the health status of the most vulnerable groups, which may, in turn, further increase their work-related productivity, and thus, enhance their overall well-being. Furthermore, the results for dowries and wedding-related shocks suggest that households with daughters significantly reduce consumption to save for dowries. Therefore, the government should continue to promote social awareness to decrease the practice of dowry payments to mitigate the financial burden from society.

## 5.3 Limitations and recommendations for future research

### 5.3.1 Limitations

This section briefly summarizes the study limitations encountered during empirical analyses. Firstly, the empirical data used in both urban and rural analyses (in all three empirical chapters), were cross sectional in nature and, therefore, prevent us from inferring major causal relationships between the outcome variables and the identified drivers.

Secondly, in the Vietnamese data for urban Households (**Chapter 2**), supermarket expenditure shares were calculated using a 30-day recall about expenditure on a number of food items. While this method was based on earlier published research by the research team (e.g. Umberger et al. 2015), the results using expenditure information are subject to measurement error due to recall bias. However, in the second analysis in **Chapter 3** we tried to minimize recall bias by calculating average calorie intake using data from the three-day, 24-hour food diaries.

Last but not the least, the only nationally representative data used in this thesis was BIHS data, used in **Chapter 4**. Data used in **Chapters 2** and **3** from a study of urban consumer survey conducted in Vietnam may not be fully representative of all urban Vietnamese households, although the two largest cities, Hanoi and Ho Chi Minh City, were covered in the primary survey.

### 5.3.2 Future research

There are many opportunities for future work to extend the analyses and further address the topics covered in this thesis. To identify possible drivers of food security, dietary diversity and diet quality for rural and urban populations, this thesis has used data drawn from both urban and rural settings in two developing countries in Asia. However, it would have been more instructive and insightful if the rural and urban data were collected from same country to

observe the rural-urban dietary transition and the possible drivers associated with this transition, unfortunately such data was not available. Future work may want to attempt to address this point, subject to data availability.

The empirical findings from the Vietnamese analyses would further improve understanding of the impact of food market modernization (**in Chapter 2**) and food westernization (**in Chapter 3**) on the dietary quality of urban consumers, if suitable panel data were available in the future.

An extension of the empirical study in **Chapter 3** could examine the association of food market modernization with household dietary quality and health outcomes by disaggregating data for the share of expenditure on different food categories within supermarkets.<sup>29</sup> Further analysis could also include expenditure shares on traditional markets and do a comparative analysis of expenditure shares on both modern and traditional markets and their impact on the dietary quality of Vietnamese consumers.

In **Chapter 3**, this thesis found that food westernization is associated with macronutrient intakes, such as higher shares of fat intake as a percentage of calories. However, there is scope to analyse the association between food westernization and the health outcomes of urban Vietnamese adults and children in order to understand how food westernization is linked with an individual's health status, considering that overweight and obesity are on the rise in transitional economies, such as Vietnam. Future work on this may provide a complete picture of Vietnamese individuals' nutrient consumption and health status.

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<sup>29</sup> In another paper, an extension of the study (in **Chapter 2**) also examined the obesogenic impact of supermarketization on urban Vietnamese individual's weight outcomes. The earlier version of the paper named "Food market modernization and diet-related health outcomes: Evidence from urban Vietnam" authored by Di Zeng, Wendy J. Umberger, Jesmin Rupa has been presented at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, Illinois, July 30-August 1.

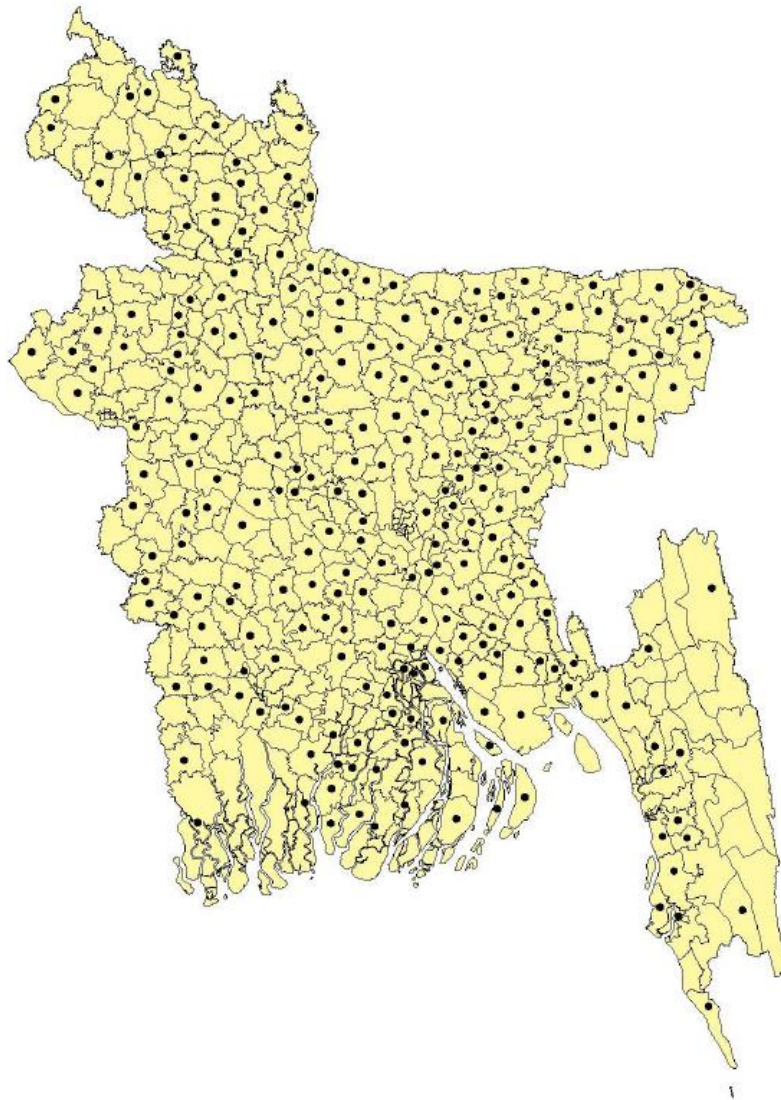
Finally, to lessen the recall-bias of economic shocks, such as crop loss and increased food prices, in the empirical study in **Chapter 4**, community reporting on shocks could be more reliable instead of self-reported responses. Furthermore, an alternative combination of indicators may also be used in calculating the FSI to increase its sensitivity in response to specific conditions within different countries.

#### 5.4 References

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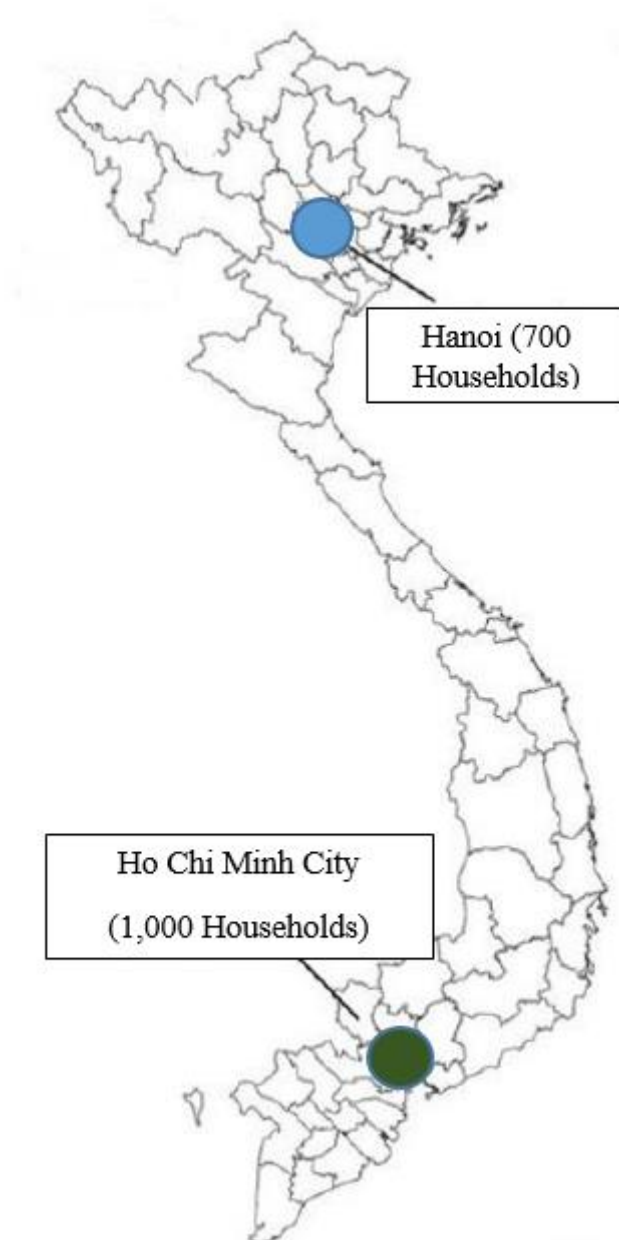
## Appendices

### Appendix 1: Survey area covered in Bangladesh and Vietnam survey



Source: Map taken from the survey report on Bangladesh Integrated Household Survey (BIHS) 2011-2012, by IFPRI researchers.

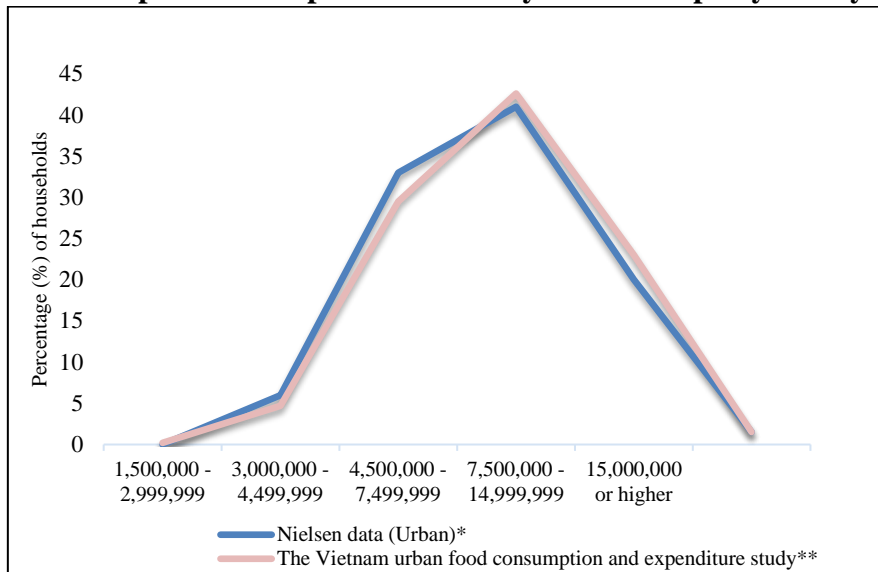
**Figure 1.1 Map of Bangladesh and the survey areas**



Source: The Vietnam Urban Food Consumption and Expenditure Study December 2016- March 2017 by the authors and researchers from University of Adelaide

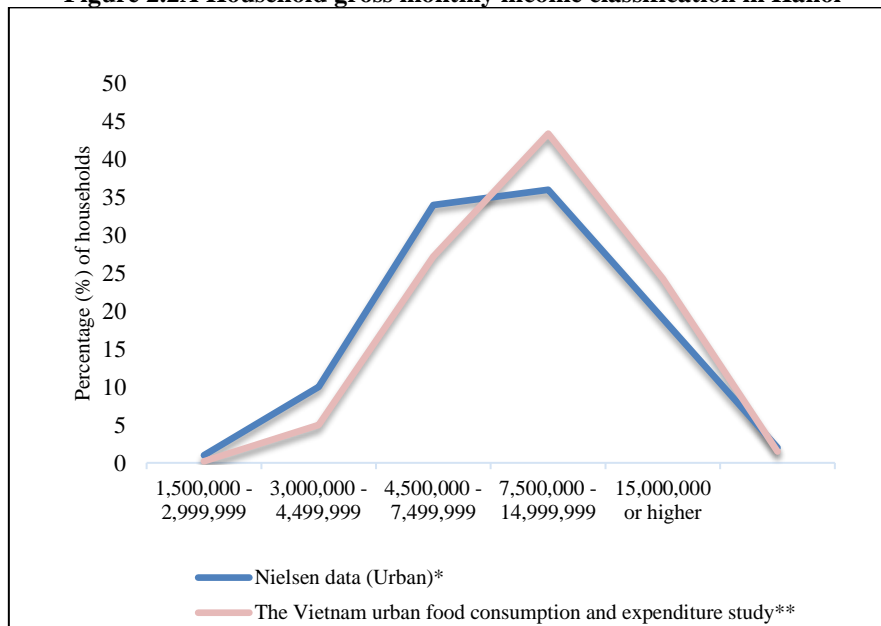
**Figure 1.2 Map of Vietnam and the survey areas**

**Appendix 2: Household income classification comparison between the urban Vietnam consumption and expenditure survey with third party survey**



Source: \*Nielsen database 2012; \*\*Authors' calculation from the survey in December 2016 to March 2017. Note: Income ranges based on gross monthly income in Vietnamese Dong.

**Figure 2.2A Household gross monthly income classification in Hanoi**



Source: \*Nielsen database 2012; \*\*Authors' calculation from the survey in December 2016 to March 2017. Note: Income ranges based on gross monthly income in Vietnamese Dong.

**Figure 2.2B Household gross monthly income classification in Ho Chi Minh City**



### Appendix 3 (For chapter 2)

**Table 2.3A Indirect estimates of household diet quality (micronutrients) through household dietary diversity using 3 SLS (Full results)**

<i>Dependent Variables:</i>	(1)			(2)		
	<i>Vitamin A</i>	<i>HDDS</i>	<i>Modern market</i>	<i>Heme iron</i>	<i>HDDS</i>	<i>Modern market</i>
<i>Modern market</i>	-0.825*	-0.709		2.709***	-0.709	
	(0.475)	(0.467)		(0.975)	(0.467)	
<i>HDDS</i>				1.685**		
				(0.706)		
<i>Age male head</i>	0.004	0.000	0.000	0.003	0.000	0.000
	(0.003)	(0.003)	(0.000)	(0.006)	(0.003)	(0.000)
<i>Age fem head</i>	-0.007**	-0.003	0.000	0.000	-0.003	0.000
	(0.003)	(0.004)	(0.000)	(0.007)	(0.004)	(0.000)
<i>Education male head</i>	-0.008	-0.022***	0.002***	-0.005	-0.025***	0.002***
	(0.009)	(0.007)	(0.000)	(0.020)	(0.007)	(0.000)
<i>Education fem head</i>	0.032***	0.007	0.006***	0.024	0.007	0.006***
	(0.007)	(0.008)	(0.001)	(0.015)	(0.008)	(0.001)
<i>Buddhist</i>	-0.102	-0.128**	0.040***	0.095	-0.128**	0.040***
	(0.068)	(0.057)	(0.006)	(0.140)	(0.057)	(0.006)
<i>Christian</i>	0.035	0.119	-0.030***	0.027	0.119	-0.030***
	(0.078)	(0.077)	(0.009)	(0.160)	(0.077)	(0.009)
<i>Income (ref. less than 4.49 mil VND/month)</i>						
<i>4.5 to 7.49 mil. VND/month</i>	0.317**	0.332***	0.033***	-0.340	0.332***	0.033***
	(0.134)	(0.082)	(0.010)	(0.275)	(0.082)	(0.010)
<i>7.5 to 14.9 mil. VND/month</i>	0.407**	0.439***	0.0364***	-0.632*	0.439***	0.0364***
	(0.168)	(0.082)	(0.010)	(0.344)	(0.082)	(0.010)
<i>15 mil. or more VND/month</i>	0.446**	0.482***	0.056***	-0.607	0.482***	0.056***
	(0.183)	(0.091)	(0.011)	(0.377)	(0.091)	(0.012)
<i>Household size</i>	0.061**	0.070***	-0.009***	-0.139**	0.070***	-0.008***
	(0.031)	(0.021)	(0.002)	(0.064)	(0.021)	(0.002)
<i>Children</i>	0.103***	0.049**	0.005*	-0.041	0.049**	0.005*
	(0.027)	(0.025)	(0.003)	(0.057)	(0.025)	(0.003)
<i>Microwave</i>	0.197	0.349***	0.010**	-0.484*	0.349***	0.010**
	(0.125)	(0.036)	(0.004)	(0.257)	(0.036)	(0.004)
<i>Ho Chi Minh City</i>	0.179***	0.175***	0.044***	-0.347**	0.175***	0.044***
	(0.066)	(0.027)	(0.002)	(0.137)	(0.027)	(0.002)
<i>Shopping list</i>		0.109**			0.109**	
		(0.043)			(0.043)	
<i>Other's modern market share</i>			9.642***			9.642***
			(0.585)			(0.585)
<i>Constant</i>	10.70***	8.99***	-0.17***	-8.87	8.99***	-0.17***
	(3.090)	(0.178)	(0.021)	(6.352)	(0.178)	(0.021)
F-statistics		28.61***	122.81***		28.61***	122.81***
Hausman test of endogeneity		10.27***	3.63*		8.98***	0.52
Hansen J statistic (p-value):		0.155 (0.694)			0.155 (0.694)	
Chi-square	124.23***	365.38***	1724.39***	43.12***	365.38***	1724.39***
Observations	5,098					

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors presented in parentheses. VND/month is Vietnamese Dong per month.

**Table 2.3B Indirect estimates of household diet quality (Macronutrient) through household dietary diversity using 3 SLS (Full results)**

<i>Dependent Variables:</i>	<i>Protein</i>	<i>HDDS</i>	<i>Modern market</i>
<i>Modern market</i>	0.485* (0.279)	-0.709 (0.467)	
<i>HDDS</i>	0.426** (0.202)		
<i>Age male head</i>	0.001 (0.001)	0.000 (0.003)	0.000 (0.000)
<i>Age fem head</i>	-0.002 (0.002)	-0.003 (0.004)	0.000 (0.000)
<i>Education male head</i>	0.002 (0.005)	-0.022*** (0.007)	0.002*** (0.000)
<i>Education fem head</i>	0.005 (0.004)	0.007 (0.008)	0.006*** (0.001)
<i>Buddhist</i>	-0.024 (0.040)	-0.128** (0.057)	0.040*** (0.006)
<i>Christian</i>	-0.061 (0.045)	0.119 (0.077)	-0.030*** (0.009)
<i>Income (ref. less than 4.49 mil VND/month)</i>			
<i>4.5 to 7.49 mil. VND/month</i>	-0.133* (0.078)	0.332*** (0.082)	0.033*** (0.010)
<i>7.5 to 14.9 mil. VND/month</i>	-0.205** (0.098)	0.439*** (0.082)	0.036*** (0.010)
<i>15 mil. or more VND/month</i>	-0.219** (0.108)	0.482*** (0.091)	0.056*** (0.011)
<i>Household size</i>	-0.008 (0.018)	0.070*** (0.021)	-0.008*** (0.003)
<i>Children</i>	-0.008 (0.016)	0.049** (0.025)	0.006* (0.003)
<i>Microwave</i>	-0.107 (0.073)	0.349*** (0.036)	0.010** (0.004)
<i>Ho Chi Minh City</i>	-0.054 (0.039)	0.175*** (0.027)	0.044*** (0.002)
<i>Shopping list</i>		0.109** (0.043)	
<i>Other's modern market share</i>			9.642*** (0.585)
<i>Constant</i>	2.97 (1.817)	8.99*** (0.178)	-0.17*** (0.021)
<i>F-statistics</i>		28.61***	122.81***
<i>Hausman test of endogeneity</i>		4.44**	0.06*
<i>Hansen J statistic (p-value):</i>		0.155 (0.694)	
<i>Chi-square</i>	47.03***	365.38***	1724.39***
<i>Observations</i>	5,098	5,098	5,098

*Note:* Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors presented in parentheses. VND/month is Vietnamese Dong per month.

### Appendix 4 (For Chapter 3)

Table 3.2A Regression Results for Estimation of Calorie intake (Full results from OLS)

	Adults		Children	
	Male	Female	Male	Female
<i>WesternFAFH</i>	0.018*** (0.001)	0.014*** (0.001)	0.011*** (0.001)	0.007*** (0.002)
<i>Age (Children: ref. Age&lt;4Yrs)</i>				
<i>Age4-6Yrs</i>			0.848*** (0.119)	0.895*** (0.158)
<i>Age7-9Yrs</i>			0.834*** (0.121)	0.919*** (0.158)
<i>Age10-12Yrs</i>			0.897*** (0.122)	0.977*** (0.163)
<i>Age13-15Yrs</i>			0.898*** (0.123)	0.912*** (0.162)
<i>Age16-17Yrs</i>			0.856*** (0.129)	0.921*** (0.167)
<i>Age (Adults: ref. Age18-25Yrs)</i>				
<i>Age26-35Yrs</i>	-0.045 (0.034)	0.012 (0.032)		
<i>Age36-45Yrs</i>	-0.074* (0.038)	0.019 (0.035)		
<i>Age46-55Yrs</i>	-0.030 (0.037)	0.068* (0.038)		
<i>Age56-64Yrs</i>	0.005 (0.043)	0.067 (0.045)		
<i>Age65Yrs&amp;Plus</i>	-0.001 (0.058)	-0.003 (0.057)		
<i>EduMale</i>	-0.012*** (0.004)	-0.007 (0.004)	0.005 (0.008)	0.001 (0.010)
<i>EduFemale</i>	0.002 (0.005)	0.002 (0.005)	0.002 (0.009)	-0.006 (0.010)
<i>FemaleWork</i>	-0.000 (0.000)	0.000 (0.000)	0.002** (0.000)	-0.000 (0.000)
<i>Buddhist</i>	-0.221*** (0.033)	-0.246*** (0.034)	-0.147** (0.064)	-0.322*** (0.072)
<i>Christian</i>	-0.213*** (0.046)	-0.180*** (0.046)	-0.003 (0.092)	-0.176 (0.107)
<i>ConsFreq</i>	0.028*** (0.009)	0.027*** (0.009)	0.072*** (0.018)	0.063*** (0.022)
<i>WatchTV</i>	0.001 (0.007)	-0.010 (0.007)	0.055*** (0.015)	0.052*** (0.016)
<i>Income (ref: Low income)</i>				
<i>Lower-middle income</i>	-0.011 (0.047)	-0.035 (0.048)	-0.075 (0.115)	0.093 (0.122)
<i>Upper-middle income</i>	0.018 (0.047)	0.006 (0.047)	-0.126 (0.114)	0.162 (0.119)
<i>High income</i>	0.069 (0.050)	0.068 (0.051)	-0.092 (0.118)	0.199 (0.125)
<i>Household size</i>	-0.019 (0.011)	-0.012 (0.012)	0.036 (0.025)	0.009 (0.029)
<i>Children</i>	0.015 (0.015)	0.016 (0.015)	0.001 (0.034)	0.024 (0.038)
<i>Ho Chi Minh City</i>	0.218*** (0.034)	0.252*** (0.034)	0.212*** (0.066)	0.292*** (0.074)
<i>Constant</i>	2.117*** (0.094)	2.063*** (0.097)	0.596** (0.235)	0.721** (0.282)
<i>Mean VIF</i>			4.42	
<i>R-squared</i>	0.195	0.139	0.224	0.230
<i>Observations</i>	1,750	1,784	732	731
<i>Number of households</i>			1,685	

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors presented in parentheses. Calorie intake is measured as daily kilo calorie per person. 1 USD = 22,318 VND in December 30, 2016.

**Table 3.2B Regression results for estimation of calorie intake (2SLS)**

	<i>Adults</i>		<i>Children</i>	
	Male	Female	Male	Female
<i>WesternFAFH</i>	0.059*** (0.019)	0.024** (0.009)	0.001 (0.031)	0.029 (0.022)
<i>Age (Children: ref Age&lt;4Yrs)</i>				
<i>Age4-6Yrs</i>			0.803*** (0.220)	0.868*** (0.140)
<i>Age7-9Yrs</i>			0.791*** (0.213)	0.896*** (0.139)
<i>Age10-12Yrs</i>			0.851*** (0.224)	0.951*** (0.144)
<i>Age13-15Yrs</i>			0.848*** (0.235)	0.916*** (0.143)
<i>Age16-17Yrs</i>			0.845*** (0.157)	0.895*** (0.159)
<i>Age (Adults: ref. Age18-25Yrs)</i>				
<i>Age26-35Yrs</i>	0.024 (0.061)	0.029 (0.041)		
<i>Age36-45Yrs</i>	0.032 (0.074)	0.042 (0.046)		
<i>Age46-55Yrs</i>	0.080 (0.075)	0.101* (0.055)		
<i>Age56-64Yrs</i>	0.114 (0.079)	0.103* (0.060)		
<i>Age65Yrs&amp;Plus</i>	0.161 (0.112)	0.051 (0.080)		
<i>EduMale</i>	-0.021*** (0.007)	-0.009* (0.005)	0.009 (0.017)	0.000 (0.012)
<i>EduFemale</i>	0.006 (0.007)	0.004 (0.005)	-0.001 (0.014)	-0.001 (0.012)
<i>FemaleWork</i>	-0.000 (0.001)	0.000 (0.000)	0.002*** (0.001)	-0.000 (0.001)
<i>Buddhist</i>	-0.224*** (0.052)	-0.240*** (0.038)	-0.119 (0.120)	-0.364*** (0.089)
<i>Christian</i>	-0.187*** (0.067)	-0.173*** (0.051)	-0.004 (0.110)	-0.181 (0.133)
<i>ConsFreq</i>	-0.016 (0.025)	0.016 (0.015)	0.084* (0.046)	0.029 (0.042)
<i>WatchTV</i>	0.011 (0.009)	-0.006 (0.007)	0.058*** (0.017)	0.042** (0.021)
<i>Income (ref: Low income)</i>				
<i>Lower-middle income</i>	0.037 (0.066)	-0.028 (0.045)	-0.113 (0.176)	0.140 (0.146)
<i>Upper-middle income</i>	0.072 (0.0677)	0.0120 (0.044)	-0.159 (0.165)	0.182 (0.140)
<i>High income</i>	0.139* (0.072)	0.072 (0.046)	-0.123 (0.158)	0.221 (0.140)
<i>Household size</i>	-0.046** (0.020)	-0.016 (0.013)	0.040 (0.028)	0.020 (0.031)
<i>Children</i>	0.031 (0.022)	0.022 (0.017)	-0.007 (0.045)	0.025 (0.037)
<i>Ho Chi Minh City</i>	0.0464 (0.095)	0.223*** (0.050)	0.217*** (0.073)	0.238*** (0.090)
<i>Constant</i>	2.172*** (0.133)	2.057*** (0.0961)	0.694 (0.425)	0.588* (0.328)
<u>First stage regression:</u>				
<i>OtherWesternFAFH</i>	0.581*** (0.163)	1.05*** (0.194)	1.65 (1.955)	4.07*** (1.390)
F stats (p-value)	9.39***	29.27***	7.06***	8.58***
Hausman test of endogeneity	2.74 (0.10)	1.21(0.269)	0.104 (0.74)	1.51(0.21)
<i>R-squared</i>	0.129	0.106	0.195	0.114
<i>Number of households</i>			1,685	
<i>Observations</i>	1,750	1,784	732	731

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors presented in parentheses. Calorie intake is measured as daily kilo calorie per person. 1 USD = 22,318 VND in December 30, 2016.

**Table 3.2C Regression results for estimation of macronutrients intake of adults (2SLS results for Carbohydrate, Fat and Protein models)**

	<i>Male</i>			<i>Female</i>		
	Carbohydrate	Fat	Protein	Carbohydrate	Fat	Protein
<i>WesternFAFH</i>	-0.431* (0.247)	0.370*** (0.138)	0.0634 (0.102)	-0.462*** (0.142)	0.319*** (0.0761)	0.0552 (0.0948)
<i>Age(ref: Age18to25Yrs)</i>						
<i>Age26to35Yrs</i>	-1.479* (0.794)	0.591 (0.462)	0.639** (0.306)	-0.134 (0.664)	-0.162 (0.374)	0.119 (0.286)
<i>Age36to45Yrs</i>	-1.164 (0.992)	0.471 (0.567)	0.565 (0.393)	-0.610 (0.747)	0.281 (0.434)	0.0737 (0.348)
<i>Age46to55Yrs</i>	-1.544 (1.007)	0.776 (0.574)	0.568 (0.387)	-1.804** (0.877)	0.667 (0.488)	0.500 (0.423)
<i>Age56to64Yrs</i>	-2.750** (1.092)	1.419** (0.635)	1.176*** (0.437)	-2.242** (0.980)	1.212** (0.577)	0.627 (0.484)
<i>Age65plusYrs</i>	-2.679* (1.463)	1.937** (0.899)	1.084* (0.584)	-2.341* (1.245)	0.855 (0.748)	1.034 (0.661)
<i>EduMale</i>	0.218** (0.108)	-0.142** (0.0633)	-0.0454 (0.0422)	0.129 (0.0936)	-0.113** (0.0549)	0.0151 (0.0396)
<i>EduFemale</i>	-0.326*** (0.0969)	0.136** (0.0576)	0.101*** (0.0368)	-0.216** (0.0970)	0.105* (0.0557)	0.0370 (0.0401)
<i>FemaleWork</i>	-0.00545 (0.00868)	0.00172 (0.00523)	0.00105 (0.00328)	-0.00331 (0.00847)	0.00177 (0.00498)	0.00133 (0.00337)
<i>Buddhist</i>	-0.793 (0.655)	0.0550 (0.385)	0.109 (0.252)	0.275 (0.690)	-0.311 (0.382)	-0.165 (0.263)
<i>Christian</i>	-0.327 (0.906)	-0.400 (0.529)	0.305 (0.370)	-0.132 (0.907)	-0.342 (0.504)	0.0822 (0.376)
<i>ConsFreq</i>	0.232 (0.323)	-0.116 (0.183)	-0.128 (0.132)	0.676*** (0.244)	-0.176 (0.138)	-0.191 (0.133)
<i>WatchTV</i>	0.280** (0.142)	-0.0761 (0.0808)	-0.109* (0.0578)	0.123 (0.138)	-0.0202 (0.0797)	-0.0591 (0.0612)
<i>Income (ref: Low income)</i>						
<i>LowerMiddle</i>	0.268 (0.973)	0.359 (0.578)	-0.0343 (0.387)	-0.220 (0.856)	0.0285 (0.551)	0.168 (0.353)
<i>UpperMiddle</i>	0.239 (0.982)	0.381 (0.577)	-0.202 (0.386)	-1.199 (0.842)	0.715 (0.541)	0.262 (0.350)
<i>High income</i>	-0.870 (1.083)	1.033* (0.628)	0.216 (0.423)	-1.581* (0.901)	0.957* (0.573)	0.429 (0.369)
<i>Household_size</i>	0.310 (0.274)	-0.211 (0.159)	-0.178 (0.111)	0.536** (0.237)	-0.270** (0.134)	-0.165* (0.0980)
<i>Children</i>	-0.493 (0.310)	0.133 (0.177)	0.289** (0.129)	-0.594* (0.309)	0.141 (0.175)	0.196 (0.130)
<i>HoChiMinhCity</i>	0.613 (0.400)	-0.780*** (0.229)	-0.0425 (0.164)	0.771*** (0.265)	-0.691*** (0.144)	0.0191 (0.131)
<i>Constant</i>	65.35*** (1.979)	23.25*** (1.196)	17.97*** (0.771)	63.33*** (1.806)	23.99*** (1.100)	17.91*** (0.682)
<u>First stage rgression</u>						
<i>OtherWesternFAFH</i>		0.535***			1.0253***	
F stats (p-value)		9.39***			29.27***	
Hausman test of endogeneity (p-value)	1.18(0.276)	1.44(0.229)	0.50(0.478)	1.37(0.246)	1.58(0.208)	0.30(0.581)
<i>Observations</i>	1,750	1,750	1,750	1,784	1,784	1,784
<i>R-squared</i>	0.133	0.123	0.040	0.185	0.015	0.040

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors presented in parentheses.

**Table 3.2D Regression results for estimation of macronutrients intake of children (2SLS results for Carbohydrate, Fat and Protein models)**

	<i>Male</i>			<i>Female</i>		
	Carbohydrate	Fat	Protein	Carbohydrate	Fat	Protein
<i>WesternFAFH</i>	-1.057 (1.541)	0.411 (0.476)	0.0114 (0.293)	-0.0355 (0.512)	0.0239 (0.310)	-0.149 (0.172)
<i>Age(ref: Age&lt;4Yrs)</i>						
<i>Age1to3Yrs</i>	4.167 (8.741)	-8.418** (3.349)	0.767 (1.512)	0.608 (3.494)	-4.178 (2.856)	3.662** (1.528)
<i>Age4to6Yrs</i>	7.628 (9.234)	-11.56*** (3.486)	0.102 (1.602)	4.806 (3.425)	-7.592*** (2.795)	2.221 (1.491)
<i>Age7to9Yrs</i>	6.818 (9.030)	-10.85*** (3.409)	-0.164 (1.549)	4.511 (3.416)	-7.620*** (2.783)	2.257 (1.491)
<i>Age10to12Yrs</i>	7.485 (9.452)	-11.01*** (3.539)	-0.359 (1.648)	5.508 (3.504)	-8.624*** (2.815)	2.403 (1.512)
<i>Age13to15Yrs</i>	8.748 (9.902)	-12.12*** (3.673)	-0.710 (1.737)	8.176** (3.375)	-8.817*** (2.774)	0.733 (1.513)
<i>Age16toless18Yrs</i>	12.49** (5.496)	-13.07*** (2.583)	-0.756 (0.985)	8.204** (3.466)	-8.488*** (2.819)	0.472 (1.515)
<i>EduMale</i>	0.361 (0.701)	-0.104 (0.235)	-0.0104 (0.139)	-0.0195 (0.158)	0.0653 (0.105)	-0.0215 (0.0759)
<i>EduFemale</i>	-0.404 (0.603)	0.122 (0.206)	-0.00357 (0.125)	-0.0803 (0.199)	-0.0729 (0.121)	0.0255 (0.0915)
<i>FemaleWork</i>	0.003 (0.0203)	-0.009 (0.0093)	0.0007 (0.0052)	-0.0089 (0.0140)	-0.0022 (0.0089)	0.0109* (0.0061)
<i>Buddhist</i>	3.053 (4.854)	-1.150 (1.623)	-0.103 (0.974)	-0.516 (1.388)	0.441 (0.855)	0.0862 (0.614)
<i>Christian</i>	0.816 (2.256)	-0.501 (1.120)	-0.236 (0.636)	-0.376 (1.468)	-0.150 (0.953)	0.113 (0.683)
<i>ConsFreq</i>	1.686 (2.207)	-0.319 (0.692)	-0.136 (0.421)	0.308 (0.836)	0.367 (0.503)	0.193 (0.295)
<i>Watch_TV</i>	0.708 (0.631)	-0.446* (0.235)	-0.105 (0.127)	0.884*** (0.320)	-0.590*** (0.204)	-0.169 (0.133)
<i>Income(ref: Low income)</i>						
<i>LowerMiddle</i>	-3.612 (6.928)	1.545 (2.263)	-0.539 (1.376)	1.296 (1.953)	0.379 (1.239)	-2.095** (1.019)
<i>UpperMiddle</i>	-3.792 (6.256)	1.871 (2.061)	-0.468 (1.245)	0.710 (1.624)	1.271 (1.068)	-2.266** (0.891)
<i>High_income</i>	-3.359 (6.033)	1.793 (1.999)	-0.289 (1.205)	0.325 (1.750)	1.677 (1.151)	-2.268** (0.917)
<i>Household_size</i>	0.519 (1.031)	0.0825 (0.368)	-0.349 (0.217)	-0.127 (0.507)	0.0138 (0.358)	-0.0253 (0.210)
<i>Children</i>	-1.148 (1.848)	-0.179 (0.604)	0.453 (0.371)	-0.129 (0.632)	-0.0835 (0.386)	-0.0463 (0.292)
<i>HoChiMinhCity</i>	0.780 (0.536)	-0.790*** (0.245)	0.112 (0.148)	1.024* (0.526)	-1.007*** (0.316)	0.229 (0.214)
<i>Constant</i>	58.41*** (17.68)	34.25*** (6.149)	20.21*** (3.269)	52.66*** (5.199)	33.19*** (3.746)	18.98*** (2.434)
<u>First stage regression</u>						
<i>OtherWesternFAFH</i>		1.658			4.07***	
<i>F stats(p-value)</i>		5.90*			8.58***	
<i>Hausman test of endogeneity(p-value)</i>	0.94(0.331)	0.69(0.404)	0.011(0.948)	0.001(0.975)	0.022(0.883)	0.74(0.386)
Observations	732	732	732	731	731	731
R-squared	1.306	0.095	0.040	0.166	0.234	0.011

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors presented in parentheses.

**Table 3.3A Three Stage Multivariate Regression Results for Estimation of Adults Macronutrient shares (Carbohydrate, Fat and Protein)**

	Male			Female		
	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>
<i>WesternFAFH</i>	-0.106** (0.018)	0.138*** (0.010)	-0.019** (0.007)	-0.072*** (0.019)	0.128*** (0.011)	-0.027*** (0.007)
<i>Age (Adults: ref. Age18-25Yrs)</i>						
<i>Age26-35Yrs</i>	-0.935 (0.597)	0.204 (0.339)	0.500** (0.252)	0.598 (0.540)	-0.520 (0.325)	-0.036 (0.224)
<i>Age36-45Yrs</i>	-0.330 (0.661)	-0.123 (0.376)	0.353 (0.279)	0.359 (0.593)	-0.193 (0.357)	-0.133 (0.245)
<i>Age46-55Yrs</i>	-0.677 (0.643)	0.159 (0.365)	0.347 (0.271)	-0.427 (0.630)	-0.006 (0.379)	0.206 (0.261)
<i>Age56-64Yrs</i>	-1.895** (0.748)	0.810* (0.425)	0.958*** (0.316)	-0.760 (0.767)	0.487 (0.461)	0.312 (0.317)
<i>Age65Yrs&amp;Plus</i>	-1.408 (1.006)	1.032* (0.572)	0.761* (0.424)	-0.074 (0.948)	-0.253 (0.571)	0.552 (0.392)
<i>EduMale</i>	0.140* (0.076)	-0.086** (0.043)	-0.025 (0.032)	0.029 (0.075)	-0.064 (0.045)	0.036 (0.031)
<i>EduFemale</i>	-0.293*** (0.082)	0.112** (0.046)	0.092*** (0.034)	-0.129 (0.081)	0.062 (0.048)	0.018 (0.033)
<i>FemaleWork</i>	-0.008 (0.007)	0.004 (0.004)	0.001 (0.003)	-0.008 (0.007)	0.004 (0.004)	0.002 (0.002)
<i>Buddhist</i>	-0.818 (0.570)	0.072 (0.324)	0.115 (0.240)	0.556 (0.567)	-0.448 (0.341)	-0.225 (0.235)
<i>Christian</i>	-0.128 (0.799)	-0.542 (0.454)	0.254 (0.337)	0.129 (0.783)	-0.470 (0.471)	0.026 (0.324)
<i>ConsFreq</i>	-0.124 (0.157)	0.138 (0.089)	-0.0376 (0.066)	0.212 (0.160)	0.0512 (0.096)	-0.091 (0.066)
<i>WatchTV</i>	0.348*** (0.128)	-0.124* (0.072)	-0.126** (0.053)	0.274** (0.122)	-0.093 (0.073)	-0.091* (0.050)
<i>Income (ref: Low income)</i>						
<i>Lower-middle income</i>	0.649 (0.820)	0.0882 (0.466)	-0.131 (0.346)	0.049 (0.808)	-0.103 (0.486)	0.111 (0.334)
<i>Upper-middle income</i>	0.663 (0.811)	0.079 (0.461)	-0.310 (0.342)	-0.949 (0.798)	0.593 (0.480)	0.209 (0.330)
<i>High income</i>	-0.325 (0.863)	0.646 (0.491)	0.0771 (0.364)	-1.390 (0.846)	0.864* (0.509)	0.388 (0.350)
<i>Household size</i>	0.095 (0.205)	-0.0583 (0.117)	-0.124 (0.086)	0.330 (0.201)	-0.169 (0.121)	-0.121 (0.083)
<i>Children</i>	-0.371 (0.267)	0.046 (0.152)	0.258** (0.113)	-0.343 (0.263)	0.0185 (0.158)	0.143 (0.109)
<i>Ho Chi Minh City</i>	0.494 (0.590)	-1.383*** (0.335)	0.214 (0.249)	1.108* (0.583)	-1.485*** (0.351)	0.314 (0.241)
<i>Constant</i>	66.40*** (1.632)	22.16*** (0.928)	17.82*** (0.688)	63.82*** (1.622)	23.43*** (0.976)	17.99*** (0.671)
<i>Breusch-Pagan Chi-sq. (p-value)</i>		1957.4 (0.00)			779.7(0.00)	
<i>R-squared</i>	0.044	0.130	0.025	0.038	0.119	0.020
<i>Observations</i>	1,750	1,750	1,750	1,784	1,784	1,784
<i>Number of households</i>				1,685		

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors presented in parentheses. 1 USD = 22,318 VND in December 30, 2016.

**Table 3.4A Three Stage Multivariate Regression Results for Estimation of Children Macronutrient shares (Carbohydrate, Fat and Protein)**

	Male			Female		
	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>	<i>Carbohydrate</i>	<i>Fat</i>	<i>Protein</i>
<i>WesternFAFH</i>	-0.087*** (0.027)	0.125*** (0.017)	-0.018 (0.011)	-0.019 (0.031)	0.066*** (0.020)	-0.025* (0.014)
<i>Age (Children: ref. Age&lt;4Yrs)</i>						
<i>Age4-6Yrs</i>	12.38*** (1.801)	-12.96*** (1.167)	-0.0427 (0.743)	4.787** (2.270)	-7.643*** (1.463)	2.075** (1.009)
<i>Age7-9Yrs</i>	11.31*** (1.830)	-12.18*** (1.186)	-0.301 (0.756)	4.495** (2.276)	-7.663*** (1.467)	2.134** (1.012)
<i>Age10-12Yrs</i>	12.39*** (1.840)	-12.46*** (1.192)	-0.508 (0.760)	5.490** (2.340)	-8.672*** (1.508)	2.264** (1.040)
<i>Age13-15Yrs</i>	13.95*** (1.856)	-13.65*** (1.202)	-0.868 (0.766)	8.178*** (2.333)	-8.810*** (1.504)	0.755 (1.037)
<i>Age16-17Yrs</i>	13.67*** (1.945)	-13.42*** (1.260)	-0.792 (0.803)	8.186*** (2.403)	-8.536*** (1.549)	0.331 (1.068)
<i>EduMale</i>	-0.058 (0.131)	0.019 (0.085)	0.002 (0.054)	-0.020 (0.144)	0.063 (0.092)	-0.025 (0.063)
<i>EduFemale</i>	-0.049 (0.144)	0.017 (0.093)	-0.014 (0.059)	-0.077 (0.154)	-0.064 (0.099)	0.049 (0.068)
<i>FemaleWork</i>	0.006 (0.012)	-0.010 (0.007)	0.000 (0.005)	-0.009 (0.013)	-0.002 (0.008)	0.018* (0.005)
<i>Buddhist</i>	0.137 (0.974)	-0.288 (0.631)	-0.014 (0.402)	-0.545 (1.037)	0.362 (0.668)	-0.142 (0.461)
<i>Christian</i>	0.840 (1.397)	-0.508 (0.905)	-0.237 (0.577)	-0.380 (1.540)	-0.160 (0.993)	0.0827 (0.685)
<i>ConsFreq</i>	0.346 (0.282)	0.077 (0.183)	-0.095 (0.116)	0.284 (0.318)	0.303 (0.205)	0.007 (0.141)
<i>WatchTV</i>	0.391* (0.231)	-0.352** (0.150)	-0.095 (0.095)	0.877*** (0.242)	-0.609*** (0.156)	-0.224** (0.108)
<i>Income (ref: Low income)</i>						
<i>Lower-middle income</i>	0.316 (1.745)	0.383 (1.130)	-0.658 (0.720)	1.329 (1.752)	0.467 (1.129)	-1.841** (0.779)
<i>Upper-middle income</i>	-0.337 (1.729)	0.850 (1.120)	-0.573 (0.714)	0.725 (1.716)	1.310 (1.106)	-2.155*** (0.763)
<i>High income</i>	-0.176 (1.790)	0.851 (1.160)	-0.386 (0.739)	0.340 (1.795)	1.718 (1.157)	-2.150*** (0.798)
<i>Household size</i>	0.0703 (0.386)	0.215 (0.250)	-0.335** (0.159)	-0.119 (0.423)	0.035 (0.273)	0.037 (0.188)
<i>Children</i>	-0.188 (0.529)	-0.463 (0.343)	0.424* (0.218)	-0.128 (0.554)	-0.081 (0.357)	-0.040 (0.246)
<i>Ho Chi Minh City</i>	1.888* (1.002)	-2.237*** (0.649)	0.349 (0.414)	3.033*** (1.071)	-3.123*** (0.690)	0.390 (0.476)
<i>Constant</i>	48.88*** (3.562)	36.51*** (2.308)	20.63*** (1.471)	53.59*** (4.056)	31.93*** (2.614)	18.49*** (1.803)
<i>Breusch-Pagan Chi-sq.(p-value)</i>		779.7 (0.00)			762.5 (0.00)	
<i>R-squared</i>	0.178	0.342	0.050	0.166	0.239	0.109
<i>Observations</i>	732	732	732	731	731	731
<i>Number of households</i>			1,685			

Note: Asterisks \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors presented in parentheses. 1 USD = 22,318 VND in December 30, 2016.



### Appendix 5 (For Chapter 4)

**Table 4.3A Descriptive statistics for each of the sub-sample by farm size**

	(1)		(2)		(3)		(4)	
	<i>Marginal farmers</i>		<i>Small farmers</i>		<i>Medium farmers</i>		<i>Large farmers</i>	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Dependent variables:								
<i>Food secure</i>	.1459	.3531	.3473	.4763	.4407	.4969	.5920	.4921
<i>Marginally food secure</i>	.6237	.4845	.5831	.4932	.5048	.5004	.3937	.4892
<i>Food insecure</i>	.2302	.4211	.0694	.2543	.0543	.2269	.01416	.1183
Health shocks:								
<i>Death main earner</i>	.0178	.1324	.0066	.0813	.0038	.0622	.0084	.0919
<i>Medical expenses</i>	.0695	.2545	.0406	.1975	.0563	.2307	.0424	.2019
Economic shocks:								
<i>Crop loss</i>	.0141	.1181	.0458	.2091	.0660	.2485	.1104	.3139
<i>Food price increase</i>	.0658	.2481	.0495	.2170	.0446	.2067	.0226	.1490
<i>Dowry</i>	.0387	.1931	.0384	.1923	.0388	.1933	.0254	.1578
Other covariates:								
<i>Age</i>	42.92	14.132	45.42	13.46	49.26	12.75	48.26	13.86
<i>Age squared</i>	2042.0	1335.2	2244.1	1298.9	2588.9	1281.3	2521.0	1374.4
<i>Education</i>	2.105	3.491	3.206	4.412	3.667	3.957	4.498	4.309
<i>Household size</i>	4.191	1.571	4.617	1.654	5.248	2.042	5.410	2.173
<i>Children</i>	1.545	1.166	1.543	1.173	1.607	1.309	1.535	1.324
<i>Female head</i>	.1915	.3936	.0650	.2466	.0213	.1447	.04815	.2144
<i>Total expenditure</i>	.5182	.3246	.5794	.5650	.7044	.6842	.8858	.7254
<i>Cultivable land</i>	.6896	1.297	2.356	1.951	3.414	2.026	3.994	2.266
<i>Home grown food</i>	.7296	.8542	1.468	1.128	1.875	1.128	2.232	1.248
<i>Electricity</i>	.3374	.4729	.4634	.4988	.4252	.4948	.4929	.5006
<i>Dairy cows</i>	.3134	.7839	.7191	1.136	.9980	1.243	1.317	1.537
<i>Mobile phone</i>	.6022	.4895	.7324	.4428	.7961	.4032	.9093	.2875
<i>Agri-sale location</i>	.2068	.4052	.3466	.4760	.3941	.4891	.4192	.4941
<i>Loan access</i>	.6428	.4793	.6903	.4625	.7262	.4463	.7337	.4426
<i>Extension</i>	.01600	.1255	.0776	.2676	.1475	.3550	.1558	.3631
Number of households	1,624		1,353		515		353	

Source: Authors' calculation from Bangladesh Integrated Household Survey (BIHS) 2011-2012 sample data

## **Appendix 6: Training manual prepared for the Urban Vietnam Consumption and Expenditure Study**

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November 2016

### **Introduction**

This manual is designed to help the enumerators and their supervisor to carry out the Vietnam Survey of Urban Consumers. It provides definitions and instructions for completing the questionnaire.

### **The Interview**

#### ***Starting the interview***

To begin the interview, introduce yourself and explain the purpose of the survey. There is a suggested paragraph on the cover page, but you may wish to expand or modify this based on your experience. If the respondent is hesitant about responding to the interview or asks what the data will be used for, explain that the information you collect will remain confidential, no individual names will be used for any purpose, and all information will be collated to write a report.

It is important to establish a good relationship with the respondent since we are asking for about 90 minutes of their time. In addition, a respondent that is treated well might trust the enumerator more and is more likely to give accurate responses.

Next ask who in the household would be most knowledgeable about food purchases and preparation. Normally, this will be the wife/mother or may be grandmother in the household, but not always. If the most knowledgeable person is not present, it may be

possible to interview someone else who is well informed or it may be necessary to return to the household later.

An Example: Hello, my name is \_\_\_\_\_. I work for a research institute in Hanoi called Indochina Research Ltd and we are carrying out a survey on food shopping habits. The survey is intended to improve our understanding of how food shopping patterns are changing and how to help farmers adapt to those changes. The survey will be conducted for two rounds. The first round is in December 2016 and the second round will be conducted in May 2017. You are one of 2000 households in Hanoi, HCM and North West Vietnam selected to participate. The individual results are confidential - only summary results will be included in the report. I would like to have some of your time to ask you some questions. I would also like to seek your kind consent to let me get all family member's (including a new born) weight and Height, Waist, Hip and Mid-Upper Arm Circumference (MUAC).

Whenever possible, the interview should be carried out privately, without neighbours, company representatives, or government officials.

***General Information:***

- Only use CommCare application in the tablet for full Household Socioeconomic survey and leave 24-hour food diary modules (Module M1 to Module M3), to the interviewee to be filled in later. Then ask the interviewee kindly what is the most convenient day and time for picking the form later.
- Steps to use the tablets:

The device that has been provided for surveys would need to have latest version of the application 'CommCare'. Always update and synchronize the version so that you do not miss any updated information. Below is an example of how to update and synchronize the application:

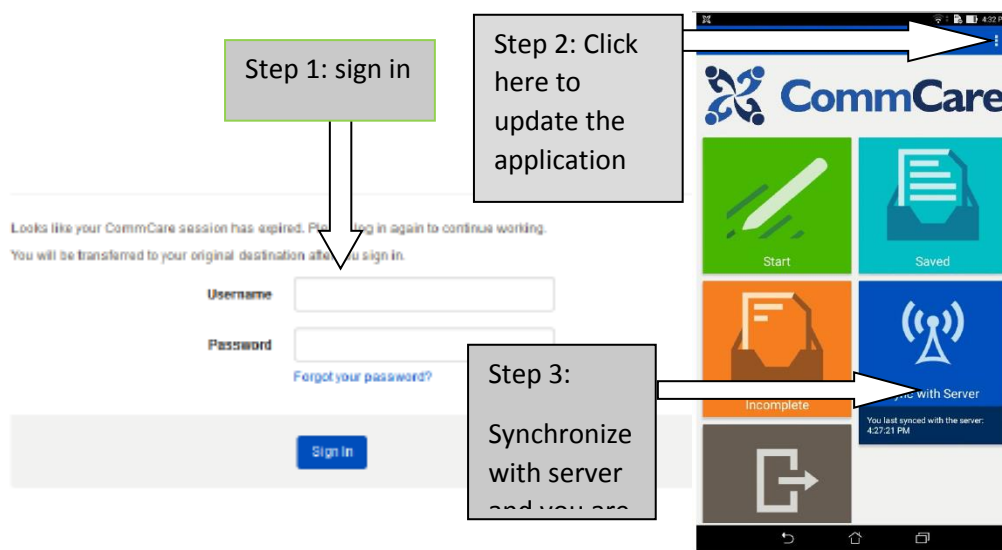


Figure: 1 Steps to access the CommCare application

**Step 1:** You would need a user name and a password to access the application. These credentials must be used to log into the application and access the projects assigned for survey.

**Step 2:** Always update the app before you use it.

**Step 3:** Always synchronize the app before you start the survey.

Also, check that the device has adequate battery power to sustain the survey through the day.

Furthermore, following steps must be taken to improve performance of the device on field:

1. Do not use this device for purposes other than survey;
2. Do not install any other application than 'CommCare';
3. Power off the device if not in use for prolonged periods in the day;
4. Turn off Bluetooth and Wi-Fi when not in use;
5. Turn off GPS location service, whenever not on field;

6. Also turn off synchronisation to save power;
7. Do not leave apps running in the background;
8. Use power saver mode on the device, and turn off ‘vibrate alert

### ***Filling in the questionnaire using CommCare Application***

Below are some general guidelines for filling in the questionnaire:

- Ask the questions in order, skipping to questions when instructed to.
- There should be just *one number in each box*. For example, if the respondent says “10 to 20 kilograms”, ask him to estimate the average or use 15. If the respondent gives two reasons, but there is only one box, ask him to select the most important reason.

### **Cover Page**

The cover page records information to identify the respondent and to monitor the process of data collection and quality control. For example, the cover page includes the explanation and the objective of the usage of the data, Name of the wards by districts and by cities. It also includes the information about household name, Household identification number, name of the respondent, household address or location and information about the interviewer. The cover page also includes the name of the household head and his/her ID. In the CommCare app, the enumerator should write down the member ID number to identify the household head.

***What is a household?*** For this survey, a household is defined as a group of people who normally live and eat their meals together. To be a member, a person must live in the household for at least 6 months of the year or for at least 4 days per week. Make sure the respondent includes him or herself. To ensure that you get everyone who lives in the household, probe by asking if there are any employees or non-family-members living at the house. If so, ask more questions to see if they meet the criteria for household members. It is not necessary to record information about people who normally live elsewhere, such as someone who works in his/her rural origin most of the year.

**IMPORTANT:**

A household includes:

- Infants born within the family and living with the family within the past year.
- Servants, lodgers, farm-workers, and other individuals who have lived and eaten with the household over most of the last 12 months, even if they have no blood relation to the household head.
- Anyone who has lived and eaten with the household for most of the last 12 months.
- New members of the household (such as a son-in-law) who has lived in the household at least one month.

A household does not include:

- People who live in the same dwelling, but do not share food expenses and make economic decisions separately. For example, if two brothers, each having his own family, live in the same house but maintain separate food budgets and cooking facilities, and make their economic decisions separately, they would be two separate households.

- People who normally live away from the household for more than six months of the year, even if they are family members and are considered members of the household by the household itself. For example, if the mother of the family lives and works in the rural origin of the family and only lives for 4 months of the year in the city she is not considered a member of the household (under our definition). Similarly, a son who comes home only on weekends is not a household member.

Children of the household who have lived and eaten elsewhere most of the past 12 months, such as students who live at a boarding school and children who live with relatives.

*Housemaid:* what if the housemaid makes the decision of food purchasing and she is gone after 2 months. Then who will be person to take the decision? The decision for food purchasing for the family members must come from a permanent member of the family. For example, the wife or the grandmother of the family who are living permanently in the household. The housemaid may prepare food or go to the shopping market to purchase food but they do not take the economic decision of food purchasing for the members. In this case, the respondent who is responsible for the household food purchase in May (the second round) will be the respondent for the second round. Wendy: we should never interview the house maid. But the respondent should always be from the permanent household member. The household maid can help her to answer questions.

### ***Who is a head of household?***

The head of household is defined as the household member who makes most of the decisions for the members of the household.

### **IMPORTANT:**

- The head is not necessarily the oldest male.

- Also, because the head of household must be a member of the household, it cannot be someone who lives elsewhere for most of the year. For example, if the husband lives in another place and sends money or visits the household regularly, then the wife makes the day-to-day decisions and she is considered the household head (this would be referred to as a female headed-household).
- If the decisions for the members of the household is taken jointly, the enumerators should write the name and the ID of the both member. For example, if the husband and the wife make most of the decisions jointly, then the enumerator should write the names and the ID of the husband and the wife both.  
  
Enumerators may accept the judgment of the household members regarding who is the head of household, provided the person is a member according to our definition.

***Household Registration:***

**1. Information for household ID number**

This section provides the codes that will be used to construct the household identification (ID) number. Choose the codes for the city, district, ward and the household ID that are provided in the app. The codes for city, district, and ward are provided on the back of the cover page of the hard copy of survey questionnaire. The codes for each enumerator will be provided by the supervisors which is also shown on the back of the cover page.

**2. Information on the household**

The name, address, and phone number of the respondents should also be filled in. There are no codes for this information. This information is important for identifying the household in case there is a mistake in the household ID. This information is also



important in case we have a question about the information provided and we need to contact the respondent.

### 3. Questionnaire Interview

The interviewer should record the start date of the data entry and the finish date of the data entry here. The supervisor will check the questionnaire in the field. Any random checks by the supervisor will be recorded in the appropriate row. The office check will be carried out in the headquarters.

## **SECTION A: Characteristics of household members**

The purpose of this section is to collect basic information on each member of the household.

### *Order of questions in module A:*

Tell the respondent that you would like to make a list of all members of the household starting with the head of household and the spouse. Try to organize the roster so that, after the head of household and spouse, the household members are listed by age, from eldest to youngest. This will make it easier to complete and check the questions that only apply to members 7 years and older and the questions that only apply to members 17 years and older.

### *A1 and A2 Household ID no.:*

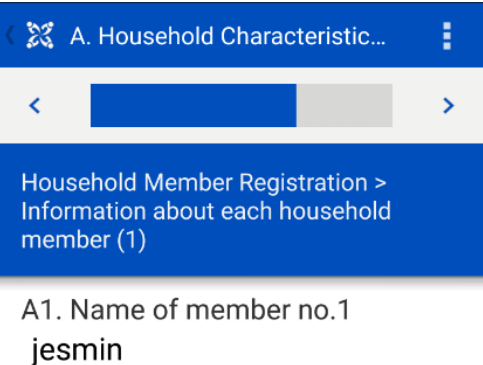
In CommCare app, the household ID number will appear in this section followed by member ID in A2

### *A3: Name of the members in the household (Confidential and will be kept by the survey company for their record and quality control)*

As described above, list the name of the household members in the following order: 1) head of the household, 2) the spouse(s), and 3) others in order of age from oldest to

youngest. Putting them in order of age will help ensure that the schooling question is asked of everyone who is six years or older. It will also help ensure that A6-A8 are only asked about members 17 years or older.

Do not write a number here. You need to write the name of the respondent. See the example below:



A. Household Characteristic...

Household Member Registration > Information about each household member (1)

A1. Name of member no.1  
jesmin

#### **A4 Gender**

Write the code for the sex/gender of the household member (1=Male, 2=Female).

#### **A5 Relationship**

Record the member's relationship to the head of the household.

“Other related” refers to people with a blood or marriage connection to the head of household, including cousins and grandparents.

“Other unrelated” refers to people in the household but not related by blood or marriage to the head of household, including domestic employees, boarders (who eat with the family), or long-term visitors.

“Domestic employee” refers to the people who perform a variety of household services for an individual or a family, from providing care for children and elderly dependents to

housekeeping, including cleaning and household maintenance, eating and living with the households in the past 12 months or more.

**A6 Age**

Record the age of the member in the app, expressed in day, months and years needs to be completed (i.e. age at the last birthday). If the oldest members do not remember their exact date of birth, then request him/her to remember the year. If they do not remember the year, then politely ask what they think their age would be. Then the enumerators should find out in which year they were born.

**A7 Education**

For all the members 6 years and older, record the number of years of schooling starting from grade 1 in primary school that the child has had. For example, if the member never completed any schooling, write “0”. If the respondent completed 3<sup>rd</sup> grade, write “3”. If s/he completed 7<sup>th</sup> grade and started 8<sup>th</sup> grade. Write “7”.

**A8 Marital status**

For members who are 17 or older, ask about his or her marital status. Marital status refers to whether the household member is or has ever been married. “Single” means never married. “Married” means the member is currently wedded to someone, usually but not necessarily another member of the household. “Divorced/separated” means that the member was married but has legally or informally separated from his/her spouse. “Widowed” means the member was married but the spouse died. If the ex-spouse of a household member dies, the member is considered “Divorced/separated”, not “Widowed.”

**A9 Main activity**

For members who are 17 years old or older, ask about his or her primary activity. The primary activity is defined according to the time it takes, rather than the money it generates. For example, a woman who spends 5 hours per day doing housework and 3 hours as a vegetable trader would have “Housework” as the main activity, even though trading generates more income. The activity codes are given on the back of Section A. The two main categories of occupations are “self-employed” and “employee”.

- The “self-employed” category refers to people who own their own business and are paid by the product or by the tasks (not by the time-period). They often have business expenses such as raw materials, rent, and labor. They typically sell to various customers.
- The “employee” category refers to people who is paid by the day, month, or year. They generally do not have business expenses.

The table below provides brief descriptions of each occupation/activity code:

11.	“Farmer/fisherman” includes people involved in crop production, livestock raising, aquaculture, and fishing. It includes independent farmers, farmers renting farmland, and sharecroppers. It does not include agricultural labourers working for a daily wage (these are “Employees – 180labourer”).
12.	“Self-employed commerce” refers people who have their own business buying and reselling products without processing or transforming them. The activities may include storage and transportation. This includes assemblers, wholesalers, and shopkeepers who own their businesses. It does not include people who work as employees in a store or trading company (they are “Employees semi-skilled active”).

13.	“Self-employed service” refers to people who have their own business and are paid by the task. They have different customers who pay them, rather than always working for one person or company. Examples include barbers, repairmen, electricians, plumbers, and drivers with own vehicle.
14.	“Self-employed manufacturing” includes activities in which the household member is self-employed and is paid by the product. Examples include bakers, butchers, metal-workers, furniture makers, and brick-makers.
21.	“Employee professional active” refers to an employee with relatively high education and skills who typically spends most of the day on his/her feet. Examples include teachers, doctors, and nurses.
22.	“Employee professional less active” refers to an employee with relatively high education and skills who typically spends most of the day seated. Examples include executives, administrators, and managers.
23.	“Employee semi-skilled active” refers to an employee with some skills and education who typically spends most of the day standing. Examples include policemen, salespeople, and bank tellers.
24.	“Employee semi-skilled less active” refers to an employee with some skills and education who usually spends most of the day seated, such as secretaries, receptionists, clerks, and drivers.
25.	“Employee 181labourer” refers to an employee with less education, such as a construction worker, a factory worker, a cleaner, a security guard, and an agricultural 181labourer.

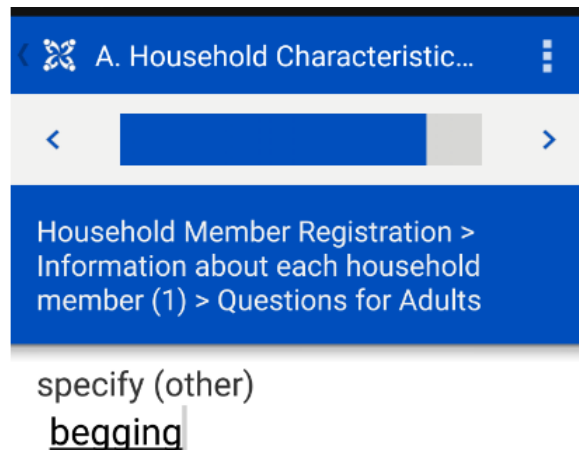
26.	“Domestic employee” refers to someone hired by a family to help with household tasks. Examples include a housekeeper, a cook, a nanny, and a gardener.
31.	“Housework” refers to an unpaid member of the family who cleans, cooks, and takes care of the children. It is often the wife/mother or an older child but does not have to be. If the person does housework as a paid job, this should be recorded as “Domestic employee.”
32.	“Student” includes school students, university student, and those in training.
33.	“Retired” includes those who have stopped working because of age.
34.	“Not working” refers to people who are not working, either because they cannot find work or because they choose not to.
35.	“Others (Specify)” includes anyone who does not fit in the other categories. If you use this code, please describe the activity/occupation. The enumerators should specify what other activity the household member mentioned as employment.

***A10 Hours worked***

For members 17 and older who have a paid occupation (codes 11-35), ask about the number of hours per week that they spend on the primary activity.

In the app, if the household have chosen the option “other”, please specify what other activities he/she is doing.

See an example below:



In the form (in case the app is not working), If the member has an unpaid primary activity (codes 31-35), then fill in the box with “99” since it would be difficult to estimate the time involved and not very useful for analysis.

#### ***A11 Religion***

Record the religion of the household using the codes provided.

#### ***A12 Ethnicity of household head***

Record the ethnicity of the head of household from the given codes.

#### ***A13 Ethnicity of spouse***

Record the ethnicity of the spouse of the head of household.

#### ***A14. Watching TV/OTHERS [CHILDREN and ADULTS (aged 2 years or more)]:***

On average, how many hours per day does each member (aged 2 years and above) in your household spend watching TV, videos, or on the internet?

- For Adults only, response should be in HOURS per day.

- We just want the average for the household per DAY.
- We just want an estimate per day, it does not have to be exact.
- If the amount is less than an hour then code to the nearest quarter of an hour. For example 30 minutes = 0.5 hours, 45 minutes = 0.45 hours.

**A15. Exercise**

On average, how many hours per week does each member (aged 2 years and above) in your household do exercise (e.g. sports, physical education at school, bike riding, playing outside)?

- For adults only, response should be in hours per week.
- We just want the average for the each household member per week.
- For example if the 3 adults in the household, Jesmin and Wahida exercise for different amounts of time each week (e.g. Jesmin never exercises, Wahida usually exercises for 6 hours per week, then the answer should be for Wahida 6 hours per week and for Jesmin 0.
- We just want an estimate per WEEK, it does not have to be exact.
- If the amount is less than an hour then code to the nearest quarter of an hour. For example 30 minutes = 0.5 hours, 45 minutes = 0.45 hours.

Enumerators should try to make an estimation from the respondent if the respondent cannot tell exactly how many hours/does not know. No “999” is allowed.

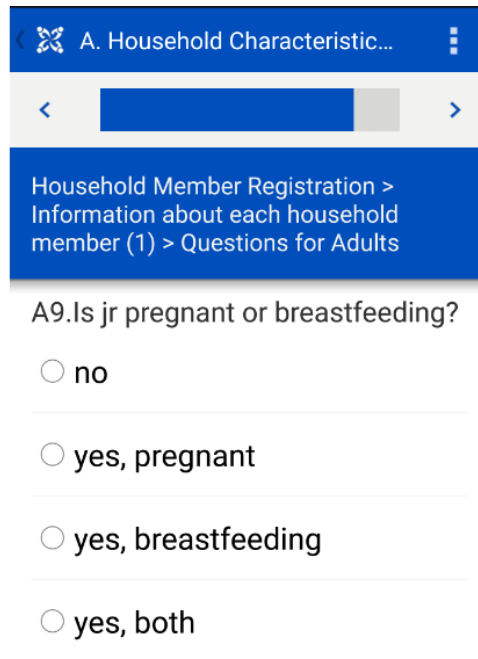
**A16. Smoking**

Who in the household smokes cigarette? Write down the member ID who smokes cigarette.

**A17 Pregnancy and lactation**



Who in the household pregnant or lactating?” Write down the member ID. In the app, you only need to select the option as below:



The screenshot shows a mobile application interface. At the top, there is a blue header bar with a back arrow, a close icon, and the text "A. Household Characteristic...". Below the header is a white bar with a blue progress indicator and navigation arrows. The main content area has a blue background with white text: "Household Member Registration > Information about each household member (1) > Questions for Adults". The question is "A9. Is jr pregnant or breastfeeding?". There are four radio button options: "no", "yes, pregnant", "yes, breastfeeding", and "yes, both".

## **SECTION B. Housing and assets**

The objective of this section is to obtain general information on housing characteristics and ownership of assets.

### ***B1 Water source***

Pick the first response that describes the main source of water for household. If there are multiple sources, ask which the source of most of the water is.

### ***B2 Toilet***

Pick the response that best describes the type of toilet used by the household most of the time.

**B3 *Types of lighting***

This questions asks about the type of lighting used by the household in the evening. If they use more than one type, pick the first one listed.

**B4 *Fuel***

This question focuses on the fuel used for cooking. If more than one fuel is used, pick the most important one.

**B5 *Distance to transportation***

The distance to the nearest transportation should be measured in meters from the edge of the household's property. If the public transport is immediately in front of the house, you can enter "0".

**B5a. *Type of the nearest transport***

In the app, also select the type of the nearest transport from the option in the app, they are: 1) Bus, 2) Xe Om, 3) Taxi, 4) Cycle, 5) other, please write down the "other" type of vehicle that is used by the respondent. Do not select a number for the option "Other".

**B6 *Asset ownership***

This question records the number of each type of consumer good owned and used by members of household. Record a "0" if the household does not own the item, "1" if they own one of the item, "2" if they own two, and so on.

**B7. *Year***

Did your household own this asset 5 years ago (in 2011)? For each item owned by the household, enter *Yes* or *No* to answer the question.

## SECTION C. Cooking and shopping attitude/behaviour

### *C1-C2 Role of domestic employee(s)*

First ask if the household has a domestic employee such as a cook or a housekeeper. If not, you can continue to C3. If they do have a domestic employee, ask questions C1 and C2. In the app, you only need to select the option as below:



The screenshot shows a mobile application interface. At the top, there is a blue header bar with a back arrow, a close icon, the text 'C. Cooking & Shopping Attitu...', and a menu icon. Below the header is a grey bar with left and right navigation arrows. The main content area has a blue header with the text 'Household Cooking'. Below this, the question 'Does this household have a cook or housekeeper?' is displayed. There are two radio button options: 'Yes' (which is selected) and 'No'.

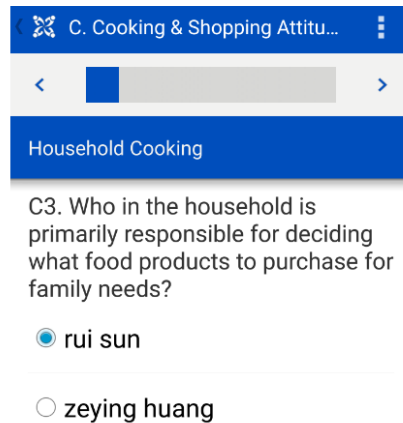
### *C3-C6 Division of responsibility*

These questions ask who in the household has responsibility for deciding what to buy, for shopping, for deciding what to cook, and for cooking. If responsibility is shared, pick the person with more responsibility. See the picture below:

### *C7 Shopping list*

Asks if the household usually makes a *written* shopping list before going food shopping.

**C7A.** In the app, you will also ask the name of the person who writes the shopping list. See the example below:



### ***C8 Eating meals together***

Asks In an average MONTH, how often is the main food for the evening meal is eaten by the most of the members together. The answer should be between 0 and 7.

### ***C9-C11 Eating out***

Asks about the frequency that the household makes use of food prepared outside the house, including take-out, delivered food, eating in restaurants, and eating at street vendors.

## **SECTION D. Retail outlets**

### ***D1. Type(s) of shopping outlets***

Hypermarket and Supermarkets include Metro, Big C, Fivi Mart, Unimart, AC Mart



Minimart/Convenience store includes seven eleven, Vinmart, Shop & Go, and Circle K



Specialty shops are small sized shops with clear external billboards signalling the offer of certified safe, clean or organic vegetables. Examples of this would include stores selling "Safe Vegetables" or "Organic Vegetables". Examples Include "Big Tom" Big Green and Klever Fruit.





**Formal wet market is a market formally established by the authorities**



**Traditional family shop: A traditional family shop is a small food shop run by the households that sell only processed foods and beverages but no fresh foods or vegetables.**



**A semi-permanent stand sells from a table, stand, cart, or stall that can be moved, but generally stays in one place during the day**



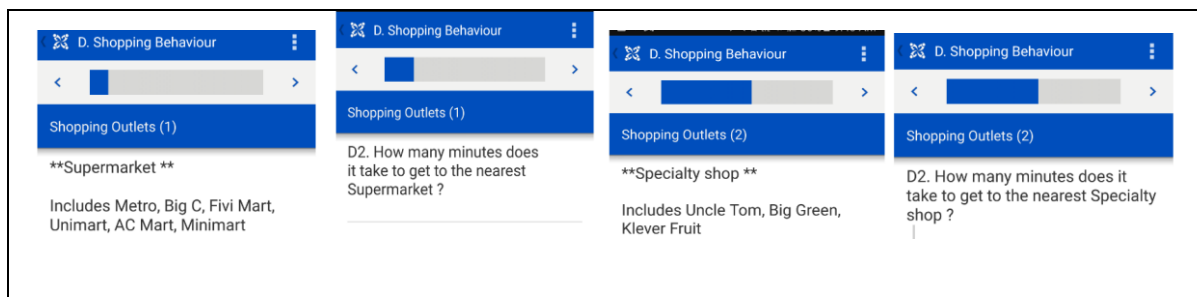
**Paddlers /mobile street vendors operate on foot, on bicycle, or pick-ups that sell both food and non-food items**



**Informal street Markets sell to the public without having a permanent built-up structure to sell.**



In the app, question D2 –D8 will appear for each of the shopping outlet starting with hyper/supermarket, minimart and then Specialty shop and so on. Example is shown as below:



### ***D2. Time to outlet***

- THIS SHOULD NEVER BE BLANK- They should fill it out how many minutes does it take to get to the nearest shopping outlet.

### ***D3. Distance to outlet***

- THIS SHOULD NEVER BE BLANK- They should fill the distance in kilometres to the nearest shopping outlets.
- If they do not know distance then the enumerator should try to ask someone else in the household. If this is impossible to know then you should indicate -999.



- If the enumerator thinks or know that the distance reported by the respondent is incorrect then the enumerator should write his estimated distance.

***D4. Frequency of non-food shopping***

Asks the question about how frequently does the household shop for NON-FOOD items at a shopping outlet.

***D5. Frequency of food shopping***

Asks the question about how frequently does the household shop for FOOD items at a shopping outlet. Food does not include tobacco and betel nut.

***D6. Transportation to outlet***

For this question, it is the transportation method they use MOST frequently. If they use “Other”, tell them to specify the type of the transportation method, e.g. it could be “Xe Om” then code as Xe Om as “Other”.

***D7-D8. Main reasons of using this outlet***

- Enumerator should show the options for the reasons they use outlets and ask respondent to select the main reason first. Then, the enumerators should also ask the second most reason they use the outlets.
- We only want the 2 most important reasons. If respondent mentions more than 2 reasons then enumerator should ask the respondent to specify the 2 most important reasons.

**SECTION E1, E2 and E3. FOOD CONSUMPTION EXPENDITURE FOR FOOD PREPERATION AND FOOD CONSUMPTION AT HOME**

The goal of this section is to collect information about food consumption expenditure, food patterns and where households buy different types of food products which are used to prepare food at home. Section E1 asks the information about staples and animal products, E2 asks the

information about fruits and vegetables and Section E3 asks the questions about the processed food and beverages. Although there are about 90 food categories in total, most households will not consume food from all of these categories.

*Questions E2 to E9 are repeated on the three sections E1, E2 and E3.*

### **FRESH VS. PROCESSED**

**PLEASE NOTE:** In several cases enumerator needs to distinguish between Fresh/Frozen and processed food products. It is important that the enumerator specifies that they want information on Fresh versus Processed. Here are the cases:

#### *In Section E1 (Staples and animal products)*

- Codes 510 to 520 refer to products that may be fresh, chilled, or frozen, but are not breaded, seasoned, salted, canned, dried, smoked, or semi-prepared.
- Codes 521 and 522 refer to products that are breaded, seasoned, salted, canned, dried, smoked, or semi-prepared in other ways.

#### *In Section E2 (fruits and vegetable products)*

- Codes 611 to 635 refer to Fresh vegetables or frozen vegetables – they can be cut for soups. They can be frozen if there is nothing (including salt) added to them.
- Code 636 is for “processed vegetables (e.g. canned or dried vegetables or vegetables in sauce (NOT fried or crisps)).
- Codes 711-723 refer to FRESH fruits, NOT processed (Not frozen, not sweetened, not dried, not juiced, and not canned).
- Code 724 is for any non-fresh processed fruit (including frozen, sweetened, juiced, dried and canned)

***In Section E3 (Processed food and beverages)***

- Codes 811 to 900 refer to any processed food and beverages including cooking oil, chocolates and ready to eat meals.

***Question E2: Food consumption over the past 12 months***

On each section E1, E2 and E3, complete question E2 before moving to E3. Consumption includes purchased food as well as food from their own gardens or farms and food received as a transfer. Record “1” for yes and “2” for no. In the app, you need to select the option if the respondent says YES or No.

***Question E3: Food consumption over the past 30 days***

On each section E1, E2 and E3, complete question E2 before moving to E3. Consumption includes purchased food as well as food from their own gardens or farms and food received as a transfer. Record “1” for yes and “2” for no. In the app, you need to select the option if the respondent says YES or No.

***Question E4: Changes in food consumption in the past five years***

E4 asks whether per capita consumption of this food item has increased or decreased over the past five years. We want the per capita comparison because we do not want it to be affected by changes in the number of household members. If they didn’t consume it 5 years ago and they do consume it now, select for larger quantities in the app. If they consumed it 5 years ago and do not consume it now, select for smaller quantities in the app.

***Question E5: Number of times food item “X” was purchased in the last 30 days***

This question will only appear in the app if the respondent answered “Yes” in question E2 and E3.

***Question E6: Value of average purchase***

E6 asks about the average amount spent in Vietnamese Dong on the food item per unit (e.g. per kilograms, grams, litres or number) of each time it is purchased. Note that it is the value per purchase, not per week or per month. We will estimate monthly expenditure by multiplying E5 and E9.

***Question E7: Average quantity of food consumption over the last 30 days***

Ask household member what is the average quantity of FOOD you usually purchase. Only put numbers for this question.

***Question E8: Unit of measure***

Unit of measure are as follows: Kilograms, grams, litre and numbers

**AN EXAMPLE:**

Example: I buy 24 eggs weekly. The price that I usually pay (average price) is 28,000 VND for 12 eggs. So because I buy eggs weekly, for E5 I would put 4 times; For E6 the respondent should report 56,000; E7 the average quantity would be 24; E8 number (eggs)

NOTE: We are not asking question E7& E8 for Modules E1 and E3 as these are very much aggregate food product categories.

We will ask Questions E7 & E8 for all the food products in Expenditure Module E2 but we do not need to ask question E7 and E8 for the 4 products listed in lines 635, 636, 723 &724.

### ***Question E9: Outlet of food purchase***

E9 asks where most of this food item is purchased, meaning what type of food store. If the food item is bought at more than one type of store, ask at which store their spending on this food is greater.

### **Extra questions E3a and E3b in Section E1:**

In Section E1 [FOOD CONSUMPTION EXPENDITURE FOR FOOD PREPARATION AT HOME (staples and animal products)], there are two extra questions (questions E3a and E3b) to know which pork meat cuts and beef meat cuts have the household consumed in the past 30 days. This question will only be asked if the households responded that they have eaten pork and/or beef in the past 30 days. Therefore, in the app, question E3a and E3b will only appear if the household responds that they have eaten pork and/or beef in the past 30 days.

The different meat cuts for pork meat and beef meat are as follows:

Question E3a: Which pork cuts did you consume over the past 30 days?	Question E3b: Which beef cuts did you consume over the past 30 days?
Boston Butt (Pork Shoulder)	Brisket
Belly Ba	Rib eye roll
Pork Rib	Shin/shank
Loin	Striploin
Fatback	Tenderloin
Rump	Other, Please specify (...)
Leg	
Other, Please specify (...)	

## Extra questions E2a and E2b in Section E2:

In Section E2 (Fruits and vegetables), there are two extra questions (from questions E2a and E2b) for four fruits that will be asked by the enumerators. Question E2a and E2b will only appear in the app if the household responds that they have eaten any of these four temperate fruits, i.e. plum, persimmon, pear and peach in the last 12 months. For the rest of the fruits and vegetable products in section E2, question E2a and E2b will NOT be asked. Below is an example picture from the app:

The image displays three sequential screenshots of a mobile application interface for 'E. Food Consumption'. The first screenshot shows a list of food types under 'Food Types (2)'. The second screenshot shows question E3: 'During the past 12 months how many times did you eat Plum?' with radio button options: 'Once', '2-5 times', '6-10 times', '11-20 times', and 'More than 20 times'. The third screenshot shows question E4: 'Can you please tell us all of the uses for Plum?' with checkboxes for 'Eating', 'Offering', 'Gifts to others', and 'None'. In the first screenshot, 'Plum' and 'Persimmon' are selected with checkboxes.

## F. NON-FOOD EXPENDITURE

The goal of this section is to estimate non-food consumption expenditure, which will be combined with food consumption expenditure to calculate per capita consumption expenditure, a measure of the standard of living of the household. This is an important variable because many variables such as food consumption and shopping patterns are expected to differ between low-income and high-income households.

The question is “How much does your household spend on [item] in a typical week, month, or year?” For each non-food item, we code the responses with two variables.

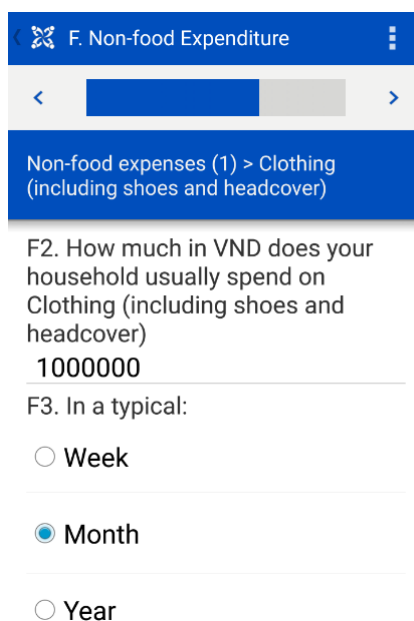
### *F2 Value (Non-food expenditure)*

Record the value (in Vietnamese Dollar) of the expenditure on each non-food category in F2.

### ***F3 Time***

Record the time period in F3, with “1” meaning weekly, “2” meaning monthly, and “3” meaning yearly. This does NOT refer to the frequency of purchases. It is only to give flexibility to the respondent in the response.

- In the app, if, for example, the respondent says that the household spends VND 100,0000 per month on clothing, write “1000000” in F2 and select the time period in F3. See the picture below:



The screenshot shows a mobile application interface for recording non-food expenditure. At the top, there is a blue header bar with a back arrow, a close icon, and the text "F. Non-food Expenditure". Below the header is a navigation bar with a left arrow, a blue bar, and a right arrow. The main content area has a blue header with the text "Non-food expenses (1) > Clothing (including shoes and headcover)". Below this, there is a question: "F2. How much in VND does your household usually spend on Clothing (including shoes and headcover)". The answer "1000000" is entered in a text field. Below the text field is a question: "F3. In a typical:". There are three radio button options: "Week", "Month", and "Year". The "Month" option is selected.

- Again, the time period does NOT refer to the frequency of purchases. It is for the convenience of the respondent. Sometimes it is easier to estimate the amount on a weekly basis (such as soap and toiletries), other items may be easier to estimate on a

monthly basis (such as water and electricity bills), while others may be easier to estimate on an annual basis (such as school fees). Let the respondent decide which time unit is easiest to estimate.

Do not include spending on the following categories:

- Food or beverages: Food expenditure is covered in Section E. We do count expenditure on city water delivered to the house in this Section, a portion of which is used for drinking. Bottled water, Aqua, and water refills are counted in Section E.
- Durable goods. Durable goods are large items that last for at least two years such as furniture, motorbikes, cars, and home improvements. Because the use (or “consumption”) of these goods lasts for several years, it does not make sense to count their expenditure in one year as “consumption.”
- Taxes. Taxes paid to central or local authorities are not directly linked to consumption, so we exclude these expenditures. We are not trying to estimate “income”; rather we are trying to estimate the value of consumption expenditure.
- Business expenses. We do not want to include business expenses because the items purchased do not directly contribute to the “consumption” and standard of living of the household. In other words, if a household owns a shop, we do not want to include the value of expenditures to restock the shop. Likewise, we do not want to count the cost of wood bought by a carpenter to make and sell furniture. These activities contribute to the household indirectly by providing income, but we count the value of consumer goods and services bought with those profits.

#### ***F4 Ownership status***



Ask the respondent whether the house is 1. Owned by the household 2. Rented/borrowed from the Government 3. Rented/ borrowed from the private landlord 4. Collectively owned 5. Owned by religious establishment 6. Collectively financed by both state and people

F5. What is the total area in square meter that you own? Ask this question if F4=1

**F5 Rental/Mortgage value:** How much rented/mortgaged amount does your household pay per year?

Ask the respondent to estimate what it would cost to rent/mortgage a house like this in a neighbourhood like this for one year.

- If this is difficult, ask how much they could get in rent if they rented out their entire house. What we want is the “rental equivalent”.
- Another way to phrase the question is how much household pay for similar houses in this neighbourhood do.
- We do NOT want the value of the house if they sold it or the cost if they had to buy the house. The rental equivalent is an important part of non-food consumption expenditure, so it is important to get an estimate of this value.

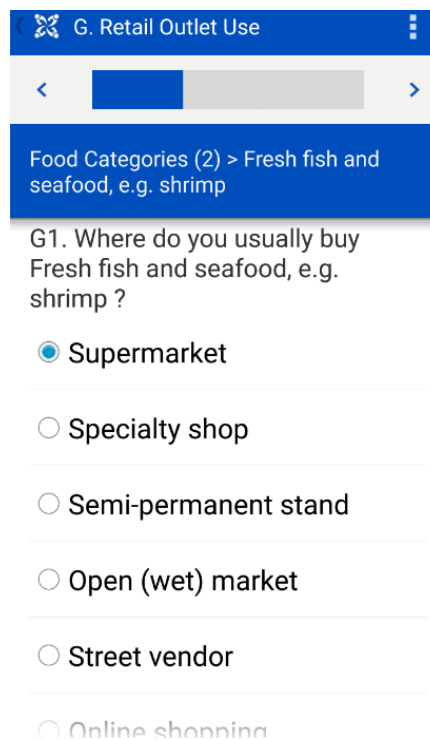
## **G. RETAIL OUTLET USE**

The following are explanations for the food product categories:

1. Fresh meat poultry and offal: Any fresh meat product that is not fish or seafood and has not been processed (not nuggets, not breaded, not salted, not smoked)
2. Fresh fish and seafood: Any fresh fish or seafood product (not processed, breaded, not nuggets, not salted, not smoked)
3. Fresh Fruits: Any fresh fruit product that is not frozen or processed (not dried, canned etc.)

4. Fresh Vegetables: Any fresh vegetable product that is not frozen or processed (not dried, canned etc.)
5. Fresh Milk and Yogurt: Only fresh cow milk or fresh yogurt, (NOT UHT, canned, long-life, dried or cheese, soymilk, cheese)
6. Processed food items: Frozen foods, cakes, candies, biscuits, boxed food
7. Rice: Only Rice

In the App, question G1-G6 will appear for each of the food categories. See the picture below:

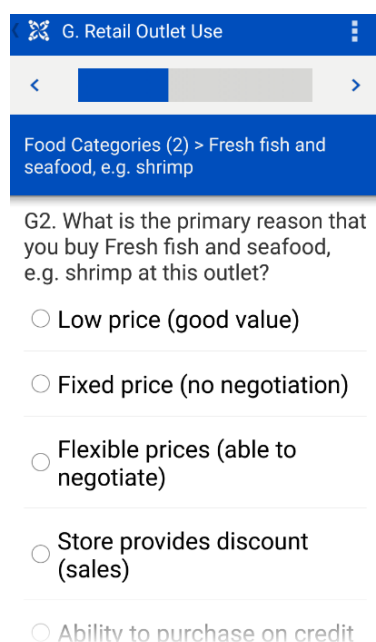


***G1. Where do you usually buy [Food Product...?]***

- NO cell in column G1 can be blank.
- They may purchase as multiple locations, but only one answer is allowed in the app. So emphasize to the respondent that we want to know the outlet that they purchase product at MOST frequently only.

### ***G2. Primary reason of buying of the [Food Product...] at the outlet***

- PROMT ANSWER: Enumerator should ask respondent to explain the reasons they choose outlet for food product and if the answer matches with the options in the app, just select the option.
- If respondent struggles to think of reason then enumerator can prompt them by showing them the lists from the app and let them pick one (See codes provided on bottom of Section G (1-22) in the form).
- Use only 1 option for each food product category- if respondent indicates more than one reason then ask them to specify the MOST important.



The screenshot shows a mobile application interface. At the top, there is a blue header with a white icon and the text "G. Retail Outlet Use". Below the header is a navigation bar with a blue background and white text that reads "Food Categories (2) > Fresh fish and seafood, e.g. shrimp". The main content area has a white background and contains the following text: "G2. What is the primary reason that you buy Fresh fish and seafood, e.g. shrimp at this outlet?". Below this text are five radio button options, each on a separate line with a light gray horizontal separator below it. The options are: "Low price (good value)", "Fixed price (no negotiation)", "Flexible prices (able to negotiate)", "Store provides discount (sales)", and "Ability to purchase on credit".

### ***G3. Best outlet for price of [Food Product...]***

- Only 1 option for blank. They should choose which 1 retail outlet is best for price in their opinion.

### ***G4. Best outlet for quality of [Food Product...]***

- Only 1 option for blank. They should choose which 1 retail outlet is best for quality in their opinion.
- QUALITY is respondent's perceptions, enumerator should NOT give a definition.

***G5. Best outlet for safety of [Food Product...]***

- Only 1 option for blank. They should choose which 1 retail outlet is best for safety in their opinion.
- SAFETY is their perception of the overall healthiness and safety of the product- that it will not make them sick or harm them.

***G6. Best outlet for trusting information of [Food Product...]***

- Only 1 option for blank. They should choose which 1 retail outlet is most trustworthy in their opinion.
- TRUST is whether they trust the information that the outlet or workers in the outlet provide. For example, if outlet says product is fresh (not frozen), expiration date, or organic that the respondent believes information to be truthful.

**H. FACTORS IN FOOD CHOICE**

***H1-H2:*** FOR FOOD: Please ask this question UNPROMPTED (without showing them the code).

***H1.*** In choosing the food products in general you purchase, what are the 3 most important factors influencing your decision?

- An example of how to ask: *“In choosing the food products you purchase, what are the 3 most important factors influencing your decision?” Or “what comes in your mind as the most important factor that influence your decision?”* We are referring to food in general, Cabbage, Tomatoes, Broccoli Water spinach,

Su su leaves, Cai meo, Mango, Plum, Pear, Peach, Shrimp, Chicken, Beef and Pork. We are not interested in processed products (e.g. dried, salted, canned, seasoned, juiced etc.)

- If the respondents cannot think about the most important factor, enumerators should read the options for H1 then ask what is overall the most important in choosing the food in general. Enumerator should let the respondent explain what is most important and then use Codes (1-22). You can only have one code (one answer) for H1.
- H1 should never be left blank. There should be at least one answer here.
- After filling in H1 then ask them what other things they consider and fill in 2nd and 3rd most important things they consider.
- In the app, the option “Never purchase”, should NEVER be used for FOOD as all people purchase some type of food.

Codes for H1 - H3		
1	Price	Vietnamese Dong per unit
2	Nutritional content	Food is a good source of nutrition, energy, protein, vitamins, minerals
3	Food safety	food that will not harm my health
4	Quality	Overall food product is good
5	Taste	Product will have a good taste and texture when I eat it

6	Freshness	Product is fresh, not old, rotten or frozen
7	Easy to prepare	Can prepare it quickly with minimal preparation time
8	Production method (e.g. organic)	Care about how product is produced – issues such as organic, pesticide-free, GMO free, chemical free.
9	Brand	Manufacturing company or food processor (e.g. Vinamik, Unilever, Masan, Vina Acecook, Nestle etc.)
10	Origin (country or region)	(Vietnam, USA, China, Thailand, Malaysia)
11	Grade or class	<i>Food grading involves the inspection, assessment and sorting of various foods regarding quality, freshness, legal conformity and market value.</i>
12	Diversity	Many different types of food products (apples, and seafood, and milk NOT certain varieties (e.g. varieties of apples or varieties of mangoes)
13	Smell	How the product smells
14	Colour	That the colour is right according to beliefs about what is good

15	Appearance	Appearance overall- not just colour, for example if the product has blemishes, bruises, looks slimy or has flies on it.
16	Firmness/texture	Is product soft or firm?
17	Variety	Variety means type of a specific food product (varieties of apples)
18	Package size	Whether the package size is too big or too little- pre-packaged versus loose
19	Expiry date	Expiration date information (Use-by-Date)
20	Other labelling info	Any other labelling information
21	Never purchase this item	I never purchase this food item
22	Other, please Specify	If the respondent choose any other option, please ask them to specify.

**H3.** In choosing each of the following types of products, where does the best quality of these products come from and where would you prefer to not purchase products from?

Here we are interested in the origin or places from where the best quality of these abovementioned products in H1 and in H2 come from.

The respondent can provide up to 3 best origins of their preference and 3 worst origins of these food products that they do not prefer.

**H4.** How often do you use food ingredients and nutrition labels when shopping for food?

Codes are provided for this question as: 1= Always, 2=Often, 3= Sometimes and 4= Never.

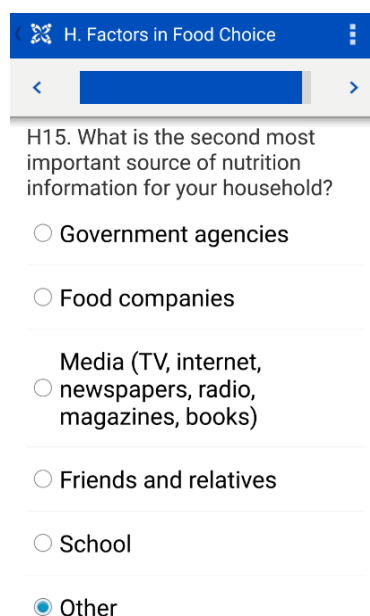
H5. [If H4 is 1-3] What type of nutritional information do you use or look for?

- This question should only be answered if H4 =1-3.
- Enumerator should prompt and ask about each specific nutrient in H5-H13.
- Response is 1 = Yes, look for information, 2 = No, do not look for information

**H6.** What are the first and second most important sources of nutrition information for your household?

For H6,

- Ask about their most important source of information regarding nutrition and health information. See codes provided to right (1-7)
- Ask them who second most important source of information is. See codes provided to right (1-7)
- If code is “other”, then please specify what “other” means.



The screenshot shows a mobile survey interface. At the top, there is a blue header bar with a white icon of a crossed fork and knife, followed by the text "H. Factors in Food Choice" and a vertical ellipsis menu icon. Below the header is a navigation bar with a left arrow, a blue progress bar, and a right arrow. The main content area displays the question: "H15. What is the second most important source of nutrition information for your household?". Below the question is a list of radio button options: "Government agencies", "Food companies", "Media (TV, internet, newspapers, radio, magazines, books)", "Friends and relatives", "School", and "Other". The "Other" option is selected, indicated by a blue dot next to the radio button.



## I. Nutrition attitudes and food concerns

I1-I27: Before starting these questions, the enumerator should read the following statement (on top of page) to the respondent:

*“For the next set of questions I1-I27, I am going to read you several statements. After I read you each statement then I would like you to point at the scale and tell me how strongly you agree or disagree with what I have said. 1 = STRONGLY DISAGREE and 5 = STRONGLY AGREE. There is no right or wrong response – I am really just interested in getting your OPINIONS and BELIEFS.”*

- SHOW RESPONDENT GREEN "AGREEMENT" SCALE PROVIDED ON CARD.  
RESPONDENT SHOULD POINT TO LEVEL OF AGREEMENT
- Place 1-5 in the blanks for I1-I27.
- NO QUESTION SHOULD BE BLANK- ALL QUESTIONS SHOULD BE CODED 1, 2, 3, 4, or 5.

LEVEL OF AGREEMENT				
STRONGLY DISAGREE	SOMEWHAT DISAGREE	INDIFFERENT/ UNSURE	SOMEWHAT AGREE	STRONGLY AGREE
1	2	3	4	5
---				+++

## J1. CERTIFICATION AWARENESS, PURCHASES, PERCEPTIONS

### *SECTION J1. Awareness of claims*

#### *Question J1*

- For each claim listed the enumerator should ask “Have you ever seen or heard of fruits and vegetable products that are sold ....

Example for organic: “Have you ever seen or heard of fruits and vegetable products that are sold *Organic or Certified Organic?*”

***Question J2***

Have you ever PURCHASED fruits and vegetables that are sold as...?

Example for organic: “Have you ever PURCHASED fruits and vegetables that are sold as *Organic or Certified Organic?*”

- Note: AWARE means whether or not they have ever seen or heard of the claim.
- Code as 1 = Yes, they have heard or seen such products; 2 = No they have never heard of or seen such products.
  - If the respondent “does not know” then code as “2 = No”
- No space should be left blank, must be coded as 1 or 2.

***J3 – J6. Questions about different labels/standards of fruits and vegetables.***

- This section/table is to assess respondents’ perceptions of what FOOD products labelled with the 5 claims: Advertised quality by seller, Safe" Vegetables, Viet Gap certified, Organic and Organic certified by PGS.

Definition of product labels:

- Advertised Quality by seller: Traceability information covers place of origin of the product but no further information on the product label.
- Safe Vegetables: Product is produced by safe vegetables protocol by a group of farmers and certification is only on production condition.

- Viet gap fruits and Vegetables: Vietnamese Good Agricultural Practices (Viet Gap) is certified by Government which prevents or minimizes the potential hazards of chemical, biology and physics that could occur during production, harvesting and post-harvest handling of fruit and vegetables. Safe and clean fruits and vegetables are sold in safe vegetable stores. Traceability information covers farming
- Organic Vegetables: Produced by a group of farmers. It has a certificate which shows that no chemicals or pesticide have been used in the production.
- Participatory Guarantee Systems (PGS) certified organic vegetables: Organic certification is certified by NGOs organizations which adopted international PGS organic standards. Organic certified vegetables are sold in the fresh market. Traceability information covers farming, distribution and processing, circulation and marketing.

- Please do this one column at a time.

- ***Question J3:***

Begin question J3 by first asking: “When purchasing fruits and vegetables, how important it is for you that the product is labelled or certified as....?” This question is asked to understand if the respondent is aware of the meaning of certified labels how much of importance they are giving in choosing between conventional fruits and vegetables and organic, safe or pesticide free fruits and vegetables.

- Show the respondent the ‘Importance Scale’ on the app window. Respondent should point to level of importance.

- Place 1-5 for question J3.
- NO QUESTION SHOULD BE BLANK- ALL QUESTIONS SHOULD BE CODED 1, 2, 3, 4, or 5.
- **Question J4:**  

Have you ever bought/use fruits or vegetables labelled as [...]? Show the respondent the food product labels with the 5 claims: Advertised quality by seller, Safe" Vegetables, Viet Gap certified, Organic and Organic certified by PGS.

  - If their response in row 1 is “yes”, then proceed to ask the questions in rows 2-10.
  - No space should be left blank, must be coded as yes = 1 or no = 2. If the consumer doesn’t know any standards for fruits and vegetables, the answer should be “No”, then go to the next module.
- **Question J5: Place(s) you have bought them**  

This question asked to know the place from where they have bought the fruits and vegetables labelled as [...].
- **J6. Agreement**
  - Do you agree with the following statements? [Complete each column in this section ONLY if the answer in row 1 above = yes. Otherwise leave column blank]
  - Asks the question about the reason of buying the fruits and vegetables labelled as [...]. We have 9 agreement statements which are answered by choosing the option “Yes” or “No”
  - No space should be left blank, must be coded as 1 – 10 in the hard copy of the questionnaire.
  - If they do not want someone to certify then use “10 = no difference”.

## SECTION J2: TRUSTS AND CERTIFICATION

*J7-J9 ask the questions about TRUST TO CERTIFY [...] For Fruits and Vegetables, Shrimp, Chicken and Beef.*

For each certification in the row, we want to know who they think would be best to certify that attribute for fresh Fruits and Vegetables, Shrimp, Chicken and Beef. There is no right answer – it is the respondent’s opinion of who they think is best for each different type of certification and food product.

- ***Safety certification:*** Agency is inspecting the production processes to ensure that producers and processors are following “best practices” to prevent food borne pathogens or residues that might harm human health. The following are claims that might be used: "Clean", "Safe", “Organic”, Expiry Date, and No Additives.
- ***Quality certification:*** Agency inspects the product to guarantee that the product meets specific grades or standards or levels of quality.
- ***Production information certification:*** Agency inspects and verifies that claims such as organic, pesticide free, natural etc. are actually used.
- ***Nutrition information certification:*** Agency is inspecting food manufacturer to make sure any nutritional claims such as fat free, low fat, low calorie, low sugar, high energy etc. are true.

The following table provides some examples for codes for J8

Codes for J7-J9	
1	The Vietnamese Government (Federal) (e.g. Central Government, Ministry of Health)
2	State or local government (e.g. Provincial or District government)
3	Foreign Government (e.g. E.U., USA, China, Japanese government)
4	Farmers & farmer organizations Individual farmer or Vietnamese farmers org. HKTI
5	Food company (brand) Vinamik, Unilever, Masan, Vina Ace-cook, Nestle
6	Retailer/Supermarket Metro, Big C, Fivi Mart, Uni-mart, AC Mart, Minimart.
7	Independent 3 <sup>rd</sup> party (not for profit) Not for profit organization, WHO, consumer group,
8	Religions organization The Charity Commission of the Buddhist Church of <i>Vietnam</i>
9	Other (Specify)
10	No opinion This should be used only if they suggest another option, this is not suitable for “do not know”

**J11. Does your household ever purchase (...) product?**

- All cells in J11 must be filled in with either 1 = Yes or 2 = No
- If J12 = 2 then do not need to answer J13-J15 for the product and can skip to next product (row)

J12-J14: Only Ask for product if J12 = 1, otherwise skip to next product (row)

**J12. Normal price paid**

- Ask respondent to estimate the average price per unit (VND per kilogram) that they pay for each product. It is their best estimate.

- If they purchase different varieties (e.g. different varieties of mangos), then just ask for an average price per kilogram.

- Only blank if J11 = 2

**J13. Choice:** between buying conventional [product] and [product] that is labelled "Certified [...]" Ask respondent *"If you have a choice between buying conventional [product] and [product] that is labelled "Certified Organic", which one would you buy?"*

- Must be a code (1-3) if respondents buy product (J11 = 1).
- Only blank if J11 = 2

**J14. Maximum amount willing to pay:** What is the maximum amount that you would be willing to pay for [product] that is labelled as "[Certified ...]?"

- Only ask to respondents if J12 = 2 or J12 = 3.
- Ask respondent "What is the maximum amount extra that you would be willing to pay for [product] that is labeled as "Certified "?"
- Note for the enumerators:
- For J14, create that comes up with a series of prices that are calculated off of the value the respondent indicate for J13. So we would have 5 boxes each in 20% premium increments. If the respondent said that they would pay \$2/kg for tomatoes normally then we'd have 5 boxes that had a formula in them that calculates the % based on what they put in J13. The boxes that would pop-up in the app would be as shown below in \$ values appropriate. Then enumerator would code in what they punched 1-5 where 1=0% premium, 2=25% premium, 3 = 50% premium; 4= 75% premium; 5= 100% premium.

Considering the value that the household normally pay for (product listed (J10))

for question J11), what is the most that you would be willing to pay for a certified ....(NOTE- this would be 1) "Certified-Safe" and then 2) "Certified Bac Ha Grown"

<b>Formula embedded</b>	= J13	=1.25*J13	=1.50*J13	=1.75*J13	=1*J13
<b>Values REspondent Sees on Screen and can point to and select</b>	\$2.00/kg	\$2.50/kg	\$3.00/kg	\$3.50/kg	\$4.00/kg

## K. DIET RELATED HEALTH AND MANAGEMENT

### K2. Level of concern:

- We want to know whether or not they are concerned about these health and diet related diseases – we are NOT asking about whether they have the disease, but whether they are concerned.
- You might suggest explaining that OBESITY means “very fat” and UNDERWEIGHT means very thin
- Please try to get them to answer 1-5 (Show them the options in the app)
  - 1 = NOT at all Concerned. This means that they are not worried at all about whether or not they have or will get this disease.
  - 5 = EXTREMELY OR VERY CONCERNED- they are worried about getting this disease and possibly do things such as buying different food products or changing what they eat or the amount of exercise they get to try and prevent or manage the disease.

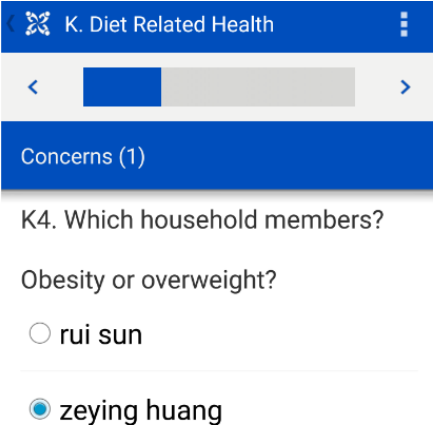


### ***K3. Diagnosed***

- This question is to know if a licensed medical practitioner (e.g. doctor, nurse, dietician, government health official) has diagnosed ANYONE (adult or child) with the diseases.
  - Diagnosis by a non-medical professional (e.g. natural health practitioner) is not suitable for “Yes”
- If the answer is “Yes” then they also need to answer K4 and following questions in the row.
- If the answer “No” then they do not need to answer K4-K9 for that row, they can skip to the next row.

### ***K4. Which household member was diagnosed?***

- Select the name of the household member from the options in the app



The screenshot shows a mobile application interface. At the top, there is a blue header with a white icon and the text 'K. Diet Related Health'. Below the header is a navigation bar with a left arrow, a blue selection bar, and a right arrow. Underneath is a blue bar with the text 'Concerns (1)'. The main content area displays the question 'K4. Which household members?' followed by 'Obesity or overweight?'. There are two radio button options: 'rui sun' (unselected) and 'zeying huang' (selected).

### ***K5. Year first diagnosed***

- If K3 = 2 (“no”) for row then please leave blank.
- We just want to know the year of diagnosis for the first person who had the disease in the household.

- Example: A household has 3 members that have obesity, their names are Jesmin, Zung and Ina, Jesmin was diagnosed with obesity in 1998, Zung was diagnosed with obesity in 2002 and Ina was diagnosed in 2008.
- The response in K5 (Obesity) would be “1998” because this was the year the disease was FIRST diagnosed in the household.

***K6. Were any changes made to manage the diagnosed diseases?***

- This is “yes” or “no”. Ask if they have done anything to try and manage their disease, in other words, if they have diabetes, what are they doing to keep it from getting worse or harming their ability to lead a normal life. If they have obesity, are they doing things to keep from gaining more weight or to lose weight?
- If Yes then go to K7
- If No then No need to ask questions for K7, K8 and K9 and these questions will not appear in the app.

***K7-K9. What has been done?***

- Ask this question “Unprompted”. In other words if their answer to K6 was “YES” then you would ask the respondent “*What have you done to control [problem]?*” You should code their responses using the codes provided in the lower right hand side of page. (Codes for K7-K9 are 1-15).
- If respondent cannot think of specific ways they manage disease, THEN show respondent the codes and they can indicate yes or no. We do not want more than 3 for each row/disease.
- If they only do 1 or 2 things to manage disease then no need to ask questions K8 to K10

- If no code matches their explanation then please code using “15” and explain in the space provided.

**NOTE: FOR K1** “Underweight or malnourished” K6-K9 should not be filled in.

***K10. Experienced diarrhoea***

- We want to know if ANYONE (ADULTS AND CHILDREN) in the household has experienced diarrhoea in the past year. The answer should be either Yes or No. If they answer Yes, then you should ask the name of the family member that appears in the app as below:
- This does not have to be diagnosed by medical professional- just if they think they have had diarrhoea.
- NOTE: Code is provided above question.



The screenshot shows a mobile application interface. At the top, there is a blue header with a white icon of a crossed fork and knife, followed by the text "K. Diet Related Health" and a vertical ellipsis menu icon. Below the header is a navigation bar with a blue background and white arrows on either side of a central white bar. The main content area has a white background and contains the text: "K10. In the last 12 months have you or anyone in your household experienced severe diarrhea?". Below this text are two radio button options: "Yes" (which is selected) and "No".

***K11. Experienced illness related food poisoning***

- We want to know if ANYONE (ADULTS AND CHILDREN) in the household has experienced any illness that they think they obtained from bad food. For example if they got diarrhoea, vomiting, and/or stomach ache that they think is related to the food they ate then the response should be 1 or 2.

- This does not have to be diagnosed by medical professional- just if they think they got sick because of something they ate.

***K12. Adult saw any medical professional?***

- We want to know if any ADULTS saw a doctor or health care provider in the past 12 months- this should be a licensed doctor, nurse or government health care worker – NOT traditional or alternative medicine provider.

***K13. Child saw any medical professional?***

- We want to know if any of the CHILDREN saw a doctor or health care provider in the past 12 months- this should be a licensed doctor, nurse or government health care worker – NOT traditional or alternative medicine provider. The answer should be either Yes or No.

**L. OTHER**

***L1. Change in household size***

- L1 has a code (1-3)
- Today compared to 5 years ago (2011 vs. 2016)
- 1 = increased could be because of birth, marriage, in-laws moving in etc.
- 2 = No change or household is the same size as it was 5 years ago
- 3 = household size decreased could be because of a death, divorce/separation, child moving out, household member working away from home etc.

***L2. Change in health status***

- L2 must have a code (1-4)
- On average are people in the household more or less healthy than 5 years ago? (2011 vs. 2016)

- This is the respondent's opinion or perception.
- 1 = improved, 2 = no change (same as 5 years ago), 3 = deterioration (worse than 5 years ago), 4 = do not know (only use if respondent doesn't understand or really has no understanding)

***L3. Specify the change***

- Only answer if L2 = 1 (improved) or 3 (deterioration)
- Use codes 1- 6 provided
- Specify the reason in word, if the respondent chose the option "Other".

In the app L3 will only appear if the respondent answers Improved or deterioration in question L7.

***L4. Approximate gross income per month***

- L4 has a code (1-10)
- Income of the household per MONTH, this should include any income coming into the household from all household members EXCEPT domestic employees. For self-employed members income is business revenue minus business expenses.
- Use the code (1- 10) provided that gives the best estimate of total household income

***L5. Change in standard of living?***

- L10 must have a code (1-5)
- Standard of living today compared to 5 years ago? (2011 vs. 2016)
- This is the respondent's opinion or perception.

***L6. Reason for change***

- If L5 = 3 then skip question L6. Otherwise L6 must have a code (1-9) and only one response should be coded. If respondent says change is related to more than one reason then enumerator must ask them to specify the most important reason for the change.
- This is the respondent's opinion or perception.

## **M. ECONOMIC SHOCKS**

The Recall period for economic shocks is 5 years (2011-2016).

- Note to enumerator: Households sometimes have good and bad surprises. First ask about any bad surprises or things that hurt the household financially.
- Section M has Shock codes from (1-32) for a variety of economic loss that affected the household member financially. If the household responds that there were some other reason (NOT included in the codes), then select the option "Other" (code 99) and specify the reason.

### ***M1. Which shocks?***

- Asks the respondent "Which shocks did you experience in the last 5 years (2011-2016)?" The respondent may either select the options from the app or may specify other option.
- Please note that the household can select multiple option considering the possibility of facing multiple shocks faced by the household members.

### ***M2. Number of occurrences***

- Asks the following question: "If yes, how many times did it occur in your household in the last 5 years (2011-2016)?" The household may have faced the same shock more than one time during the past 5 years.

***M3 – M4. When did it happen?***

- Select the month and the year of the first occurrence of a shock. You do not need a specified date if the household does not know which day it has happened.

***M5. Current condition after the shock***

Asks the current condition of the household after the shock/shocks.

**M6 HOW MUCH ECONOMIC IMPACT HAVE YOU FACED AFTER THE SHOCK?**

0= no impact, 1=small impact, 2 = moderate impact, 3= Large/significant impact

***M7 Coping strategy***

These questions ask about the coping strategies taken by the household in response to any shocks. M7 will ask about the first coping strategy

***M8 Impact of the shock (How Long?)***

- This question asks the respondent how long did the impact of the event or shock last. The answer should be given as the number of days that were affected by the event/shock.

In the app, M2 to M10 will appear for each type of the shocks selected by the respondent.

***M9 rank the worst three shocks***

- Ask the respondent to rank the worst 3 shocks if they have responded more than two shocks in the past five years. Show them the options from the app to rank the worst 3 shocks.

## Module N: HOUSEHOLD FOOD CONSUMPTION SCORE NUTRITIONAL QUALITY ANALYSIS

- The enumerator should read the following to the respondent: “Now, I am going to ask you how many days over the last 7 days, did members of your household eat the following food items, prepared and/or consumed at home, and what was their source? I am going to read you several statements. Please tell me either yes or no, and if yes, how often does it happen.”
- *Question NI-N9* are the questions about the food items that were prepared and/or consumed by the household at home and where was their source. There are 16 food groups in SECTION N which are as follows:

### FOOD ITEMS IN MODULE N

Cereals, grains, roots and tubers: Rice, pasta, bread, sorghum, millet, maize, potato, yam, cassava, white sweet potato

Legumes / Nuts: beans, cowpeas, lentils, nut, soy, pigeon pea and / or other nuts

Milk and other dairy products: fresh milk / sour, yogurt, cheese, other dairy products

(Exclude margarine / butter or small amount of milk for tea / coffee)

Meat, fish and eggs: goat, beef, chicken, pork, blood fish including canned tuna, escargot, and / or other seafood, eggs (meat and fish consumed in large quantities and not as a condiment)

Flesh meat: beef, pork, lamb, goat, rabbit, chicken, duck, other birds, insects

Organ meat: liver, kidney, heart and / or other organ meat



Fish/shellfish: fish including canned tuna, escargot, and / or other seafood, eggs (fish in large quantities and not as a condiment)

Eggs Trúng

Vegetables and leaves: spinach, onion, tomatoes, carrots, peppers, green beans, lettuce, etc.

Orange vegetables (vegetable rich in Vitamin A): carrot, red pepper, pumpkin, orange sweet potatoes

Green leafy vegetables: spinach, broccoli, amaranth and / or other dark green leaves, cassava leaves

Fruits: banana, apple, lemon, mango, papaya, apricot, peach, etc.

Orange Fruits (Fruits rich in Vitamin A): mango, papaya, apricot, peach

Oil / fat / butter: vegetable oil, palm oil, shear butter, margarine, other fats / oil

Sugar, or sweet: Sugar, honey, jam, candy cookies, pastries, cakes and other sweet (sugary drinks)

Condiments / Spices: tea, coffee / cocoa, salt, garlic, spices, yeast / baking powder, tomato / sauce, meat or fish as a condiment, condiments including small amount of milk / tea coffee

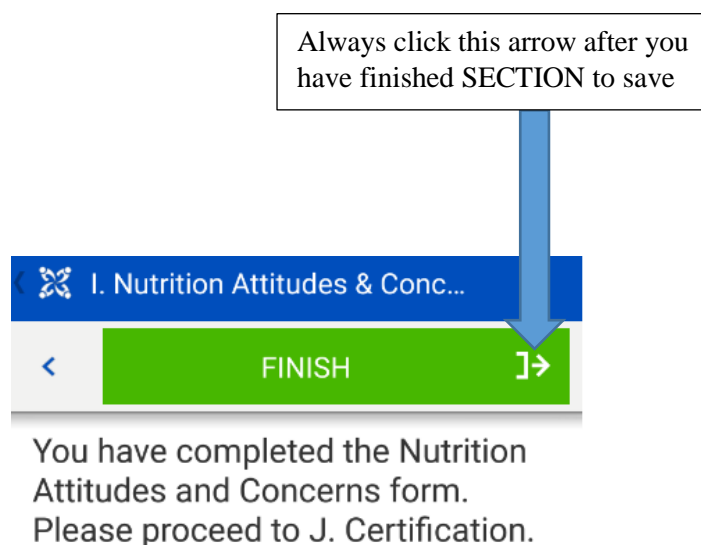
- For each of these 16 food items, the respondent must answer the “Number of days eaten in previous 7 days”
- For each of these 16 food items, the respondent must answer the “main source of this food in the last 7 days”
- An example in the app is shown below:
- Codes for the question: “What was the main source of this food in the last 7 days?” are as follows:

1. From Own production (e.g. own garden or farm)
2. Purchased by the family member
3. Borrowed from friends/relatives
4. Gifts from friends/relatives
5. Food assistance (e.g. from government organizations or NGOs)

### FINAL QUESTION:

1. TAKE THE ANTHROPOMETRIC MEASUREMENTS: Follow the instruction provided in the anthropometric manual.
2. LEAVE THE 24 HOUR FOOD RECALL FORM TO THE HOUSEHOLD AND PICK THEM LATER.

IMPORTANT: THE ENUMERATOR SHOULD LEAVE THE 24 HOUR FOOD DIARY FORM TO THE RESPONDENT TO BE FILLED IN LATER. ALSO ASK HIM/HER THE MOST CONVENIENT TIME TO PICK THE FORM LATER OR SOME OTHER DAY.



## TRAINING MANUAL FOR ANTHROPOMETRIC MEASUREMENT

<p>Anthropometric measurements<sup>30</sup></p>	<p>Take the anthropometric measurements AFTER the interview is finished.</p> <p>Prior to taking the physical measurements, explain to the participants that you will be taking the following measurements of <u>all</u> household members:</p> <ol style="list-style-type: none"> <li>a. height</li> <li>b. weight</li> <li>c. mid-upper arm circumference</li> <li>d. waist</li> <li>e. hip</li> </ol> <p>It is preferable to have female field researchers or enumerators do this as female respondents may not be comfortable when getting the waist and hip measurements.</p>
<p>Height (cm)</p>	<p>We are also interested in getting the height (in centimetres), weight (in kilograms), mid-upper arm circumference (in centimetres), waist (in</p>

<sup>30</sup> Detailed information on how to correctly record anthropometric measurements were taken from:

- a. Height and weight for adults, waist and hip measurements - WHO STEPwise Approach to Surveillance (STEPS) (2008) Section 3 Guide to Physical Measurements, pp. 3-3-1 to 3-3-14, <http://www.who.int/chp/steps/manual/en/index3.html> [WHO. *WHO STEPwise approach to surveillance (STEPS)*. Geneva, World Health Organization (WHO), 2008.];
- b. Height and weight for infants, MUAC - National Health and Nutrition Examination Survey (NHANES) Anthropometry Procedures Manual (2007) (including photos) published by CDC, pp. 3-1 to 3-16 ([www.cdc.gov/nchs/data/nhanes/nhanes\\_07\\_08/manual\\_an.pdf](http://www.cdc.gov/nchs/data/nhanes/nhanes_07_08/manual_an.pdf)) [National Health and Nutrition Examination Survey. (2004). *Anthropometry procedures manual*. Atlanta, GA: Centers for Disease Control and Prevention.]

centimetres) and hip measurements (in centimetres) to link with the consumption data, and see if there is any relationship between these variables.

For adults, the height and the weight will be used to compute for their body mass index [BMI= (weight in kg) / (height in centimetres)<sup>2</sup>]; waist and hip will be used to compute for the waist-to-hip ratio (WHR = W ÷ H).

For children, the height and weight will be converted into z-scores, and will be evaluated based on the WHO child growth standards to identify severe acute undernutrition.

To get the height measurements, first, all adults and children who can stand by themselves will be measured in centimetres using a tape measure.

- a. First, ask them to remove their shoes, slippers or sandals, and any head gear (cap, hat, hair brows, ribbons, etc.) before taking their height measurements.
- b. Place the tape measure on a flat vertical wall with a flat even floor.

- c. Ask them to stand with his/her back to the tape measure on the wall. Feet should be together; heels against the back board; knees straight; the back of the head, back, buttocks, calves and heels should be touching the upright, feet together.
- d. Ask the participant to hold the head in a position where s/he can look straight at a spot, head high, on the opposite wall (no tilting).
- e. Make sure eyes are the same level as the ears.
- f. Ask the participant to breathe in and stand tall. Place the ruler perpendicular to the tape measure and slide down to the head so that the hair (if present) is pressed flat.
- g. Record the height measurement in centimetres.

For infants and toddlers of up 3 years who cannot stand on their own,

- a. Place them in a lying down position facing upwards on an infant meter, if available.

	<ul style="list-style-type: none"> <li>b. Adults and children with illness or injury and are unable to stand will also be measured in a similar fashion but not on an infant meter.</li> <li>c. When in this position, have both legs outstretched with their feet resting on a hard piece of wood or on the wall before taking any measurement.</li> <li>d. If the participant is having difficulty having both feet outstretched, one leg would also suffice.</li> </ul>
<p>Weight (kg)</p>	<p>To measure weight, use the digital weight scale provided to you and get the value in kilograms.</p> <p>Place the scale on a flat even surface. Do not place it on carpet or sloping floor. If impossible to find a flat even surface (house is on a compacted soil or mud floor), ask for a wooden flat board.</p> <p>First, all adults and children who can stand by themselves will be weighed in kilograms using the digital weight scale.</p> <ul style="list-style-type: none"> <li>a. Ask them to remove any heavy piece of clothing, items in their pockets, and shoes, slippers or sandals before taking their weights.</li> </ul>

b. Ask them to place both feet on the scale, stand still, face forward, and arms on the side.

c. Record the weight in kilograms.

For infants and toddlers who cannot stand by themselves on the weighing scale, they will be weighed with the help of an adult.

a. The adult and infant will be weighed at the same time.

b. Then, the adult's previous weight will be deducted to get the infant's weight.

c. Infants should only wear diapers and/or thin clothing, if possible.

Exhibit 3-4.  
Marking spine extending from acromion process



Exhibit 3-5.  
Correct tape placement for upper arm length



Exhibit 3-6.  
Incorrect tape placement for upper arm length



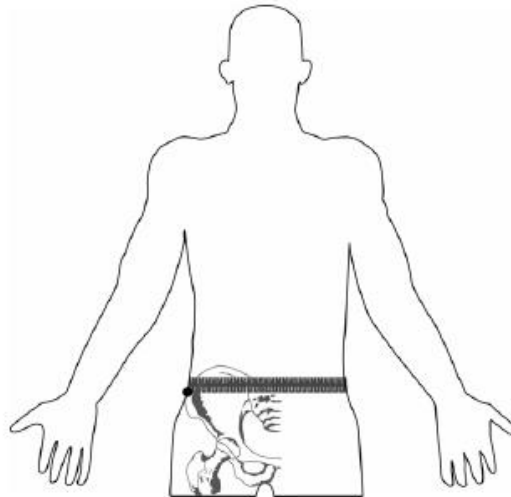
Exhibit 3-7.  
Marking upper arm length midpoint



Exhibit 3-9.  
Abdominal (waist) circumference mark



Exhibit 3-10. Measuring tape position for abdominal (waist) circumference



\*\*\*Note: These figure shows how to get the midpoint in the right arm for the mid-upper arm circumference measurement. Source: NHANES (2008), p. 3-13

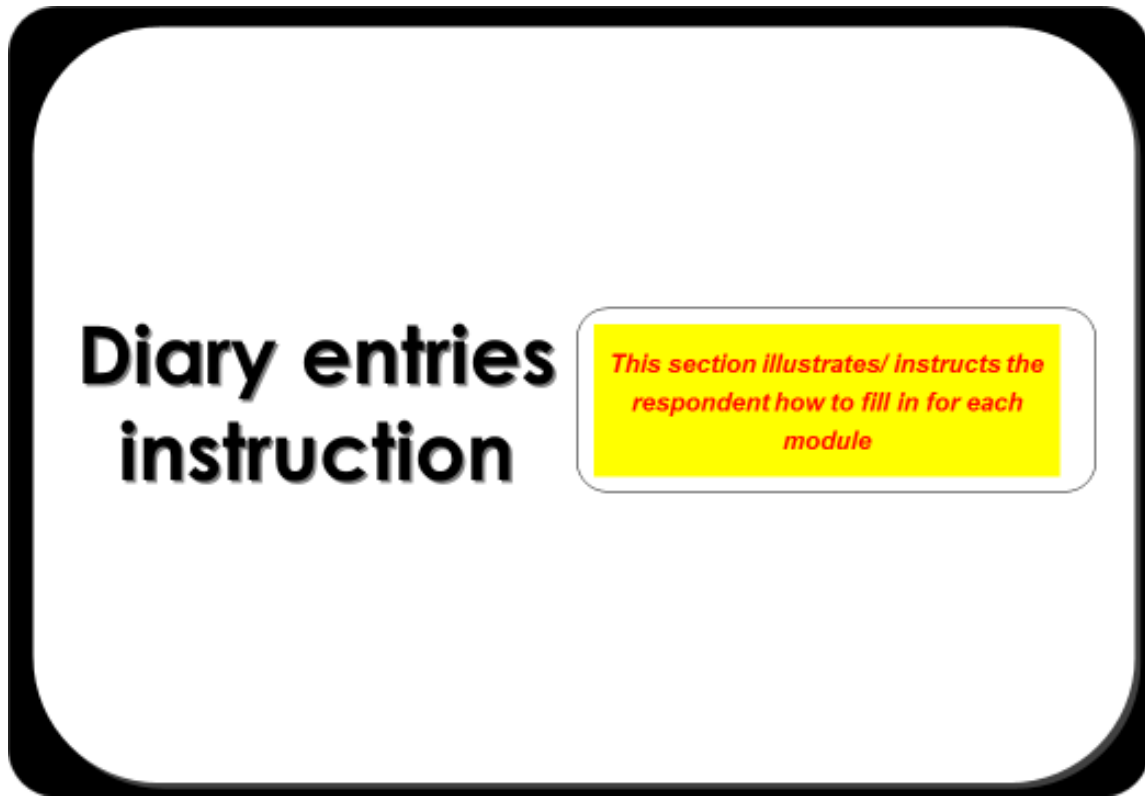


## **ENDING THE HOUSEHOLD INTERVIEW**

After completing the questions thank the respondent for his or her time. As a matter of courtesy, it may be appropriate to ask the respondent if he or she has any questions about the survey or the study.

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**Appendix 7: 24-hour food diary questionnaire and instructions for the interviewee to complete the 24 hour food diaries**



## Instructions

### Module 1



#### Instructions on how to complete the diary

- Instruction: This part of the interview is to ask you **[THE MAIN PERSON WHO IS RESPONSIBLE FOR FOOD PURCHASING DECISIONS]** what your entire household members ate or drink in the past 24 hours. For example, the person who would tell the domestic assistant (if they have one) what to buy and give advice on what to cook.
- Please recall and tell us all items including:
  - Food (main dish, snacks, vegetables, fruits, soups & other soft food taken for babies – if any)
  - Drinks (water, tea, soft drinks, milk and milk substitutes & other beverages).
  - Alcohol (including home-made alcohol)
  - Any type of condiment (fish sauce, vinegar, pepper, salt, ketchup, chilli or any other spices).

#### When and how do I need to complete the diary?

- Ideally you should complete a Diary Entry immediately after you eat/prepare a food (as it will be easier for you to remember) but if you aren't able to do this please make note during the day and fill the diary entries once you are able to
- Your 24h food recall starts tomorrow morning when you start your FIRST meal and end until your last meal of the day

### Module 2

## Instructions for the interviewee to complete 24 hour food diaries

### Diary entry instruction

### Instruction for quantity measurement

- While filling in this diary, you will need to ask about volume of measurement for food/ drink that you have consumed in the past 24 hour.
  - Use the below kitchen equipment to estimate the volume/ quantity.
  - **Note:**
    - If you have used a plate(s), convert the dish into an equivalent bowl to measure the quantity of food eaten.
    - You need to measure the amount of food eaten/ drink taken only, NOT the equipment itself.
- For example:** Your house has glass No 5 and you drink half glass of water, you need to fill in 160ml in Module 2 for Quantity question.



## Instructions for the interviewee to complete 24 hour food diaries

### Diary entry instruction

#### Instruction for Module 2: Intra-Household 24h food recall



1. In Module 2, please use an individual page for each HH member. If you need more pages for each HH member, please use the next page.
2. Each HH member can use multiple pages (as many as needed).
3. In order to fill in food/ drink consumption for each of the occasion, please fill in the diary immediately after the dish is consumed or a drink is taken, if possible. Otherwise, instruct your HH member to remember his/ her food consumption according to the order of food/ drink is taken in the past 24h for each occasion.
4. Look at the example sheet provided for more information about the way to fill in the diary



#### Instruction for Module 3: Recipe

1. Each page in Module 3 will be used for 1 home-made/ home-cooked dish/ drink (including alcohol) for 1 single use.
2. If for example you cooked 3 dishes for dinner, please fill in 3 separate sheets.
3. To fill these portion, do it by recipe.
  - List all ingredients used for the first recipe (ingredient 1, ingredient 2, ingredient 3, etc.) in the order of cooking/ making
  - Then, for each ingredient, please fill out equivalent required information.
4. Use the example sheet for more information about the way to fill in the diary

### Module M3 – Recipe



M16: Name of the respondent

Hing

M22a: Occasion/When eaten?

1. breakfast
2. brunch
3. morning snack
4. lunch
5. afternoon snack
6. dinner
7. late night meal
99. other (specify)

M25a: Name of home-made dish/drink: Fried rice

Does this person play a role in (MA)


- 1) Food purchase decisions;
- 2) Selection of menu
- 3) Main meal cooking/preparation

M25.b List all ingredients (edible and inedible part both)**	M25.c. Quantity of raw ingredient used for cooking	M25.d. Unit of measure	M25.e. Price per unit (in '000VND/unit)	M25.f. Where did you get this ingredient?	M25.g. If purchased, who bought it?
used for each dish you mentioned in M25.a if possible.  Describe if the food is edible or inedible (e.g. the bone part of the meat is inedible) → No space in the Qnaire to record this information	x	1. g [g] 2. ml [ml] 3. Number 4. Litre 5. Kg	(in '000VND/unit)	1. Own garden/farm 2. Ward/commune market (specify); 3. District market (specify); 4. Restaurant/cafe (specify); 5. Food stall/hawker; 6. Supermarket/grocery shop; 7. Small store near home ; 8. Office/school; 9. Neighbours 10. From home tap water 11. Relatives brought it from village	1. Husband 2. Wife 3. Father /mother /old the son/daughter/helper/relative/ other HH member 4. Son 5. Helper/relative/other HH member 6. The Diary writer her/himself 99. Other (specify)
Rice (From Hai Hau)	300	1	30	2	2
Egg	2	4	5	1	4
Fish sauce (Chinsu)	5	2	price of the whole bottle or just for 5ml used?	2	2
Onion	1	1	price of a kg/ gram or 1 piece only?	1	2

#### Example sheet for Module 3

## Instructions for the interviewee to complete 24 hour food diaries

**Module M2 –  
24h Food recall**



M16 **Name of the respondent** \_\_\_\_\_

M16 **HH Member 1 ID:** \_\_\_\_\_

M16.2 **Does this person play a role in:**

1) Food purchase decisions;  
2) Selection of menu  
3) Main meal cooking/preparation

M16.1a **Age?** \_\_\_\_\_

M16.1b **Gender?** 1: Male 2: Female

M12.b. Name for main food, drink, alcohol, fruit	M12.f. Food types - Please write codes for each occasion	M12.c. Quantity of food/drink consumed	M12.d. Unit	M12.e. Total price of the food item for each occasion	M12.a. Occasion/When eaten? (note the numbered option & detail timing)	M12.b. Place eaten	M12.f.1. Where was the food prepared?
	1. Main Foods 2. Drinks including drinking water 3. Alcohol (including homemade alcohol) 4. Fruits	(For any food item that contains inedible portion (e.g. banana skin, mango stone, chicken or fish bones), only weigh the edible portion only. Please use standard units as suggested in the photos)	1. g [g] 2. ml [ml] 3. Number 4. Litre	(If you do not have to buy, just write n/b)	1. breakfast 2. brunch 3. morning snack 4. lunch 5. afternoon snack 6. dinner 7. late night meal 99. other (specify)	1. Eaten at home 2. Packed food to office or school 3. Restaurant/coffee shop 4. Office/school 5. School/day care food outlets 6. Street food vendor 99. other (specify)	1. Prepared at home 2. Bought outside 3. Given by neighbor
Bread egg	1	3 (2bread+1egg)	4	10,000	1 (7:30 – 8:00)	1	1
Banana	4	2	4	2,000	2 (9:40 – 9:45)	1	1
Boiled water	2	200	2	1,000	2 (9:40 – 9:45)	1	1
Champagne	3				6 (19:00 – 20:00)	99 (friend's house)	
<b>Example sheet for Module 1&amp;2</b>							

**Appendix 8: Calorie and macronutrients calculation from food lists of 24 hour food diaries of the urban Vietnam Consumption and Expenditure Study**

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Bread, steamed</i>	Bánh bao	231	9.56	23.38	11.57
<i>Rice pudding</i>	Bánh đúc nóng	134	1.69	26.62	3.63
<i>Pyramidal rice dumpling</i>	Bánh giò	296	8	49	0
<i>Pâté bread/Bánh mì/Kebab</i>	Bánh mì Pate / Bánh mì pate thịt / bánh mì kebab / Bánh mì thịt	796	35	89	35
<i>Rice</i>	Cơm	135	1.07	27.64	2.64
<i>Grilled corn</i>	Ngô nướng	124	3.42	24.33	3.21
<i>Sweet sticky rice (with bean, peanut, momordica)</i>	Xôi đỗ / Xôi lạc / Xôi đậu phộng / Xôi ngô / Xôi bắp	97	0.19	21.09	2.02
<i>Sticky rice and chè</i>	Xôi chè	97	0.19	21.09	2.02
<i>Steamed rice cake</i>	Bánh tẻ	404	16	60	5
<i>Roasted rice/vegetarian rice</i>	Cơm rang ( Cơm rang tỏi ,... ) / Cơm chay	272	5	50	6
<i>Bread with fried egg</i>	Bánh mì trứng	320	6.67	54.17	9.9
<i>Stuffed pancake</i>	Bánh cuốn / Bánh ướt	189	10.07	20.72	4.47
<i>Boiled corn</i>	Ngô luộc ( Bắp luộc )	124	3.42	24.33	3.21
<i>Meat sticky rice cake (with chicken, pork floss,...)</i>	Xôi thịt ( xôi gà , xôi ruốc lợn , xôi chà bông heo , xôi xéo , xôi khúc...)	236	1.4	49.9	4.8
<i>Square sticky rice cake</i>	Bánh chưng / Bánh chưng rán	237	0.46	51.44	4.93
<i>Rice noodles, raw</i>	Bún / Bánh hời / Bánh tằm	109	0.2	24.9	0.91
<i>Bread</i>	Bánh mì	266	3.29	50.61	7.64
<i>Bloating Fern-shaped cake</i>	Bánh bèo	446	18	68	4
<i>Instant noodle</i>	Mỳ gói / Mỳ tôm / Mỳ ăn liền	420	17.02	57.41	9.28
<i>Fried rice with floss</i>	Cơm cháy chà bông ( cơm cháy ruốc )	154.6	6	19	6.5
<i>Vietnamese hollow doughnuts</i>	Bánh tiêu	450	25	51	4.9
<i>Mixed rice paper</i>	Bánh tráng trộn	121.15	1.2	26.7	2.5
<i>Banh tet</i>	Bánh tét	323.5	4	60	18
<i>Pankako</i>	Bánh xèo	155	2.3	25.8	7.9
<i>Fried corn</i>	Bắp xào (Ngô xào )	124	3.42	24.33	3.21
<i>Cereal</i>	Bột ngũ cốc	376	3.38	83.02	7.24
<i>Chinese cruller</i>	Bánh Quẩy	421	22.9	49.7	5
<i>Popcorn</i>	Bông ngô / Bánh ngô	500	28.1	57.2	9
<i>Nutritional baby powder</i>	Bột dinh dưỡng cho bé	510	28	39	24
<i>Rice dumpling cake</i>	Bánh bột lọc	124	3.21	20.22	3.3
<i>White porridge</i>	Cháo trắng / Cháo ăn liền / cháo gói	134	0.4	31	2.1
<i>Banh troi nuoc (dessert wading in water)</i>	Bánh trôi nước / Bánh trôi tàu / Chè trôi nước	193	4	37	3
<i>Sticky rice cake</i>	Bánh nếp	97	0.19	21.09	2.02
<i>Glutinous rice cake</i>	Bánh gai	237	0.46	51.44	4.93
<i>Fried flour</i>	Bột chiên	436	17.87	61.12	7.84
<i>Sponge cake</i>	Bánh bò	297	4.3	57.7	7.3
<i>Bong Gao</i>	Bông gạo	354	1	81	4
<i>Hamburger</i>	Hamburger	290	11.8	28.83	15.71



<b>English Name</b>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Fried noodle (vegetarian fried noodle)</i>	Bún xào ( bún xào chay ) / Bún gạo xào chay / Hủ tiếu xào chay / Miến trộn / Miến xào chay	137	2.06	25.01	4.51
<i>glutinous rice cake (filled with meat or green bean paste)</i>	Bánh ít	186	0.34	37.62	7.82
<i>Banh Cam</i>	Bánh cam	210	10	27	3
<i>Fried dumpling</i>	Bánh bao <i>chiên</i>	338	20.66	24.5	12.96
<i>Round sticky rice cake</i>	Bánh dày	97	0.19	21.09	2.02
<i>Corn Chè (sweet soup)</i>	Chè bắp / Chè ngô	146	0.02	37.41	0.07
<i>Young rice cake</i>	Bánh cốm	392	4.3	81.1	7.1
<i>Cellophane noodle</i>	Miến ( miến nấu không )	350	0.06	85.92	0.16
<i>Roasted young rice cake</i>	<i>Cốm</i> rang	392	4.3	81.1	7.1
<i>Sandwich</i>	Bánh sandwich	304	14.56	32.88	9.75
<i>Grilled dry cake (sesame rice dry cake)</i>	Bánh đa ( bánh trắng mè ,... ) nướng	420	21	60	6
<i>Pillow Cake</i>	Bánh gối	367	12.29	64.24	2.58
<i>Cress soup</i>	Canh cải xà lách xoong	32	0.7	3	2.6
<i>Garlard Chrysanthemum soup</i>	Canh cải cúc (canh rau tần ô)	24	0.56	3.02	3.36
<i>Celery soup</i>	Canh rau cần	49	2.78	4.76	1.49
<i>Cress/Cabbage soup (in general)</i>	Canh cải (không nêu rõ)	32	0.7	3	2.6
<i>Ceylon spinach and jute plant soup</i>	Canh mồng tơi rau đay	83	5.01	6.42	3.55
<i>Water spinach soup</i>	Canh rau muống	83	5.01	6.42	3.55
<i>Ashgourd waxgourd/winter melon/raw soup</i>	Canh bí xanh	14	0.2	3.02	0.4
<i>Kale soup</i>	Canh cải ngọt	50	0.7	10.01	3.3
<i>Cabbage soup</i>	Canh bắp cải	32	0.7	3	2.6
<i>Pumpkin squash soup</i>	Canh bí đỏ / Canh bí ngô	70	0.99	14.67	1.46
<i>Eggplant Soup</i>	Canh cà bưng (Cà tím nấu bưng ) / Canh cà tím	122	10.28	7.87	0.92
<i>Spinach soup</i>	Canh rau dền	83	5.01	6.42	3.55
<i>Potato Soup</i>	Canh khoai tây	43	1.46	5.84	1.53
<i>Bamboo shoot soup</i>	Canh măng	63	3.56	6.76	3.35
<i>Bitter melon soup</i>	Canh khổ qua / Canh mướp đắng	44	3.03	4.21	0.81
<i>Seaweed soup</i>	Canh rong biển	36	1.62	2.43	3.42
<i>Sour soup</i>	Canh chua	67	3.24	2.03	6.19
<i>Broccoli soup</i>	Canh cải xanh	87	5.02	7.56	3.44
<i>Pennywort soup</i>	Canh rau má	32	0	0	1.6
<i>Katuk/Star gooseberry/Sweet leaf soup</i>	Canh rau ngót	45	0.4	3.5	4.9
<i>Kohlrabi soup</i>	Canh su hào	28	0.2	3.7	1.9
<i>Chives soup</i>	Canh hẹ	30	0.73	4.35	3.27
<i>Gourd soup</i>	Canh bầu	60	1.8	6	6.2
<i>Ceylon spinach soup</i>	Canh mồng tơi	83	5.01	6.42	3.55
<i>Pumpkin soup (pumpkin sprout soup)</i>	Canh rau bí ( Canh đọt bí )	29	1.02	4.5	1.03
<i>Lufa soup</i>	Canh mướp	20	0.2	4.2	1

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Cauliflower soup</i>	Canh súp lơ	27	0.67	4.19	1.13
<i>Taro soup</i>	Canh khoai môn / Canh khoai sọ	112	0.2	26.46	1.5
<i>Pickled cabbage soup</i>	Canh cải chua / Canh dưa cải	30	0.1	5.67	1.6
<i>Bean sprouts soup</i>	Canh giá đỗ	74	5.11	5.03	4.59
<i>Cai meo soup</i>	Canh cải mè	83	5.01	6.42	3.55
<i>Yam soup / purple yam soup</i>	Canh khoai mỡ / Canh khoai mỡ tím	116	0.14	27.58	1.49
<i>Napa cabbage soup</i>	Canh cải thảo	12	0.17	2.23	1.1
<i>Papaya soup</i>	Canh đu đủ	27	0.1	6.86	0.43
<i>Creek Premna leaf soup</i>	Canh lá cách	17	0.5	3	1
<i>Tomato soup</i>	Canh cà chua	42	1.2	7.35	1.25
<i>Sweet potato soup</i>	Canh khoai lang	89	2.65	14.55	2.3
<i>Mushroom soup / mushroom hot pot</i>	Canh nấm / Lẩu nấm ( tất cả các loại nấm )	53	3.68	3.81	0.95
<i>Sweet corn (corn soup)</i>	Canh ngô ngọt ( Canh bắp )	86	1.18	19.02	3.22
<i>Beet soup / broth soup with radish</i>	Canh củ cải / Canh nước luộc củ cải	32	1.64	3.37	1.37
<i>Eggplant soup</i>	Canh cà pháo	98	4.81	7.73	6.88
<i>Banana soup</i>	Canh chuối	88	0.33	22.7	1.08
<i>Kimchi soup</i>	Canh kim chi	140	1.5	28	6
<i>Knotgrass soup</i>	Canh rau đắng	3.8	0.1	0.6	0.3
<i>Edible yam soup</i>	Canh khoai từ	116	0.14	27.58	1.49
<i>Tonkin creeper soup</i>	Canh hoa thiên lý	74	2.03	8.8	5.5
<i>Sweet potato buds soup</i>	Canh rau lang	90	2	16	2
<i>Zucchini flower soup</i>	Canh bông bí	12	0.4	0.5	1.7
<i>Boiled cabbage</i>	Bắp cải luộc / Cải bắp luộc	22	0.43	4.46	1.02
<i>Boiled white radish</i>	Củ cải trắng luộc	25	0	5	1
<i>Boiled water spinach</i>	Rau muống luộc	40	2.25	3.68	2.88
<i>Boiled Chayote</i>	Susu luộc	24	0.48	5.09	0.62
<i>Boiled kohlrabi</i>	Su hào luộc	29	0.11	6.69	1.8
<i>Boiled ashgourd waxgourd/winter melon</i>	Bí xanh luộc	14	0.2	3.04	0.4
<i>Boiled gourd</i>	Bầu luộc	15	0.02	3.69	0.6
<i>Boiled kale</i>	Cải ngọt luộc	51	3.12	5.47	1.83
<i>Boiled carrots (red beet)</i>	Cà rốt ( củ cải đỏ ) luộc	54	2.48	7.99	0.74
<i>Boiled bean sprouts</i>	Giá đỗ luộc ( Giá luộc )	30	0.18	5.94	3.04
<i>Boiled green beans (green beans)</i>	Đậu cove ( đậu que ) luộc / Đậu que luộc	59	3.1	7.61	1.82
<i>Boiled cauliflower (boiled broccoli)</i>	Súp lơ luộc ( Bông cải luộc )	48	3.29	4	1.77
<i>Boiled cai meo</i>	Rau cải mè luộc	83	5.01	6.42	3.55
<i>Boiled bok choy</i>	Cải thìa luộc / Cải chíp luộc	13	0.2	2.18	1.5
<i>Boiled Napa cabbage</i>	Cải thảo luộc	12	0.17	2.23	1.1
<i>Boiled pumpkin (boiled pumpkin sprout)</i>	Rau bí luộc ( Đọt rau bí luộc )	20	0.07	4.9	0.72
<i>Boiled spinach</i>	Rau dền luộc	23	0.26	3.75	2.97
<i>Boiled Okra</i>	Đậu bắp luộc	28	0.3	5.75	2.08

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Boiled yam</i>	Rau lang luộc	118	0.17	27.88	1.53
<i>Boiled broccoli</i>	Cải làn ( cải rổ ) luộc	28	0.35	5.06	2.98
<i>Boiled Chinese Brocoli</i>	Cải ngồng luộc	28	0.72	3.81	1.14
<i>Boiled snake gourd</i>	Quả lặc lè ( lặc lây ) luộc	22	0	3.1	0.5
<i>Boiled mustard greens</i>	Cải xanh luộc	37	2.77	2.08	2.18
<i>Boiled vegetable</i>	Cải luộc ( không nêu rõ cái gì )	20	0.19	4.55	0.94
<i>Boiled luffa</i>	Mướp luộc	22	0.17	4.52	1.86
<i>Boiled heartleaf</i>	Rau diếp luộc	14	0.2	1.8	1.2
<i>Boiled String Bean</i>	Đậu đũa luộc	59	3.1	7.61	1.82
<i>Boiled knotgrass</i>	Rau đắng luộc	3.8	0.1	0.6	0.3
<i>Boiled eggplant</i>	Cà tím luộc	35	0.23	8.68	0.82
<i>Boiled garlard chrysanthemum</i>	Rau tần ô luộc / Rau cải cúc luộc	24	0.56	3.02	3.36
<i>Boiled pumpkin</i>	Bí đỏ luộc	20	0.07	4.9	0.72
<i>Fried water spinach</i>	Rau muống xào	40	2.25	3.68	2.88
<i>Fried bean sprouts / fried shallots and bean sprouts</i>	Giá đỗ xào / Giá xào họ	72	0.1	16.8	2.5
<i>Fried Kohlrabi</i>	Su hào xào	80	4.63	7.73	2.67
<i>Fried green beans</i>	Đậu que xào	95	6.57	8.5	2.31
<i>Fried Chayote</i>	Susu xào	50	2.4	4.59	3.05
<i>Fried Cabbage</i>	Cải bắp xào / Bắp cải xào	42	2.79	4.36	0.99
<i>Stir-fried kale</i>	Cải ngọt xào	51	3.12	5.47	1.83
<i>Fried watercress</i>	Cải xoong xào	10	0	1	1
<i>Fried parsley / celery sauteed</i>	Rau cần xào / Cần tây xào	36	0.79	6.33	2.97
<i>Fried pumpkin / squash sauteed shoots</i>	Rau bí xào / Đọt bí xào	33	1.54	4.83	0.71
<i>Fried cauliflower / broccoli stir fry</i>	Súp lơ xào / Hoa lơ xào / Bông cải xào	44	2.94	3.9	1.7
<i>Fried ashgourd waxgourd/winter melon</i>	Bí xanh xào	13	0.2	3	0.4
<i>Sauteed string beans</i>	Đậu đũa xào	59	3.1	7.61	1.82
<i>Fried sweet potatoes</i>	Rau lang xào	168	8.71	21.47	1.66
<i>Fried bamboo shoots</i>	Măng xào	63	3.56	6.76	3.35
<i>Fried okra</i>	Mướp xào	43	2.32	5.08	1.92
<i>Sauteed potatoes</i>	Khoai tây xào	120	4.5	19	2
<i>Fried pickles (Fried pickle cucumber)</i>	Dưa chua xào ( Dưa chuột làm chua xào)	18	0.19	4.12	0.62
<i>Fried bow choy</i>	Cải chíp xào / Cải thìa xào	12	0.16	1.78	1.56
<i>Sauteed mushrooms</i>	Nấm rơm xào	70	5	3	2
<i>Fried Pumpkin / sauteed pumpkin</i>	Bí đỏ xào / Bí ngô xào	33	1.54	4.83	0.71
<i>Fried cabbage</i>	Cải thảo xào	42	2.79	4.36	0.99
<i>Pickled fried / sauteed pickled cucumbers</i>	Cải chua xào / Dưa cải chua xào	117	0.26	31.81	0.37
<i>Fried Winter Mushroom</i>	Nấm kim châm xào	70	5	3	2
<i>Fried cucumber</i>	Dưa leo xào / Dưa chuột xào	16	4	3.6	0.6

<i>English Name</i>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Bitter melon sautéed / fried bitter melon</i>	Khô qua xào / Mướp đắng xào	44	3.03	4.21	0.81
<i>Fried winged bean</i>	Đậu rồng xào	74	5.11	5.03	4.59
<i>Fried Chayote sprout</i>	Ngọn susu xào / rau susu xào	50	2.4	4.59	3.05
<i>Fried okra</i>	Đậu bắp xào	43	2.32	5.08	1.92
<i>Fried gourd</i>	Bầu xào	13	0.2	3	0.4
<i>Sauteed spinach (spinach sauteed)</i>	Cải bó xôi xào ( rau chân vịt xào )	60	3.5	4	4
<i>Fried eggplant</i>	Cà tím xào	148	10.75	11.58	2.4
<i>Fried Chinese Broccoli</i>	Cải ngồng xào	38	3.04	2.2	1.39
<i>Fried Brassicaceae</i>	Cải xào ( không nêu rõ cải gì )	85	8	4.5	1.5
<i>Fried mustard greens</i>	Cải xanh xào	30	1	5	1
<i>Fried cat greens</i>	Cải mè xào	30	1	5	1
<i>Fried radish</i>	Củ cải xào	38	2.66	3.36	0.65
<i>Fried Chinese broccoli</i>	Cải làn / Cải rô xào	30	1	5	1
<i>Fried Bell Pepper/Fried Bell Pepper and Onion</i>	Ớt chuông xào / Ớt chuông xào hành tây	72	3	13	2
<i>Fried Tonkin creeper</i>	Hoa thiên lý xào	74	2.03	8.8	5.5
<i>Radish cooked with sauce</i>	Củ cải kho	38	2.66	3.36	0.65
<i>Mixed vegetables cooked with sauce (cucumber, winter melon, carrot ,broccoli,...)</i>	Rau củ thập cẩm kho ( mix nhiều loại như bí , dưa chuột , bông cải , cà rốt,...)	81	2.1	12.7	2.8
<i>Kohlrabi cooked with sauce</i>	Su hào kho	48	2.66	3.53	1.6
<i>Picked cucumber</i>	Dưa muối ( Dưa chuột muối )	81	0.2	18.79	0.9
<i>Salted cucumber</i>	Dưa góp	12	0.16	2.16	0.59
<i>Raw vegetables (to eat raw)</i>	Rau sống (rau thập cẩm các loại ăn sống)	20	0.19	4.55	0.94
<i>Kim Chi</i>	Kim chi	21	0.22	4.07	1.65
<i>Eggplant</i>	Cà pháo	65	3.85	8.31	0.79
<i>Cucumber (to eat raw)</i>	Dưa chuột (Dưa chuột ăn sống )	12	0.16	2.16	0.59
<i>French fries</i>	Khoai tây chiên	274	14.06	35.66	3.48
<i>Salt sauerkraut (pickled)</i>	Dưa cải muối ( Cải chua ) / Dưa cải chua	19	0.14	4.28	0.91
<i>Cucumber salad</i>	Nộm dưa chuột ( gói dưa chuột )	33	0.08	7.3	0.5
<i>Pickled shallot /salted onion</i>	Dưa hành / Hành củ muối / Hành muối	72	0.1	16.8	2.5
<i>Tomatoes (to eat raw)</i>	Cà chua ( cà chua ăn sống )	18	0.2	3.92	0.88
<i>Salad</i>	Nộm xà lách / Gói xà lách	17	0.24	3.2	1.52
<i>Papaya Salad</i>	Nộm đu đủ / Gói đu đủ	39	0.14	9.81	0.61
<i>Water morning glory Salad</i>	Nộm rau muống / Gói rau muống	19	0	3	3
<i>Mixed Sprouts Salad</i>	Nộm rau mầm / Rau mầm trộn	25	0	8.5	3.5
<i>Pickled small leeks</i>	Củ kiệu	65	0.1	15.8	0.5
<i>Salad</i>	Nộm hoa chuối / Rau chuối nộm	17	0.24	3.2	1.52
<i>Cabbage Salad</i>	Nộm cải bắp / Nộm bắp cải / Gói bắp cải	35	0	7	1
<i>Lotus root Salad</i>	Nộm ngó sen	74	0.1	17.23	2.6
<i>Kohlrabi salad</i>	Nộm su hào	15	0	3	1

<b>English Name</b>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Fried pork (fried / roasted) (Bacon frying / fried pork ribs, ...)</i>	Thịt lợn rán (chiên / rang ) (Thịt ba chỉ rán / Sườn lợn rán,...) / Sườn lợn rán xốt chua ngọt	283	18.87	0	26.45
<i>Fried chicken (fried chicken / fried chicken wings)</i>	Thịt gà rán ( thịt gà chiên / Cánh gà rán) / Gà rang	297	18.82	16.32	15.59
<i>Roasted goose</i>	Thịt ngan rang	238	12.67	0	28.97
<i>Fried beef</i>	Thịt bò chiên / Bò bít tết / Bò nê	301	19.32	0	29.78
<i>Fried sausage</i>	Lạp xường chiên	339	28.36	0	19.43
<i>Fried pig liver (pork liver)</i>	Gan lợn ( gan heo ) chiên	174	4.64	5.12	26.3
<i>Fried quail</i>	Chim cút rán	233	14.04	0	25
<i>Fried/Cooked with salt/ Saute Duck meat</i>	Thịt vịt rang / Thịt vịt ram / Thịt vịt rán / Thịt vịt áp chảo	221	10.92	6.86	22.3
<i>Fried pig tripe</i>	Lòng lợn rán ( phèo lợn rán , ruột non rán , ruột già rán )	282.4	24.7	0	15.3
<i>Beef cooked with sauce</i>	Thịt bò kho	174	7.94	2.91	21.14
<i>Pork cooked with sauce</i>	Thịt heo kho / Thịt heo kho tàu / Thịt kho trứng / Già cây / Thịt heo kho với rau củ	180	9.18	2.95	19.91
<i>Chicken cooked with sauce</i>	Thịt gà kho / Gà kho sả / Gà kho gừng	140	3.43	15.94	10.95
<i>Bologna / fried pork leg cooked with sauce</i>	Chả lụa / chả chân giò kho	263	21.02	0	17.08
<i>Beef sausages cooked with sauce</i>	Chả bò / Giò bò kho	325	29.08	3.99	11.04
<i>Roasted pork cooked with sauce</i>	Thịt heo quay kho	247	14.56	0	26.93
<i>Duck cooked with sauce</i>	Thịt vịt kho / Thịt vịt om / Thịt vịt um ( vịt om sấu , vịt om sả , ... )	336	28.23	0	18.91
<i>Fake dog-meat Cairina</i>	Thịt ngan già cây	78	0.08	7	0.41
<i>Chicken tripe cooked with salt</i>	Lòng gà kho	97	3.5	1.1	13
<i>Boiled pork</i>	Thịt heo luộc/ lợn luộc	208	9.57	0	28.45
<i>Boiled duck meat</i>	Thịt vịt luộc	132	5.95	0	18.28
<i>Boiled chicken</i>	Thịt gà luộc	148	6.32	0	21.26
<i>Rare beef with lemon</i>	Thịt bò tái chanh	288	19.54	0	26.33
<i>Rare goat with lemon</i>	Dê tái chanh	143	3.03	0	27.1
<i>Boiled goose</i>	Thịt ngan luộc	161	7.13	0	22.75
<i>Boiled beef</i>	Thịt bò luộc	288	19.54	0	23.33
<i>Jellied pork</i>	Thịt heo nấu đông	354	27.1	2.7	25.1
<i>Boiled pork organ</i>	Lòng lợn luộc	134	3.65	2.47	21.39
<i>Boiled pork tongue</i>	Lưỡi heo luộc	225	17.2	0	16.3
<i>Boiled dog meat</i>	Thịt chó luộc	78	0.08	7	0.41
<i>Jelly-like chicken cooked</i>	Thịt gà nấu đông	85	1.63	5.9	12.12
<i>Boiled chicken organs</i>	Lòng gà hấp	167	6.51	0.87	24.46
<i>Grilled pork</i>	Thịt lợn nướng	169	8	0	32
<i>Roasted pork</i>	Thịt heo quay	247	14.59	0	26.98
<i>Roasted duck meat</i>	Thịt vịt quay	337	28.35	0	18.99
<i>Grilled beef</i>	Thịt bò nướng / Bò nướng mỡ chài	200	10	0	21
<i>Grilled duck meat</i>	Thịt vịt nướng ( vịt nướng lá mắc mật , vịt nướng chao,...)	308	24.8	0	19.79
<i>Grilled goat</i>	Dê nướng	109	2.31	0	20.6
<i>Roasted chicken</i>	Thịt gà quay	111	2.7	0	20.33

<i>English Name</i>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Grilled chicken (grilled chicken with honey, ... ..)</i>	Thịt gà nướng ( gà nướng mật ong , .....	237	13.49	0	27.07
<i>Roasted Cairina meat</i>	Thịt ngan quay	224.3	16.2	0	18.2
<i>Grilled chicken legs</i>	Chân gà nướng	158	10.2	0	14.1
<i>Fried pork / sweet and sour pork</i>	Thịt heo xào / Thịt heo xào chua ngọt / Thịt băm xào chua ngọt / Sườn heo xào chua ngọt	102	3.64	10.98	6.68
<i>Fried pork organ</i>	Lòng heo xào	134	3.65	2.47	21.39
<i>Fried beef / veal sauteed</i>	Thịt bò xào / Thịt bê xào	228	9.18	9.85	27.25
<i>Fried goose organ</i>	Lòng ngan xào	133	4.28	6.32	16.37
<i>Fried chicked meat</i>	Thịt gà xào / Gà xào sả ớt	297	18.82	16.32	15.59
<i>Fried buffalo meat</i>	Thịt trâu xào	131	1.8	0	26.83
<i>Fried goose meat</i>	Thịt ngan xào	238	12.67	0	28.97
<i>Fried chicken organ</i>	Lòng gà xào	172	6.43	1.11	25.78
<i>Fried duck meat</i>	Thịt vịt xào	337	28.35	0	18.99
<i>Ostrich meat stir fry</i>	Thịt đà điểu xào	174	7.01	0	25.93
<i>Fried horse meat</i>	Thịt ngựa xào	175	6.05	0	28.14
<i>Sausage (in general)</i>	Chả (không nêu rõ) / Xúc xích	304	26.53	0	15.09
<i>Grilled nuggets</i>	Chả cốm	297	18.82	16.32	15.59
<i>Bologna / Grilled pork / sausage silk</i>	Chả lụa / Chả lợn / Giò lụa / Giò chả Ước Lễ	169	8	0	32
<i>Grilled piper lotot</i>	Rau cuộn thịt ( Chả lá lốt / Lá lốt cuộn thịt / Chả xương sông / Xương sông cuộn thịt / Cải xanh cuộn thịt / Bắp cải cuộn thịt )	39	0	5.4	4.3
<i>Dried chicken / chicken floss / Dry shredded chicken</i>	Khô gà / chà bông gà / Khô gà xé	341	5.7	31.9	40.5
<i>pork floss/ ripped pork</i>	Chả bông heo / thịt nạc xé / Ruốc thịt lợn	495.9	11	34	40
<i>Nem / Nem chua</i>	Nem / Nem chua	165	6	20	8
<i>Vietnamese meatball</i>	Xíu mại / Xíu mại sốt cà / Thịt viên sốt cà chua	166	6.98	4.76	19.83
<i>Pâtê</i>	Pate	319	28	1.5	14.2
<i>Sausage beef / Grilled beef</i>	Giò bò / Chả bò	325	29.08	3.99	11.04
<i>Spring rolls / south spring roll</i>	Nem rán / Chả giò miền nam / Chả ram	101	4.07	11.12	4.73
<i>Sausages sauteed / Sausages player</i>	Giò xào / Giò thủ	301	26.56	1.98	12.07
<i>Blood pudding</i>	Tiết canh	379	34.5	1.29	14.5
<i>Bacon</i>	Thịt muối ( bắp bò muối / Thịt chân giò muối )	541	41.78	1.43	37.04
<i>Pigski / Pigskin roll mixed powder</i>	Bì / Nem bì thính / Bì trộn thính / Nem tai trộn thính / Nem tai	367	9	64	9
<i>Dried Beef</i>	Khô bò / Khô bò xé	100	3	2	16
<i>Smash'd beef, pork</i>	Phá lấu ( phá lấu bò / phá lấu lòng heo ,...)	276	18.58	0	25.35
<i>Raw vietnamese pork soup</i>	Canh mọc	65	1.2	8.3	6.25
<i>Stewed Sweet Herbal Chicken Soup</i>	Gà tần thuốc bắc / Gà ác hầm thuốc bắc / Gà nấu nấm đông cô / Gà nấu nấm	31	1.02	3.88	1.68
<i>Beef soup</i>	Canh thịt bò / Soup thịt bò	94	4.58	7.06	6.51
<i>Beef noodle</i>	Bún bò	169	5.57	13.37	15.38
<i>Bun doc mung</i>	Bún dọc mùng / Bún bung	14	0	3.8	0.5

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Chicken cellophane noodle</i>	Bún gà / Miến gà	116	2.52	13.62	9.42
<i>Bun moc</i>	Bún mọc / Miến mọc	250	10	0	14
<i>Noodle with pork (feet, ribs,...)</i>	Bún nấu với thịt heo ( Bún móng giò / Bún sườn heo,...)	203	12.28	13.97	9.99
<i>Bun rieu/Canh bun</i>	Bún riêu / Canh bún	265	10	28	17.3
<i>Chicken porridge</i>	Cháo gà	43	1.41	4.82	2.8
<i>Pork porridge (ribs, organs, meat,...)</i>	Cháo thịt heo (Cháo sườn heo / cháo lòng heo / cháo thịt băm,... )	105	5	9	6
<i>Beef porridge</i>	Cháo thịt bò / Cháo bò	115	3	23	2
<i>Heart porridge</i>	Cháo tim	216	18.2	6.5	11
<i>Instant noodles cooked with meat (beef, chicken, geese, ...)</i>	Mì nấu với thịt ( bò , gà , ngan,...) / Mi cay / Mi nấu tôm thịt	125	4.5	17	4.3
<i>Goose cellophane noodle</i>	Miến ngan / Bún ngan	169	5.57	13.37	15.38
<i>Phở beef</i>	Phở bò	72	1.58	6.89	7.11
<i>Phở chicken</i>	Phở gà	67	2.3	5.24	5.77
<i>Bun cha (vermicelli barbecue)</i>	Bún chả ( Bún thịt nướng )	410	0	108	4
<i>Bird porridge</i>	Cháo chim	43	1.41	4.82	2.8
<i>Bean vermicelli shrimp paste</i>	Bún đậu mắm tôm	150	0	36	0
<i>Nutritional porridge</i>	Cháo dinh dưỡng	116	1.6	21.9	3.3
<i>Banh canh</i>	Bánh canh	312	0	75	3
<i>Com Tam (rice ball packaging rib plate)</i>	Cơm tấm (Cơm tấm sườn bì chả) / Cơm phần / Cơm văn phòng / Cơm phần buổi trưa	150	5	11	8
<i>Mixed rice</i>	Cơm trộn	112	1.2	25.2	2.5
<i>Yangzhou fried rice / fried rice Yangzhou</i>	Cơm chiên dương châu / Cơm rang dương châu / cơm chiên dưa bò	112	1.2	25.2	2.5
<i>Hu tui</i>	Hủ tiếu	95.3	0.1	23.6	0
<i>Duck porridge</i>	Cháo vịt	43	1.41	4.82	2.8
<i>Bo Kho (served with noodle / noodles / bread, ...)</i>	Bò kho ( ăn kèm bún / hủ tiếu / bánh mì ,...)	110	3	9	10
<i>Chicken rice</i>	Cơm gà	150	5.44	19	5.66
<i>Pizza</i>	Pizza	301	13.8	31.45	12.09
<i>Wonton</i>	Hoành thánh	284	13.26	24.85	15.09
<i>Pasta fried with meat (beef / pork, ...)</i>	Nui xào thịt ( bò / heo,...)	129	5.12	13.07	7.93
<i>Bun cha gio / Bun spring rolls</i>	Bún chả giò / Bún nem rán	320	7.4	22	2
<i>Bun with bamboo shoots and ducks meat</i>	Bún măng vịt	140	3	25	4
<i>Quang noodle</i>	Mì quảng	357	0.5	85.8	2.3
<i>Goi cuon</i>	Gỏi cuốn	60	1	7	6
<i>Banh da cooked with crab</i>	Bánh da cua / Bánh da cua nấu thịt / Bánh da giò bò	160	0	38	2
<i>Pho cuon</i>	Phở cuốn	80	2	9	0
<i>Pho fried with meat (pork, beef,...)</i>	Phở xào thịt ( bò , heo, ....) / Bún gạo xào thịt	266	5.33	53.3	38.4
<i>Shrimp Dumpling</i>	Há cảo	112	2.64	9.56	11.55

<b>English Name</b>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Bo bía</i>	Bò bía	140	6	16	6
<i>Noodle fried with meat/seafood (beef, pork, shrimp, squid,...)</i>	Mì xào thịt / hải sản ( bò , heo , tôm , mực....) / Bún xào thịt	126	4.76	14.2	6.3
<i>Paste cooked with meat</i>	Nui nấu thịt	103	4.08	12.29	4.32
<i>Chicken soup</i>	Súp gà	31	1.02	3.88	1.68
<i>Sushi / rice rolls</i>	Sushi / Cơm cuộn	143	0.42	29.9	4.3
<i>Sour soup with meat</i>	Canh chua thịt	30	0.35	5.91	1.32
<i>Pickled cabbage with meat soup</i>	Canh dưa sừn (canh cải chua nấu sừn )	51	1.89	2.63	5.9
<i>Potato and meat soup</i>	Canh sừn nấu khoai / Canh thịt nấu khoai ( tất cả các loại khoai ) / Canh khoai nấu thịt	225	3.5	30	17
<i>Sweet leaf and meat soup</i>	Canh rau ngót nấu thịt / Canh rau ngót nấu mọc	51	1.89	2.63	5.9
<i>Pumpkin and meat soup</i>	Canh bí đỏ nấu thịt	32	0.78	4.17	2.29
<i>Pumpkin and meat porridge</i>	Cháo bí đỏ nấu thịt	32	0.78	4.17	2.29
<i>Stuffed meat and bitter melon soup</i>	Canh khổ qua nhồi thịt / Canh mướp đắng nhồi thịt / Canh khổ qua nấu thịt / Canh mướp đắng nấu thịt	17	0	4	1
<i>Beef hotpot</i>	Lẩu bò / Xí quách bò / Lẩu xí quách bò / Bò nhúng dấm	118	4.2	2	19.9
<i>Kale and meat soup</i>	Canh cải ngọt nấu thịt	51	1.89	2.63	5.9
<i>Carrots and meat soup</i>	Cà rốt nấu thịt / Cà rốt nấu sừn / Củ cải nấu sừn / Củ cải nấu thịt	131	7.55	6.28	9.38
<i>Celery and meat soup</i>	Cần tây nấu thịt	51	1.89	2.63	5.9
<i>Spinach and meat soup</i>	Canh rau dền nấu thịt	51	1.89	2.63	5.9
<i>River-leaf creeper and chicken soup</i>	Canh gà nấu lá giang	69	2	8.76	5.1
<i>Soup mixed with (meat / bone / sausage cooked with potatoes, carrots, corn .... (Mix variety vegetables together))</i>	Canh soup / Canh củ quả / Canh ngũ quả (thịt / xương / giò nấu với khoai tây , cà rốt , ngô ,đậu hạt....(mix nhiều loại củ quả với nhau))	23	0.76	0.72	3.23
<i>Chrysanthemum and meat soup</i>	Canh rau tần ô (rau cải cúc ) nấu thịt / Canh cải cúc nấu thịt	51	1.89	2.63	5.9
<i>Eggplant and ribs soup</i>	Canh cà tím nấu sừn	50	2.5	4.5	3
<i>Winter melon and meat soup (winter melon and ribs soup)</i>	Canh bí xanh nấu thịt ( canh bí xanh nấu sừn )	14	0.2	3	0.4
<i>Kohlrabi and meat soup</i>	Canh su hào nấu thịt	74.9	1.3	14.8	1.9
<i>Mushroom and meat soup</i>	Canh nấm nấu thịt	35	1.65	3.81	1.29
<i>Watercress and meat soup</i>	Canh cải xoong nấu thịt	51	1.89	2.63	5.9
<i>Chicken hot pot</i>	Lẩu gà	90	1.9	9.2	8.6
<i>Bamboo shoot and meat soup</i>	Canh măng nấu thịt / Canh măng nấu xương	63	3.56	6.76	3.35
<i>Cabbage and meat soup</i>	Canh bắp cải nấu thịt	51	1.89	2.63	5.9
<i>Broccoli and meat soup</i>	Canh cải xanh nấu thịt	28	0	5	3
<i>Cauliflower and meat soup</i>	Canh súp lơ nấu thịt / Canh bông cải nấu thịt	79	4.76	6.2	3.04
<i>Ceylon spinach and meat soup</i>	Canh mồng tơi nấu thịt	51	1.89	2.63	5.9
<i>Beetroot and meat soup</i>	Canh củ dền nấu thịt	32	1.64	3.37	1.37
<i>Papaya and meat soup</i>	Canh đu đủ nấu thịt	27	0.1	6.86	0.43



<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Centella and meat soup</i>	Canh rau má nấu thịt	94	4.5	4	9.5
<i>Chives and meat soup</i>	Canh hẹ nấu thịt	51	1.89	2.63	5.9
<i>Bok choy and meat soup</i>	Canh cải thìa nấu thịt / Canh cải chíp nấu thịt	51	1.89	2.63	5.9
<i>Curry</i>	Cà ri / Lagu	85	3.22	12.14	2.61
<i>Gourd and meat soup</i>	Canh bầu nấu thịt	86	2.84	12.58	3.28
<i>Water spinach and meat soup</i>	Canh rau muống nấu thịt	51	1.89	2.63	5.9
<i>Bean sprouts and meat soup</i>	Canh giá đỗ nấu thịt	55	0.18	5.94	3.04
<i>Spinach and meat soup</i>	Canh cải bó xôi nấu thịt / Canh rau Bina nấu thịt	51	1.89	2.63	5.9
<i>Plantago major and meat soup</i>	Canh mã đề nấu thịt	51	1.89	2.63	5.9
<i>napa cabbage and meat soup</i>	Canh cải thảo nấu thịt	51	1.89	2.63	5.9
<i>Melon and meat soup</i>	Canh mướp nấu thịt	14	0.2	3	0.4
<i>Chayote meat soup/ Chayote Spareribs soup</i>	Canh susu nấu thịt / Canh susu nấu xương	14	0.2	3	0.4
<i>Goat Hotpot</i>	Lẩu dê	162.5	12	25	21
<i>Tossa jute and meat soup</i>	Canh rau đay nấu thịt	51	1.89	2.63	5.9
<i>Meat and Vegetables soup</i>	Canh cải nấu thịt ( không nêu rõ cải gì )	23	0.76	0.72	3.23
<i>Artichoke flower with meat/bone soup</i>	Canh hoa Atiso nấu thịt / Canh hoa Atiso nấu xương	67	2.29	10.87	3.37
<i>Fried green bean and meat (beef, pork, ...)</i>	Đậu que xào thịt ( bò , heo , ...)	347	21.25	25.91	12.48
<i>Fried potatos and meat (beef, pork, ...)</i>	Khoai tây xào thịt ( bò , heo , ...)	292	17.74	22.87	9.98
<i>Fried vegetables and meat</i>	Rau cải xào thịt / Cải xào thịt / Cải chua xào thịt	292	17.74	22.87	9.98
<i>Fried bean sprouts and meat</i>	Giá đỗ xào thịt (Thịt xào giá đỗ )	61	0.7	1.8	5.7
<i>Fried chayote and meat</i>	Susu xào thịt	193.75	5.46	7.5	26.61
<i>Fried kohlrabi and organs (from pork, chicken hearts, and goose, ...)</i>	Su hào xào lòng ( lòng heo , lòng gà , lòng ngan, ... ) / Su hào xào lòng vịt	80	4.63	7.73	2.67
<i>Fried bean sprouts and organs (from chicken, pig, goose, ...)</i>	Giá đỗ xào lòng ( lòng gà , lòng heo , lòng ngan, Lòng ngan xào giá ... ) / Lòng vịt xào giá	74	5.11	5.03	4.59
<i>Fried celery and meat</i>	Cần tây xào thịt / Rau cần xào thịt / Bò xào cần tây cà chua	39	2.54	3.93	0.81
<i>Fried kohlrabi and meat</i>	Su hào xào thịt	80	4.63	7.73	2.67
<i>Fried cauliflower and meat</i>	Súp lơ xào thịt	292.85	17.85	17.85	14.28
<i>Fried cauliflower and organs (from chicken, pig, and goose, ...)</i>	Súp lơ xào lòng ( lòng gà , lòng heo , lòng ngan ...)	292.85	17.85	17.85	14.28
<i>Fried bamboo shoots and meat</i>	Măng xào thịt	63	3.56	6.76	3.35
<i>Chayote fried with organs (chicken, pig, ...)</i>	Susu xào lòng ( lòng gà , lòng heo , lòng ngan, ...)	193.75	5.46	7.5	26.61
<i>Sautéed vegetables and organs</i>	Rau cải xào lòng / Cải chua xào lòng	75	4.26	5.42	4.55
<i>Fried pumpkin flower and meat</i>	Bông bí xào thịt	167	13.07	11.32	2.03
<i>Fried roccoli and meat</i>	Cải lân ( Cải rổ ) xào thịt	91.76	2.7	4.31	12.15

<i>English Name</i>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Fried winter melon and meat</i>	Bí xanh xào thịt	22.6	0.4	5.3	0.7
<i>Fried winged bean and meat</i>	Đậu rồng xào thịt	281	8	16	7
<i>Fried water spinach and meat</i>	Rau muống xào thịt	40	2.25	3.68	2.88
<i>Fried luffa with pork</i>	Mướp xào thịt	150	7.3	6.63	14.11
<i>Fried mushroom with viscera</i>	Nấm xào lòng	101	7.04	6.61	3.4
<i>Fried luffa with viscera ( chicken, pork, goose, etc.)</i>	Mướp xào lòng ( lòng gà , lòng heo , lòng ngan,...)	152	8.73	5.48	12.6
<i>Fried pumpkin with meat ( of any kind)</i>	Bí đỏ xào thịt ( tất cả các loại thịt )	91.76	2.7	4.31	12.15
<i>Fried peas and viscera</i>	Đậu que xào lòng	82	3.7	0	12
<i>Fried winter melon leaves with meat</i>	Dưa muối xào thịt	185	8	14	20
<i>Fried pumpkin buds with beef/pork</i>	Rau bí xào thịt / Đọt bí xào thịt ( rau bí xào thịt bò / rau bí xào thịt lợn )	91.76	2.7	4.31	12.15
<i>Fried eggplant with meat</i>	Cà tím xào thịt	171	16	2	5
<i>Fried cucumber and meat</i>	Dưa leo xào thịt / Dưa chuột xào thịt	127	6.39	4.07	11.5
<i>Fried radish and meat</i>	Củ cải xào thịt	153	8.89	7.27	11.57
<i>Fried mushroom with meat</i>	Nấm xào thịt	115	6.23	3.91	10.92
<i>Fried bitter gourd and organs</i>	Khô qua xào lòng / Mướp đắng xào lòng	305	15.18	12.05	28.85
<i>Fried green pineapple and organs</i>	Dứa xanh xào lòng / Thơm xào lòng	305	15.18	12.05	28.85
<i>Fried tonkin creeper and meat</i>	Hoa thiên lý xào thịt	167	13.07	11.32	2.03
<i>Chicken salad</i>	Gỏi gà	290	23	12	9
<i>Pig ear salad</i>	Gỏi tai heo / Nộm tai heo	176	11.1	0	19.1
<i>Beef salad/Beef jerky salad</i>	Gỏi bò / Gỏi khô bò	272	21.02	1.4	18.38
<i>Fried bitter gourd stuffed with pork/ Bitter gourd stuffed with pork in tomato sauce</i>	Mướp đắng nhồi thịt chiên / Mướp đắng nhồi thịt sốt cà	100	25	31	31
<i>Duck salad</i>	Gỏi vịt	218.6	20.1	2.2	7.2
<i>Fried carp</i>	Cá chép rán	279	15.77	12.33	20.77
<i>Fried Tram fish</i>	Cá Trắm rán	91	2.6	0	17
<i>Fried shrimp / prawns rim</i>	Tôm rang / Tôm rim / Tôm rim thịt / Tôm chiên giòn	287	14.64	27.57	10.58
<i>Fried fish (in general)</i>	Cá chiên (không nêu rõ cá gì ) / Cá tằm bột chiên	232	12.29	16.97	14.66
<i>Fried dried fish (all kinds of colorful fish, croaker, ...)</i>	Cá khô chiên (tất cả các loại cá sặc , cá đù ,... )	290	2.37	0	62.82
<i>Fried fish cakes</i>	Chả cá chiên	165	6.05	13.67	12.82
<i>Fried shrimp ball</i>	Tôm viên chiên	201	10.49	12.38	13.65
<i>Fried tilapia</i>	Cá rô phi rán	96	1.7	0	20.08
<i>Fried anchovies</i>	Cá com chiên	172	9.9	0.1	19.3
<i>Fried red snapper fish</i>	Cá diêu hồng chiên	100	1.34	0	20.51
<i>The pink fish fry</i>	Cá hường chiên	116	3	0	20
<i>Fried Codfish</i>	Cá thu chiên	88	0.5	0.5	20.4
<i>Fried scad</i>	Cá nục chiên (rán)	115	10	0	6

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Fried lava</i>	Nhộng rang	199	11.37	6.71	16.72
<i>Fried major cap</i>	Cá trôi rán	279	15.77	12.33	20.77
<i>Fried Bac Ma</i>	Cá bạc má chiên	84	0.92	0	17.76
<i>Fried loaches</i>	Cá trạch rán / Cá chạch rán	292	19.12	8.24	20.55
<i>Fried sardines</i>	Cá mòi chiên	208	11.45	0	24.62
<i>Fried Snakehead fish</i>	Cá lóc / Cá quả chiên	122	3.8	1.4	20.8
<i>Fried mandarin fish</i>	Cá mó chiên	135	4.8	0	25
<i>Fried basa fish</i>	Cá basa chiên	139.1	4.3	14.2	10.9
<i>Fried anabas (with fish sauce, ...)</i>	Cá rô đồng chiên ( cá rô chiên nước mắm, ...)	199	11.37	6.71	16.72
<i>Fried Catfish</i>	Cá trê chiên	243	17.07	6.71	14.03
<i>Fried Chem fish</i>	Cá trêm chiên / Cá chêm chiên	199	11.37	6.71	16.72
<i>Fried tuna</i>	Cá ngừ chiên	236	11.14	8.25	24.4
<i>Fried Ho fish</i>	Cá hồ chiên	199	11.37	6.71	16.72
<i>Fried carp eggs</i>	Trứng cá chép rán	65	1	0.3	14
<i>Fried Gobies</i>	Cá bóng rán ( cá bóng chiên )	124	8	3.7	13
<i>Fried Featherback ( cooked with saurce)</i>	Cá thác lác chiên / Cá thác lác sốt cà	110	2.5	9	13
<i>Fried Pangasius/ Yellowtail catfish</i>	Cá hú chiên / Cá basa chiên	243	17.07	6.71	14.03
<i>Fried Pomfret or with tomato source</i>	Cá chim rán / Cá chim chiên / Cá chim sốt cà	102	3	0	18
<i>Grilled Chopped Squid</i>	Chả mực rán / Chả mực chiên	105	1.58	3.53	17.86
<i>Fried Squid ( with meat ball)</i>	Mực chiên / Mực nhồi thịt chiên	197	8.43	11.56	17.6
<i>Fried flathead mullet</i>	Cá dôi chiên	273	14.17	12.65	22.27
<i>Fried crab/and tamarind</i>	Cua rang / Cua rang me	333	19.95	17	20.45
<i>Fried Solefish</i>	Cá lưôi trâu chiên	150	3	0	30
<i>Fried red mullet</i>	Cá pèn chiên	228	14.4	7.4	15.8
<i>Fried yellow tail scad</i>	Cá ngân chiên	248	16.26	7.01	17.48
<i>Fried squid</i>	Mực xào	197	8.43	11.56	17.6
<i>Fried frog</i>	Ếch xào	287.3	7.7	22	29.5
<i>Fried shrimp sauce (with meat, dried shrimp, ...)</i>	Mắm ruốc xào ( xào thịt , xào tôm khô, ...)	172	15	15	1
<i>Fried snails</i>	Ốc xào ( ốc xào me / ốc xào dứa, ...)	136	4.77	2.43	19.55
<i>Fried baby clam</i>	Hến xào	400	22.5	30	20
<i>Fried fish stomach (with pepper/lemongrass)</i>	Bao tử cá xào ( bao tử cá xào sả ớt, ...)	345	2.5	1	79.5
<i>Fried eel</i>	Lươn xào	248	12	0	15
<i>Fish and galangal cooked with sauce</i>	Cá kho riêng / Cá kho ( không nêu rõ cá gì )	348	4.5	66.5	15.8
<i>Carp cooked with sauce</i>	Cá chép kho	84.1	3.7	2.9	9.8
<i>Snakehead fish cooked with sauce</i>	Cá lóc kho / Cá quả kho	112	1.22	0	23.3
<i>Mullet cooked with sauce</i>	Cá dôi kho	273	14.17	12.65	22.27
<i>Howling fish stock (Tra fish, basa fish, ...)</i>	Cá hú kho ( cá tra kho , cá basa kho )	17	0.81	0	2.26
<i>Catfish cooked with sauce</i>	Cá bông lau kho	105	2.8	0	18

<i>English Name</i>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Frog cooked with sauce</i>	Ếch kho	73	0.3	0	16.4
<i>Tuna cooked with sauce</i>	Cá ngừ kho	153	3.96	0.41	27.3
<i>Tram fish cooked with sauce</i>	Cá trắm kho	91	2.6	0	17
<i>Goby cooked with sauce</i>	Cá bống kho	215	15	5	15
<i>Scad cooked with sauce</i>	Cá nục kho	248	16.26	7.01	17.48
<i>Troi fish cooked with sauce</i>	Cá trôi kho	99	3.02	1.64	15.71
<i>Keo fish cooked with sauce</i>	Cá kèo kho	99	3.02	1.64	15.71
<i>Red snapper fish cooked with sauce</i>	Cá diêu hồng kho	100	1.34	0	20.51
<i>Mussel cooked with sauce</i>	Hến kho	150	8.25	4.41	13.78
<i>Bac Ma cooked with sauce</i>	Cá bạc má kho	84	0.92	0	17.76
<i>Dried octopus cooked with sauce</i>	Mực kho	164	2.07	4.39	29.73
<i>Mackerel cooked with sauce</i>	Cá thu kho	222	13.79	0.41	22.56
<i>Anchovy cooked with sauce</i>	Cá com kho	172	9.9	0.1	19.3
<i>Catfish cooked with sauce</i>	Cá trê kho	105	2.85	0	18.47
<i>Salmon cooked with sauce</i>	Cá hồi kho	139	4.3	0	23.45
<i>Anabas cooked with sauce</i>	Cá rô đồng kho ( cá rô kho )	199	11.37	6.71	16.72
<i>Crucian carp cooked with sauce</i>	Cá diếc kho	84.1	3.7	2.9	9.8
<i>Tilapia cooked with sauce</i>	Cá rô phi kho ( cá phi kho )	128	2.65	0	26.15
<i>Hairfish cooked with sauce</i>	Cá hổ kho	82	0.9	0	18.5
<i>Mangrove red snapper cooked with sauce</i>	Cá hồng bạc kho	100	1.34	0	20.51
<i>Loach cooked with sauce</i>	Cá chạch kho	96	3.7	1.7	17.3
<i>Yellow tail scad cooked with sauce</i>	Cá ngán kho	248	16.26	7.01	17.48
<i>Japanese amberjack cooked with sauce</i>	Cá cam kho	129	8.4	0.2	42
<i>Red mullet cooked with sauce</i>	Cá phèn kho	273	14.17	12.65	22.27
<i>Steamed clams (with lemongrass, Thai-style, ..)</i>	Nghêu hấp / Ngao hấp ( hấp sả , hấp thái ...)	92	1.2	3.19	15.83
<i>Steamed squid</i>	Mực hấp	105	1.58	3.53	17.86
<i>Boiled snails</i>	Ốc luộc	136	4.77	2.43	19.55
<i>Steamed shrimp ( with beer, coconut, ...)</i>	Tôm hấp ( Tôm hấp bia , Tôm hấp nước dừa ,...)	138	2.26	1.19	26.5
<i>Distilled paste (meat, egg, meat with egg)</i>	Mắm chung ( mắm chung thịt / mắm chung trứng / mắm chung thịt trứng )	127	2.3	1.94	23.78
<i>Steamed red tilapia</i>	Cá diêu hồng hấp	139	2.9	0	26.34
<i>Steame fish</i>	Cá hấp ( không nêu rõ cá gì )	139	2.9	0	26.34
<i>Boiled crab/ Steamed crab</i>	Ghẹ luộc / Ghẹ hấp	101	1.76	0	20.03
<i>Steamed Cirrhinus</i>	Cá trôi hấp	161	7.09	0	22.57
<i>Steamed pompano</i>	Cá nục hấp	205	11.84	0	23.1
<i>Steamed carp/ Steamed carp with soy sauce</i>	Cá trắm hấp / Cá trắm hấp xì dầu	161	7.09	0	22.57
<i>Steamed Chen fish</i>	Cá chép hấp	139	2.9	0	26.34
<i>Steamed snakehead fish</i>	Cá lóc hấp	112	1.22	0	23.3

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Steamed mackerel with black bean sauce</i>	Cá thu chưng tương / Cá thu chưng	222	13.79	0.41	22.56
<i>Carp soup</i>	Canh cá chép	40	0.91	1.27	6.37
<i>Tram fish soup</i>	Canh cá Trắm	40	0.91	1.27	6.37
<i>Crab soup</i>	Canh cua / Canh riêu / Canh riêu cua	105	5.93	4.43	7.52
<i>Tra fish soup/Basa fish soup</i>	Canh cá tra / cá basa	40	0.91	1.27	6.37
<i>Clam soup</i>	Canh ngao	67	2.39	7.79	3.62
<i>Mussel soup</i>	Canh hến	71	4.4	3.2	4.4
<i>Snakehead soup</i>	Canh cá quả / Canh cá lóc	40	0.91	1.27	6.37
<i>Crab hot pot</i>	Lẩu cua	181.05	5.95	10.9	19.95
<i>Bac Ma soup</i>	Canh cá bạc má	40	0.91	1.27	6.37
<i>Carp hot pot</i>	Lẩu cá chép	82	2.35	2.82	12.31
<i>Red snapper fish soup</i>	Canh cá diêu hồng	48	0.93	2.79	6.68
<i>Fish soup</i>	Canh cá ( không nêu rõ cá gì )	40	0.91	1.27	6.37
<i>Grilled shrimp</i>	Tôm nướng	106	1.73	0.91	20.31
<i>Grilled dried squid</i>	Khô mực nướng	349	5.23	11.68	59.06
<i>Grilled So Long</i>	Sò lông nướng	109	1.18	0.28	22.6
<i>Grilled salmon</i>	Cá hồi đúc lò	139	4.3	0	23.45
<i>Grilled snakehead fish</i>	Cá lóc nướng	112	1.22	0	23.3
<i>Grilled snails</i>	Ốc nướng	136	4.77	2.43	19.55
<i>Grilled carp</i>	Cá chép nướng	198	8.74	0	27.84
<i>Grilled Squid/Octopus</i>	Mực nướng / Bạch tuột nướng	137	4.61	3.78	18.77
<i>Grilled elongatus</i>	Cá kèo nướng	109	1.18	0.28	22.6
<i>Winter melon and shrimp soup</i>	Canh bí xanh nấu tôm	51	2.5	3	4
<i>Carp fish sour soup</i>	Canh chua cá chép	40	0.91	1.27	6.37
<i>Ceylon and crab soup /ceylon, jute plant and crab soup /jute plant and crab soup</i>	Canh mỏng toi nấu cua / Canh mỏng toi rau đay nấu cua / Canh cua rau đay	105	5.93	4.43	7.52
<i>Sweet leaf and shrimp soup</i>	Canh rau ngót nấu tôm	106	1	5	17
<i>Thai hot pot/Seafood hot pot</i>	Lẩu thái / Lẩu hải sản	181.05	5.95	10.9	19.95
<i>Bong Lau fish sour soup</i>	Canh chua cá bông lau	70.5	3.5	3.1	6.95
<i>Snakehead fish sour soup</i>	Canh chua cá lóc	72	2.2	5.6	7.4
<i>Hu fish sour soup/Basa fish sour soup</i>	Canh chua cá hú / canh chua cá basa	70.5	3.5	3.1	6.95
<i>Cabbage and fish soup</i>	Canh cải nấu cá	40	0.91	1.27	6.37
<i>Cabbage and crab soup</i>	Canh cải nấu cua	41	0.4	7	3.3
<i>Winter melon and crab soup</i>	Canh bí nấu cua	41	0.4	7	3.3
<i>Gourd and shrimp soup</i>	Canh bầu nấu tôm	106	1	5	17
<i>Tram fish sour soup</i>	Canh chua cá trắm / Cá trắm nấu chua	72	2.2	5.6	7.4
<i>Chrysanthemum and shrimp soup</i>	Canh cải cúc ( rau tần ô ) nấu tôm	105	5.93	4.43	7.52
<i>Sweet leaf and crab soup</i>	Canh rau ngót nấu cua	41	0.4	7	3.3
<i>Celery and fish soup</i>	Canh rau cần nấu cá	40	0.91	1.27	6.37

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Tilapia fish sour soup</i>	Canh chua cá rô phi	96	1.7	0	20.08
<i>Ceylon and fish soup</i>	Canh mỏng toi nấu cá	40	0.91	1.27	6.37
<i>Pumpkin and shrimp soup</i>	Canh bí đỏ nấu tôm	165	9	10	12
<i>Ceylon and shrimp soup</i>	Canh mỏng toi nấu tôm	52	2.95	4.49	1.95
<i>Spinach and crab soup</i>	Canh rau dền nấu cua	130	9	9	4
<i>Shallots and shrimp soup</i>	Canh hẹ nấu tôm	52	2.95	4.49	1.95
<i>Shrimp sour soup</i>	Canh chua tôm / canh chua tép	40	0.91	1.27	6.37
<i>Thac Lac fish sour soup</i>	Canh chua cá thác lác	47	1.82	0.87	6.36
<i>Cabbage and shrimp soup</i>	Canh cải nấu tôm	40	0.91	1.27	6.37
<i>Bitter melon and shrimp soup</i>	Canh khổ qua nấu tôm	40	0.91	1.27	6.37
<i>Telosma cordata and crab soup</i>	Canh hoa thiên lý nấu cua	105	5.93	4.43	7.52
<i>Amaranth with shrimp soup</i>	Canh rau dền nấu tôm	98.5	4	7	7.5
<i>Green squash with field crab soup</i>	Canh bầu nấu cua / Canh bầu cua đồng	105	4.5	12.25	4.5
<i>Sweet and sour tilapia soup</i>	Canh chua cá diêu hồng	96	1.7	0	20.08
<i>Potato with shrimp soup</i>	Canh khoai nấu tôm	250	8.5	30.3	14.3
<i>Sweet and sour salmon soup</i>	Canh chua cá hồi	132.9	1.9	20.7	6.9
<i>Mallow-leaves with shrimp soup</i>	Canh rau đay nấu tôm	40	0.91	1.27	6.37
<i>Centella with shrimp soup</i>	Canh rau má nấu tôm	40	0.91	1.27	6.37
<i>Luffa with shrimp soup</i>	Canh mướp nấu tôm	52	2.95	4.49	1.95
<i>Water spinach with shrimp soup</i>	Canh rau muống nấu tôm	40	0.91	1.27	6.37
<i>Sweet and sour goby soup</i>	Canh chua cá kèo / cá kèo nấu chua	145	8	5	12
<i>Broccoli with shrimp soup</i>	Canh súp lơ nấu tôm / Canh bông cải nấu tôm	87	5.02	7.56	3.44
<i>Water spinach with crab soup</i>	Canh cua rau muống / Canh rau muống nấu cua	41	0.4	7	3.3
<i>Sour soup with scad</i>	Canh chua cá nục	80	3	4	8
<i>Sour soup with mud carp</i>	Canh chua cá trôi	95	2.1	0.7	18.4
<i>Sour soup with frog</i>	Canh chua ếch	105	0.43	0	23.57
<i>Green squash with baby basket clams soup</i>	Canh bầu nấu hến	92	1.2	3.19	15.83
<i>Salmon floss</i>	Ruốc cá hồi / Chả bông cá hồi	408	13.5	43.5	27.9
<i>Shrimp sausage</i>	Chả tôm / Bánh tôm	210	26	2	10
<i>Sour shrimp past/Sour shrimp and lesser galangal</i>	Mắm tôm chua / Tôm làm mắm chua / Tôm chua củ riềng	131.3	3.7	14.2	10.3
<i>Fried green bean and shrimp</i>	Đậu que xào tôm	209	13.2	12.3	12
<i>Fried green bean and shrimp</i>	Bầu xào tôm	209	13.2	12.3	12
<i>Fried kale and shrimp</i>	Cải ngọt xào tôm	142	8.73	2.45	12.96
<i>Fried okra and shrimp</i>	Đậu bắp xào tôm	160	12	0	7
<i>Fried mushroom and shrimp</i>	Nấm xào tôm	120	2.25	17.5	10
<i>Snail noodle</i>	Bún ốc	176	3.11	25.7	10.05

<i>English Name</i>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Clam porridge</i>	Cháo trai	67	2.39	7.79	3.62
<i>Shrimp porridge</i>	Cháo tôm	65	0.5	0.5	15
<i>Snakehead fish porridge</i>	Cháo cá lóc (cháo cá quả)	78	2.01	4.8	9.73
<i>Crab soup</i>	Súp cua	41	0.4	7	3.3
<i>Crab porridge</i>	Cháo cua	41	0.4	7	3.3
<i>Cellophane noodle and fish</i>	Miến cá	136	5.57	9.72	11.62
<i>Eel porridge</i>	Cháo lươn	78	2.01	4.8	9.73
<i>Fish Noodle / Fish sausage noodle</i>	Bún cá / Bún chả cá	136	5.57	9.72	11.62
<i>Cellophane noodle and eel</i>	Miến lươn	136	5.57	9.72	11.62
<i>Mussel porridge</i>	Cháo hến	129	0.2	30.3	0.6
<i>Banh Da and fish</i>	Bánh đa cá	130	8.8	7.6	5.2
<i>Frog porridge</i>	Cháo ếch	73	0.3	0	16.4
<i>Oyster porridge</i>	Cháo hào	130	8.8	7.6	5.2
<i>Tram fish porridge</i>	Cháo cá trắm	78	2.01	4.8	9.73
<i>Fish porridge</i>	Cháo cá ( không nêu rõ cá gì )	78	2.01	4.8	9.73
<i>Baby clam and rice</i>	Cơm hến	67	2.39	7.79	3.62
<i>Squid porridge</i>	Cháo mực	250	10.44	29.51	8.56
<i>Carp porridge/with green bean</i>	Cháo cá chép / Cháo cá chép đậu xanh	78	2.01	4.8	9.73
<i>Duck egg cooked with sauce</i>	Trứng vịt kho	184	13.72	1.44	12.76
<i>Balut</i>	Trứng vịt lộn	286	18	4	25
<i>Chicken egg omelets</i>	Trứng gà rán	153	12.02	0.69	10.62
<i>Fried eggs (not specify what kind of eggs)</i>	Trứng rán (không nêu rõ loại trứng gì)	194	14.69	0.93	13.56
<i>Eggs cooked with meat</i>	Trứng đúc thịt (trứng chung thịt ) / Trứng chung	156	9.12	1.48	15.94
<i>Egg fried with meat</i>	Trứng rán thịt	156	9.12	1.48	15.94
<i>Egg porridge</i>	Cháo trứng	79.1	2	11.1	4.1
<i>Boiled chicken eggs</i>	Trứng gà luộc	154	10.57	1.12	12.53
<i>Boiled duck eggs</i>	Trứng vịt luộc	154	10.57	1.12	12.53
<i>Fried duck eggs</i>	Trứng vịt rán	129	9.6	1	8.9
<i>Egg soup</i>	Canh trứng	54	3	2.7	4.3
<i>Salted eggs</i>	Hột vịt muối	110	9	1	8
<i>Quail eggs cooked with sauce</i>	Trứng cút kho	77	5	1	7
<i>Chicken egg cooked with sauce</i>	Trứng gà kho	168	12.21	1.27	12.29
<i>Grilled chicken eggs</i>	Trứng gà nướng	168	12.21	1.27	12.29
<i>Boiled eeg</i>	Trứng luộc ( không nêu rõ trứng gì )	155	10.61	1.12	12.58
<i>Unhatched quail eggs</i>	Trứng cút lộn	77	5	1	7
<i>Omelet/ Fried quail eggs</i>	Trứng cút ốp la / Trứng cút chiên	158	11.09	0.41	13.05
<i>Duck Century Egg</i>	Trứng vịt bắc thảo	184	13.72	1.44	12.76
<i>Egg fried with cabbage</i>	Bắp cải xào trứng	194	14.69	0.93	13.56
<i>Fried egg with radish</i>	Củ cải xào trứng	201	15.31	0.88	13.62
<i>Kohlrabi ried with eggs</i>	Su hào xào trứng	201	15.31	0.88	13.62
<i>Fried egg with gourd</i>	Khô qua xào trứng	129	8.95	2.9	8.81

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Fried egg with gourd</i>	Bầu xào trứng	129	8.95	2.9	8.81
<i>Eggs with tomato soup</i>	Canh trứng cà chua / Canh cà chua trứng	55	1.27	9.12	2.44
<i>Fried eggs with chayote</i>	Susu xào trứng	129	8.95	2.9	8.81
<i>Egg fried with noodles</i>	Mì trứng ( mì nấu trứng / mì xào trứng )	127	1.6	22.8	4.2
<i>Fried tofu with tomato sauce / fried tofu stuffed meat with tomato sauce / tofu stuffed meat</i>	Đậu phụ rán sốt cà chua / Đậu phụ dồn thịt rán sốt cà chua / Đậu hũ dồn thịt rán	74	4	5	5
<i>Peanuts roasted / roasted peanuts</i>	Lạc rang / Đậu phộng rang	585	49.66	21.51	23.68
<i>Sesame / peanut sesame salt / sesame salt</i>	Muối vừng / Muối lạc vừng / Muối mè	567	48	26.04	16.96
<i>Chè mixed beans (many types of bean)</i>	Chè đỗ thập cẩm ( nhiều loại đỗ )	67	0.9	7.4	4.4
<i>Tau Pho (tofu syrup)</i>	Tào phớ ( đậu hũ nước đường )	94	4	10	7
<i>Tofu soup</i>	Canh đậu phụ / Canh chuối đậu ( canh đậu phụ nấu chuối xanh ) / Canh đậu hũ / Canh tàu hũ	35	1.4	3.24	2.51
<i>Fried tofu</i>	Đậu phụ rán / Đậu hũ chiên / Đậu hũ chiên sả / Đậu hũ tẩm hành chiên	271	20.18	10.49	17.19
<i>Chè green beans / chickpeas</i>	Chè đỗ xanh / Chè đậu xanh	74	2.2	13	0.6
<i>Boiled tofu</i>	Đậu phụ luộc / Tàu hũ luộc	76	4.8	1.9	8
<i>Bean porridge</i>	Cháo đậu	67	0.9	7.4	4.4
<i>Boiled peanuts (boiled peanuts)</i>	Lạc luộc ( Đậu phộng luộc )	318	22	21	14
<i>Candy peanuts (peanut candy)</i>	Kẹo lạc ( Kẹo đậu phộng )	522	33.7	47.4	15.5
<i>Green beans water (green beans Milk)</i>	Nước đậu xanh ( Sữa đậu xanh )	100	4	10	0
<i>Chè Black beans</i>	Chè đậu đen / Chè đỗ đen	74	2.2	13	0.6
<i>Tofu cook with sauce</i>	Đậu phụ kho / Đậu hũ kho	80	4	6	4
<i>Black sesame milk</i>	Sữa mè đen	90	4	10	3
<i>Green bean cake</i>	Bánh đậu xanh	349	1	73.4	12.8
<i>Black bean milk</i>	Sữa đậu đen / Sữa đậu đen óc chó	65	2.2	9	2
<i>Dried soya bean</i>	Đậu nành sấy / đậu nành rang / Hạt đậu nành sấy	271	20.18	10.49	17.19
<i>Banana</i>	Chuối	89	0.33	22.84	1.09
<i>Tangerine</i>	Quýt	53	0.31	13.34	0.81
<i>Watermelon</i>	Dưa hấu	30	0.15	7.55	0.61
<i>Apple</i>	Táo	52	0.17	13.81	0.26
<i>Guava</i>	Ổi	68	0.95	14.32	2.55
<i>Jujubes (small green apple)</i>	Táo ta (táo xanh trái nhỏ )	79	0.2	29.23	1.2
<i>Oranges</i>	Cam	47	0.12	11.75	0.94
<i>Ambarella</i>	Cóc	60	0	13	1
<i>Mango</i>	Xoài	65	0.27	17	0.51
<i>Grapefruit/pomelo</i>	Bưởi	32	0.1	8.08	0.63
<i>Grape</i>	Nho	69	0.16	18.1	0.72
<i>Papaya</i>	Đu đủ	39	0.14	9.81	0.61



<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Water apple</i>	Mận (roi)	31	0.33	6.73	1.04
<i>Dragon fruit</i>	Thanh long	51	0.38	12.38	0.78
<i>Tamarind</i>	Me	239	0.6	62.5	2.8
<i>Pear</i>	Quả lê	58	0.12	15.46	0.38
<i>Jackfruit</i>	Mít	94	0.3	24.01	1.37
<i>Pineapple</i>	Thơm / Khóm / Dứa	48	0.12	12.63	0.54
<i>Longan</i>	Nhãn	60	0.1	15.14	1.31
<i>Jicama</i>	Củ đậu / Củ sắn ( Củ sắn nước )	38	0.09	8.82	0.72
<i>Sugarcane</i>	Mía	76	0	12.6	0
<i>Sapodilla</i>	Sapoche / Lồng mứt	83	1.1	19.96	0.44
<i>Pomegranate</i>	Lựu	68	0.3	17.17	0.95
<i>Cabrambola</i>	Khế	31	0.33	6.73	1.04
<i>Cherry</i>	Sơ ri	63	0.2	16.01	1.06
<i>Honeydew</i>	Dưa lê	36	0.14	9.09	0.54
<i>Persimmon</i>	Hồng ( trái hồng )	70	0.19	18.59	0.58
<i>Coconut</i>	Dừa	354	33.49	15.23	3.33
<i>Strawberry</i>	Dâu tây	32	0.3	7.68	0.67
<i>Rambutan</i>	Chôm chôm	82	0.21	20.87	0.65
<i>Custard apple</i>	Mãng cầu ( na )	101	0.6	25.2	1.7
<i>Star apple</i>	Vú sữa	79	0.2	29.23	1.2
<i>Cobra melon</i>	Dưa gang	28	0.1	6.58	1.11
<i>Peach</i>	Đào / Quả đào	39	0.25	9.54	0.91
<i>Lychee</i>	Vải / Trái vải	66	0.44	16.53	0.83
<i>Durian</i>	Sầu riêng	147	5.33	27.09	1.47
<i>Cantaloupe</i>	Dưa lưới	34	0.19	8.16	0.84
<i>Dried jackfruit</i>	Mít sấy	252	0.49	66.58	2.64
<i>Raisins</i>	Nho khô	299	0.46	79.1	3.07
<i>Fried banana</i>	Chuối chiên	193	10.88	25.76	1.24
<i>Banana ice cream</i>	Kem chuối	201	10.72	24.4	3.52
<i>Fruit Mixture</i>	Trái cây thập cẩm / Trái cây dầm / Trái cây đĩa	244	0.44	64.81	2.19
<i>Fresh milk (unpasteurized)</i>	Sữa tươi ( thanh trùng )	60	3.25	4.52	3.22
<i>Drinking yogurt</i>	Sữa chua uống	99	1.15	18.64	3.98
<i>Soya milk</i>	Sữa đậu nành	22	1.2	0.1	2
<i>Milk scum</i>	Váng sữa	214	20.96	4.27	3.16
<i>Pasteurized milk</i>	Sữa tiệt trùng	50	2	4.71	3.29
<i>Powdered milk / formula milk / milk powder prepared</i>	Sữa bột / Sữa công thức / Sữa bột pha sẵn	66	3.52	6.62	1.42
<i>Mother milk</i>	Sữa mẹ	65	6.7	3.8	1.3
<i>Yoghurt (yoghurt)</i>	Sữa chua ăn ( yaourt )	99	1.15	18.64	3.98
<i>Sweetened condensed milk / hot milk</i>	Sữa đặc có đường / Sữa nóng	60	3.25	4.52	3.22
<i>Cream</i>	Kem	214	20.96	4.27	3.16

<b>English Name</b>	<b>Vietnamese Name</b>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Cheese</i>	Phô mai	350	26.91	4.71	22.21
<i>Glutinous Rice Yougurt</i>	Sữa chua nếp cẩm	99	1.15	18.64	3.98
<i>Filtered water</i>	Nước lọc / Nước đóng bình	0	0	0	0
<i>Boiled water</i>	Nước đun sôi	0	0	0	0
<i>Hot tea</i>	Nước trà nóng / Nước chè ( chè khô )	1	0	0.2	0
<i>Iced tea</i>	Trà đá	38	0	9.89	0.01
<i>Fresh fruit juice (orange, pomelo, tangerine juice)</i>	Nước ép từ trái cây tươi ( nước cam , nước bưởi ép , quýt ép...)	46	0.11	11.12	0.41
<i>Carbonated soft drink (Coca cola, pepsi,...)</i>	Nước ngọt có ga (Cocacola , pepsi,...)	42	0	10.6	0
<i>Beer</i>	Bia	43	0	3.55	0.46
<i>Coffee</i>	Cà phê	1	0.02	0.04	0.12
<i>Bottled green tea (C2, Khong Do)</i>	Trà xanh đóng chai (C2 , không độ,..)	20	0	5	0
<i>Energy drink (sting, red bull,...)</i>	Nước tăng lực (Sting , red bull,...)	45	0.1	11	0.3
<i>Herbal tea (Adenosma glutinosum, Syzygium nervosum)</i>	Trà thảo dược / Nước mát (Nước vối , nước nhân trần,...)	1	0	0.2	0
<i>Milk tea/Thai milk tea</i>	Trà sữa / Trà sữa thái	10	0.47	0.85	0.53
<i>Tea bag (Lipton,...)</i>	Trà túi lọc (Lipton,túi atiso...)	0	0	0	0
<i>Green tea</i>	Nước trà xanh /chè xanh	1	0	0.2	0
<i>Bottled water (Lavie,...)</i>	Nước khoáng đóng chai (Lavie,...)	0	0	0	0
<i>Iced water</i>	Nước đá lạnh	0	0	0	0
<i>Smoothie (avocado, strawberry,...)</i>	Sinh tố (sinh tố bơ , dâu,...)	62	0.14	15.96	0.42
<i>Sugarcane juice</i>	Nước ép khác ( nước mía , nước rau má ,...)	269	0	73	0
<i>Chè lotus seed</i>	Chè hạt sen	89	0.53	17.28	4.13
<i>Chè fruit (mango, pomelo, Thai,...)</i>	Chè trái cây ( chè xoài , chè bưởi , chè thái ,...)	74	2.2	13	0.6
<i>Chè babana</i>	Chè chuối	74	2.2	13	0.6
<i>Bottled herbal tea (Dr Thanh, Ô long,...)</i>	Trà thảo mộc đóng chai ( Dr Thanh , Ô long,...)	1	0	0.2	0
<i>Fruit milk (corn milk,...)</i>	Sữa trái cây ( Sữa bắp / Sữa ngô ,...)	71	1.37	13.02	2.37
<i>Alcohol</i>	Rượu	134	0	5	0.5
<i>Bird nest drink</i>	Nước yến / Yến sào	47	1.09	3.13	5.64
<i>Lemon tea</i>	Trà chanh	10	0	2.72	0.1
<i>Lotus seed milk</i>	Sữa hạt sen	143	9	11	3
<i>Cocoa</i>	Ca cao	229	13.7	54.3	19.6
<i>Cake in general</i>	Bánh ngọt không nều rõ	297	4.3	57.7	7.3
<i>Gum</i>	Kẹo cao su	247	0.3	66.08	0
<i>Bim Bim (Snack)</i>	Bim Bim (Snack)	447	21.1	57.3	6.7
<i>Chocopie cake</i>	Bánh Chocopie	358	15.1	53.4	5.3
<i>Lollipop / candy</i>	Kẹo mút / Kẹo	384	0.1	95.71	0
<i>Chicken thighs cake</i>	Bánh đùi gà	255	14.9	12.82	16.7
<i>Egg cake (Custa,...)</i>	Bánh ngọt nhân trứng ( Custas , ... )	220	11.6	20.8	5.5
<i>Banana cake</i>	Bánh chuối	299	7.27	56.54	3.46

<i>English Name</i>	<i>Vietnamese Name</i>	<b>Energy p 100 g</b>	<b>Fat (g)</b>	<b>Carbs (g)</b>	<b>Protein (g)</b>
<i>Salted egg cake / Sponge cake</i>	Bánh bông lan trứng muối / Bánh bông lan	289	2.7	61.1	5.4
<i>Biscuits (cozy, ...)</i>	Bánh quy ( cosy ,...)	353	16.3	44.6	7
<i>Rice cake</i>	Bánh gạo	387	2.8	82	8
<i>Donuts</i>	Bánh rán	421	22.9	49.7	5
<i>AFC cake</i>	Bánh AFC	297	4.3	57.7	7.3
<i>Brithday cake/Cheesecake</i>	Bánh kem	321	23	26	6
<i>Shrimp chips</i>	Bánh phồng tôm	541	35.19	50.08	6.66
<i>Jelly</i>	Rau câu	266	0.02	69.95	0.15
<i>Sunflower seed</i>	Hạt hướng dương	570	49.57	18.76	22.78
<i>Pumpkin seeds</i>	Hạt bí	541	45.85	17.81	24.54
<i>Salted dry apricot</i>	Ô mai / Xí muối	241	0.51	62.64	3.39
<i>Cream Puffs</i>	Bánh su kem	362	25.9	22.8	9
<i>Caramel / Flan</i>	Caramen / Bánh Flan	348	0	91.6	0
<i>Chocolate / Chocolate</i>	Socola / Chocolate	535	29.66	59.4	7.65
<i>Pig skin cakes</i>	Bánh da lợn	324	24.66	16.65	8.7
<i>Cashew nut</i>	Hạt điều	553	43.85	30.19	18.22
<i>Chè lam cake</i>	Bánh chè lam	350	15.47	31.28	20.25
<i>Coconut jams</i>	Mứt dừa	300	10	50	0
<i>Theochew pastry</i>	Bánh pía / Bánh lột da	344.8	17.24	41.37	6.89
<i>Fried sweet potato cake</i>	Bánh khoai ( bánh khoai lang / bánh khoai mì / bánh khoai môn )	363	16.29	51.31	4.77
<i>Boiled sweet potato</i>	Khoai lang luộc	90	0.15	20.71	2.01
<i>Shake potato/French fries</i>	Khoai tây lắc / Khoai tây chiên	274	14.06	35.66	3.48
<i>Grilled sweet potato</i>	Khoai lang nướng	86	0.05	20.12	1.57
<i>Chè cassava</i>	Chè sắn ( Chè khoai mì )	160	0.28	38.06	1.36
<i>Fried taro</i>	Khoai môn chiên	144	0.26	34.09	1.93
<i>Boiled taro</i>	Khoai môn luộc	112	0.2	26.46	1.5
<i>Chè taro</i>	Chè khoai môn / Chè khoai sọ	109	0.2	25.2	1.5
<i>Boiled potato</i>	Khoai tây luộc	103	2.24	19.52	1.81
<i>Boiled cassava</i>	Khoai mì luộc / Sắn luộc	160	0.28	38.06	1.36
<i>Cassava root soup</i>	Canh sắn / Canh khoai mì	134	3.47	25.01	1.25
<i>Fish sauce</i>	Nước mắm	35	0.01	3.64	5.06
<i>Shrimp pasty</i>	Mắm tôm	127	2.3	1.94	23.78
<i>Soy sauce</i>	Nước tương	53	0.04	7.61	6.28
<i>Homemade salted soybeans</i>	Tương bần	471	25.4	33.55	35.22
<i>Braised pork sauce</i>	Kho quẹt	620	49.6	21.4	23.6
<i>Shirm pasta</i>	Mắm ruốc	83	0.47	16.76	3.05
<i>Fermented soya bean</i>	Chao	212	11	14.36	17.72
<i>Canned fish</i>	Cá hộp	125	2.49	0	24.02
<i>Canned meat</i>	Thịt hộp chiên	541	41.78	1.43	37.04