Nutrition transition in urban Kenya: The role of supermarkets and nutritional knowledge

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Summary

Nutrition transition is described as a shift in demographic and epidemiologic patterns; fostered through economic development, globalization, urbanization, and technological improvements. Depending on the stage of transition in a given society, changes in lifestyle and eating habits lead to an increased intake of processed foods, saturated and total fats, salt, sugar, and energy-dense beverages. Many developing countries are undergoing such a nutrition transition, which contributes to emerging problems in their health systems. For a long time, the elimination of undernutrition has been a top priority of development policies in low-income countries. Worldwide, it is estimated that 24% of all children under-five are currently stunted, mainly caused by sustained episodes of energy and micronutrient deficiencies. There has been remarkable progress in reducing this prevalence; still the number of stunted children continues to increase in African countries. While globally undernutrition and stunting are declining, overweight, obesity, and nutrition-related non-communicable diseases (NR-NCD) such as diabetes and hypertension are growing epidemically. The large majority of the worldwide NCD-related deaths occur in low- and middle-income countries. Especially for some African countries like Kenya, where stunting is still widespread and overweight and obesity are increasing rapidly, it is of immense importance to analyze and understand driving factors and prevent malnutrition in all its forms.

Against this background, this dissertation presents three essays dealing with the ongoing nutrition transition and malnutrition in Kenya. In the first two essays, we investigate the influence of supermarket purchase on adult's nutrition, diet, and health. In the third essay, we study the link between different types of maternal nutrition knowledge and child and adolescents' nutritional outcomes.

Kenya has experienced a rapid growth of supermarkets in recent years. Overall, the share of national grocery sales through supermarkets in Kenya is about 10%; with big cities already having a much higher share. At the same time, the country is struggling with many nutrition and health-related issues. While 35% of the children under-five are stunted, NR-NCDs are also a growing concern. More than 26% of all adults in Kenya are either overweight or obese. The national prevalence of diabetes and hypertension is estimated at 2.5% and 35%, respectively.

The first two essays are motivated by the hypothesis that the rapid spread of supermarkets in developing countries contributes to the observed nutrition transition and thus causes changes in nutrition and health. Recent research revealed significant effects of supermarket purchase on dietary choices and the body mass index (BMI) in various developing countries. However to our knowledge the question whether supermarket purchase affects the prevalence of NR-NCDs has not been analyzed up till now. We add to the literature by using detailed health data and indicators of NR-NCDs. In addition, existing studies only had cross-sectional data available, so that possible bias due to unobserved heterogeneity remains an issue in the analysis of supermarket impacts. Here, we address this issue with panel data for dietary choices and BMI. Related to our third essay, maternal nutrition knowledge has been identified as one important factor to shape a healthy living environment for the whole household and to improve child nutrition. While associations between maternal nutrition knowledge and young children's nutritional outcomes are well documented, it is much less understood, what type of maternal nutrition knowledge matters most and what are possible impacts on older children and adolescents.

The first essay investigates the effects of supermarket purchase on BMI, as well as on health indicators such as fasting blood glucose (FBG), blood pressure (BP), and the metabolic syndrome. To this end, we use cross-section observational data from urban Kenya collected in 2015. Demographic, anthropometric, and bio-medical data were collected from 550 randomly selected adults. Supermarket purchase is defined as any food purchase done in supermarkets during the last 30 days. Instrumental variable (IV) regressions are applied to control for confounding factors and establish causality between supermarket purchase, BMI, and health. We find that supermarket purchase leads to higher BMI and an increased probability of being overweight or obese. Supermarket purchase is also related to significantly higher levels of FBG and a higher likelihood of suffering from pre-diabetes and the metabolic syndrome. Effects on BP cannot be observed. We conclude that supermarkets and their food sales strategies seem to have direct effects on people's health. In addition to increasing overweight and obesity, supermarkets contribute to FBG, pre-diabetes, and the metabolic syndrome.

In the second essay, we analyze robust effects of supermarket shopping on BMI and the probability of being overweight or obese. Further, we investigate the relationship of supermarket

shopping on the share of energy from highly processed foods and the energy consumption of different food groups (unprocessed staples, fruits/vegetables, meats/fish, dairy/eggs and vegetable oils). For this analysis, we use panel data collected in 2012 and 2015. Econometric analysis is carried out with an unbalanced panel comprising 1,199 observations of male and female adults with differing supermarket access and use. Using fixed effects (FE) estimations, we find that supermarket shopping significantly increases adult's BMI through changed diets. Supermarket shopping decreases the energy consumption from unprocessed staples, fresh fruits, and vegetables and increases energy consumption from dairy, vegetable oil, processed meat products, and highly processed foods. The data suggest that the BMI-increasing effect of supermarket shopping is primarily due to changed dietary composition, rather than higher total energy consumption. As 'unhealthy' foods are also available in traditional retail outlets, the contribution of supermarkets might be of an additional character driven by lager package sizes, pricing, advertising, and placing strategies.

The third essay examines the link between maternal nutrition knowledge and long-term nutritional outcomes of children and adolescents between 5-18 years, focusing on whether associations differ depending on the type of maternal nutrition knowledge. We use panel data from urban Kenya collected in 2012 and 2015. After controlling for confounding factors, we find that maternal nutrition knowledge, measured in terms of an aggregated nutrition knowledge score, is positively associated with children's height-for-age Z-score (HAZ). However, further disaggregation by type of maternal nutrition knowledge reveals important differences. The strongest positive association with child HAZ is found for maternal nutrition knowledge about the health consequences of not following recommended dietary practices.

All three essays contribute to the existing literature about the links between transforming food systems and nutrition in developing countries. Concrete empirical research on such links is relatively scarce. Beyond nutrition, we also broadened the scope and analyzed effects of supermarket shopping on health and NR-NCDs. The results have immediate policy-relevance. Policy interventions should be designed such that positive effects of supermarket growth are strengthened, while negative nutrition and health impacts are avoided to the extent possible. One concrete idea could be to improve the offer and placement of fresh foods in supermarkets located in small urban centers. Furthermore, our results on the role of nutrition knowledge suggest that

nutrition education should especially focus on raising awareness of the health risks associated with unsuitable dietary practices. As shown, awareness of such health risks among mothers and caretakers can help to improve long-term nutritional outcomes of children and adolescents.

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1 General Introduction

1.1 Background

Malnutrition in all its forms is one of the greatest challenges of the 21st century. The main types of malnutrition include undernutrition, overnutrition and micronutrient deficiencies (FAO, 2013). The elimination of undernutrition has long been a major priority in development efforts. Worldwide, there has been remarkable progress in reducing this prevalence. Still, undernutrition remains a major public health problem especially in parts of South Asia and East and Central Africa (NCD Risk Factor Collaboration, 2016). It is estimated that approximately 800 million people are suffering from undernutrition, out of these, 156 million children under-five are currently stunted, meaning that they are too short for their age (FAO, 2015; IFPRI, 2016; UNICEF et al., 2015). While undernutrition is commonly associated with malnutrition, micronutrient deficiencies and overnutrition are increasingly posing a health threat. Recent studies estimate an approximate number of 2 billion people suffering from insufficient micronutrients and another 2 billion people being overweight and obese worldwide (FAO, 2013; NCD Risk Factor Collaboration, 2016; Ng et al., 2014). Globally, 39% of adults are overweight and 13% are classified as obese. Although, the mean body mass index (BMI) in many developing countries is still lower than in high-income countries, the prevalence of a high BMI is rising rapidly also in low-income countries (NCD Risk Factor Collaboration, 2016). Together with these dietary shifts and an increasing sedentary lifestyle, overweight, obesity, and nutrition-related non-communicable diseases (NR-NCDs), like diabetes, coronary heart diseases, and certain cancers are growing epidemically (NCD Risk Factor Collaboration, 2016; Ng et al., 2014; Rosin, 2008; 2015a, WHO, 2016a). By now, numbers for 2015 show that out of the worldwide total amount of approximately 57 million deaths, 40 million (70%) were due to NCDs. Altogether, 78% of global NCD-related deaths occur in low- and middle-income countries (WHO, 2017). These problems are likely to grow further in the years and decades to come (Popkin, 2015; Popkin and Slining, 2013).

Being in an epidemiological and behavioral transition, many developing countries face a widespread coexistence of infectious and chronic diseases. Having people living in food insecurity and being undernourished, while people within the community or even in the same household suffer from obesity and NCDs, a double burden of malnutrition is acute in many of

these countries (Sawaya et al., 2004; Steyn and Mchiza, 2014; Roemling and Qaim, 2013). Since changes in lifestyle, eating habits, and society are happening rapidly, prevention of new emerging health threats is even more difficult, especially as most developing countries are not aware of and do not have necessary experience in these fields (Dalal et al., 2011; Narayan et al., 2010; Okafor, 2012). Further, the double burden of malnutrition and related NCDs are also placing a substantial economic load on countries in terms of increased health care costs and reduced labor productivity (Bommer et al., 2017; Herman, 2013; World Economic Forum, 2011).

Causes for malnutrition and related health problems are complex and multidimensional. The availability of and access to sufficient, nutritious and safe food plus a balanced diet are key factors for fighting malnutrition in all its forms. Or put differently, consuming too little or too much energy or poor diets that are low in micronutrients and vitamins lead to undernutrition, overnutrition and micronutrient deficiencies (FAO, 2013). While in many developing countries especially the rural populations still consume a 'traditional' diet, high in locally available or own-produced staples, nuts and vegetables, economic and social development are driving factors for transformation processes and fostering changes in diets. The so called 'nutrition transition' is a phenomenon describing different shifts in lifestyle, eating habits, and related diseases. Urbanization, technological changes for work, and an expansion of mass media cause an increased intake of processed foods, meat and dairy products, saturated and total fats, sugar and energy-dense beverages (Popkin and Ng, 2007; Popkin et al., 2012; Kennedy, 2013; Roemling and Qaim, 2013). While diets that are higher in energy content can be beneficial for people that suffer from having too little to eat, they foster overweight and obesity in others. The transformation in diets goes along with changes in the food systems in developing countries. The rapid diffusion of modern retails is often referred to as 'supermarket revolution' (T Reardon et al., 2012). This expansion of modern retail is mainly driven by a response to many interconnected forces, like increased incomes, urbanization, greater female labor participation and the desire to emulate Western culture (Traill et al., 2014). The influence of a growing number of supermarkets is not only associated with changes in purchasing location, shopping atmosphere, food prices, and types of foods but also in the way procurement systems are organized (Chege et al., 2015; T Reardon et al., 2012). Accordingly, the changes in supply chains do not only affect the retail systems and consumers but also farmers and their ways of production (Chege et al., 2015; Schipmann and Qaim, 2011). New technologies and new contractual arrangements between

farmers and agribusiness firms cause a rising share of supermarkets in food retailing. In contrast to the supermarket expansion in developed countries, which already happened in the middle of the last century, the supermarket revolution in developing countries is happening at a much faster pace (Andersson et al., 2015; Chege et al., 2015; T Reardon et al., 2012; Timmer, 2009). These changes are often at the costs of traditional shops and daily markets (Reardon, 2011), but also constitute an alternative income source (Chege et al., 2015).

Although the diffusion of supermarkets happens in a rapid manner, the offer of fresh foods is rather slow. In comparison to traditional food retail formats, supermarkets tend to offer less fresh fruits and vegetables to the extent of a much wider variety of packed and (highly) processed foods (Rischke et al., 2015). The transformation in agri-food markets presents challenges and opportunities for farmers and consumers with profound implications for food consumption, nutrition, and health (Qaim, 2017). Possible influences on farmers are only one consequence of the modern retail formats. Other implications can be observed for the consumers. On the one hand, the way supermarket users decide on what they buy does highly influence the supply and organization in modern retails (Anand et al., 2015). Besides personal preferences, habitual and every-day shopping practices, customers' choices are also affected by changing lifestyles and society. On the other hand, as Hawkes (2008) and Traill et al. (2014) point out, not only the consumers' preferences shape the new retail outlets. Supermarkets and the way their business is organized also stimulate the consumers' food choices. Through pricing, advertising, positioning, and availability of different products they directly shape food preferences or create desires (Anand et al., 2015; Story et al., 2008).

Being confronted with the challenges of modern food systems, changing diets and the rising numbers of overweight and obesity, there is still an urgent need to tackle undernutrition. Facing undernutrition especially early in life can lead to delayed or impaired growth, triggering morbidity, mortality and a vicious circle since maternal undernutrition has adverse effects on pregnancy outcomes (Martins et al., 2011). It might seem illogical that societies are facing the problem of overnutrition, obesity and NCDs, while at the same time other members of the community or even the same family suffer from chronic energy and micronutrient deficiencies (Roemling and Qaim, 2013). But it is possible. While economic growth and increased affluence are potential drivers for changing dietary choices, overweight and obesity, they do not

automatically lead to reductions in undernutrition (Vollmer et al., 2014). Remaining poverty, inequality as well as environmental and sociopolitical factors are responsible for causing and maintaining undernutrition in societies. Many interventions are trying to solve or cope with these underlying characteristics. Besides programs that provide food, cash, and nutrient supplements, enhancing maternal nutrition knowledge has been identified as one important channel to shape a healthy living environment for the whole household and to improve child nutrition (Hirvonen et al., 2016; Tabbakh and Freeland-Graves, 2016; World Bank, 2010). In this context, associations between maternal nutrition knowledge and young children's nutritional outcomes are well documented. What is much less understood, are the types of maternal nutrition knowledge that matter most, and that are possibly influencing older children and adolescents. Mainly there are two pathways and mechanisms through which maternal nutrition knowledge and nutritional outcomes are interrelated. First, assuming that mothers capitalize on their nutrition knowledge at any given level of household income and the food budget, household food availability, food choices, handling and sanitation practices are expected to change or to be maintained in a way that contributes to good nutritional outcomes (Variyam et al., 1999). Second, children and adolescents develop better, or maintain beneficial attitudes towards healthy dietary practices and lifestyles (Yabancı et al., 2014), something which can be influenced also by their peers and own (health) education. Enhanced nutritional attitudes are then expected to contribute to better dietary practices (Kigaru et al., 2015) and to improved long-term nutritional outcomes.

1.2 Problem Statement

Several papers deal with the linkage between supermarkets and farmers, their households' nutrition and income potentials when they are taking part in the supermarkets' procurement system (e.g. Andersson et al., 2015; Chege et al., 2015; Neven et al., 2009). While there seems to be a generally positive effect through the involvement of farmers in the supermarkets' procurement system, literature on supermarkets and the effects on consumers, their diets and nutritional outcomes show more diverse results. Regarding high-income countries the proximity to supermarkets and their wide range offer of diverse fresh and processed foods seem to be beneficial for the nutritional outcomes of consumers (Drewnowski et al., 2012; Laraia et al., 2004; Morland et al., 2006). However, there are some examples from developing countries which show different and controversial results. It is still not well understood how food choices are shaped and to what extent supermarkets play a role in the comprehensive dietary decision process

where they are likely to influence nutritional outcomes. Given the few existing examples, the influences of supermarkets on consumers in developing countries cannot be regarded as necessarily positive or negative (Qaim, 2017). Based on linear estimations, one study from Tunis states positive associations with supermarket shopping and dietary quality of the modern retail users. By applying an instrumental variable (IV) approach on cross-sectional data, research from Guatemala and Kenya show negative relation in this context. Built on a large sample of urban and rural households, Asfaw (2008) finds supermarket shopping in Guatemala to increase caloric shares of partially and highly processed foods. With a sample of urban households in Kenya, Rischke et al. (2015) underline these findings. They depict that supermarket users have a greater caloric availability and higher food expenditure shares of highly and primary processed foods. Also for the impacts of supermarkets on nutritional outcomes the literature shows mixed results. After applying a Lewbel IV approach on data from urban adults in Indonesia, Umberger et al. (2015) do not find evidence for a link between supermarket shopping and higher BMI or the probability of being overweight or obese. Different to that and on top to the effects on diet, Asfaw (2008) derives positive effects of supermarket purchase on BMI and the probability of being overweight or obese. Comparably, and also on the basis of an IV approach, Kimenju et al. (2015) find urban supermarket users in Kenya to have higher BMI and a higher likelihood of being overweight or obese.

Almost all existing studies used cross-sectional data and IV techniques to draw causal inference about the effects of supermarket shopping on dietary choices and nutritional outcomes. We are not aware of any study that went beyond nutritional status and analyzed possible links between supermarkets and NR-NCDs. Here, we hypothesize that such a link exists, because overweight and obesity are known to increase the risk of NCDs (NCD Risk Factor Collaboration, 2016; Ng et al., 2014; Popkin, 2015). Better understanding possible health implications of the rapid spread of supermarkets could help in designing food and nutrition policies aimed at curbing the epidemic of NR-NCDs. Further, cross-section observational data have their limitations for robust impact assessment, because the causal inference relies on the validity of an instrument. Panel data are preferred for impact evaluation, because they help to reduce issues of unobserved heterogeneity with less restrictive assumptions.

This dissertation comprises three essays. The first two essays directly address shortcomings in the existing literature about the effects of supermarkets on nutrition and health, building on data collected in urban Kenya. The first essay investigates the influence of supermarket purchase on NR-NCDs. The second essay focuses on the effects of supermarket shopping on nutritional outcomes and dietary choices using panel data. Both essays make use of a quasi-experimental setting, which allows us to compare households with easy supermarket access and households with no (or limited) supermarket access. The third essay focuses on the link between the type of maternal nutrition knowledge and child and adolescent nutritional outcomes.

While associations between maternal nutrition knowledge and young children's nutritional outcomes are well documented, it is much less understood, what type of maternal nutrition knowledge matters most, and which type possibly influences older children and adolescents. Examples from developing countries are mainly restricted to children under-five (e.g. Appoh and Krekling, 2005; Burchi, 2010; Webb and Block, 2004) as it is assumed that nutritional improvements are most beneficial for younger children (Black et al., 2013; Leroy et al., 2014; Ruel et al., 2008). Although a few studies found positive effects of different types of maternal nutritional knowledge on children above-five, the evidence is thin and limited to developed countries: based on a nationally representative sample of U.S. households, including children from 2 to 17 years, Variyam et al. (1999) built a maternal knowledge score out of questions on nutrient content and health awareness. They show positive effects of maternal knowledge on children's dietary quality. Similar to that and also based on an U.S. sample, Tabbakh and Freeland-Graves (2016) measure maternal nutritional knowledge based on combined knowledge about nutrient contents and recommendations. They found the nutritional knowledge of mothers to shape the home environment in such a way that it is positively associated with adolescents' dietary quality and negatively with adolescents' BMI. These studies base maternal nutrition knowledge on one or a maximum of two different components. In the third essay we aim at assessing more comprehensive types of maternal nutrition knowledge and their differentiated associations with nutritional outcomes of children above-five and adolescents. The analysis are based on a panel data set from urban Kenya.

1.3 Research Objectives

The three essays in this dissertation focus on the links between supermarket shopping, dietary choices, nutritional outcomes and NR-NCDs, and the associations of maternal nutrition knowledge with child and adolescent nutritional outcomes. Specifically, the dissertation addresses the following research questions:

I. Does supermarket shopping increase the level of BMI and the probability of being overweight or obese?
II. Does supermarket shopping increase the outcomes of NR-NCDs?
III. Does supermarket shopping directly affect the nutrition transition in terms of dietary choices?
IV. Does maternal nutrition knowledge influence nutritional outcomes of children between 5 and 18 years?
V. Do different types of maternal nutrition knowledge result in differential results concerning child nutritional outcomes?

In order to address all research questions, Central Kenya is the chosen study region for all three essays in this dissertation. Kenya, which has one of the most prospering supermarket sectors in Sub-Saharan Africa, is of special interest for our analysis (Neven et al., 2009; Rischke et al., 2015). The share of national grocery sales through supermarkets is about 10% (Planet Retail, 2016). Further, Kenya provides an interesting study country given that malnutrition in all its forms is widespread. The share of adults being overweight or obese has risen to over 26% with steadily increasing NR-NCDs in recent years (Kenya National Bureau of Statistics, 2014; WHO, 2015a). The national prevalence of diabetes and hypertension is estimated at 2.5% and 35%, respectively (International Diabetes Federation, 2015; WHO, 2015b). While the rates of overweight, obesity, and NCDs are growing, the prevalence of undernourished children under-five is still rather high. The share of Kenyan children being stunted is 35%, 7% are wasted, and 16% are underweight (Matanda et al., 2014; Ministry of Public Health and Sanitation, 2012). As in most Kenyan regions, child undernutrition in Central Kenya has shown little or no improvement for over two decades after the year 1993 (Matanda et al., 2014). Given these multiple nutritional problems under a rapidly changing economy and society, Kenya represents a developing country like many African countries that urgently needs to account for these emerging

nutritional challenges and improve the prevention of overweight, obesity and NCDs while also fighting hunger and undernutrition (IFPRI, 2016).

1.3.1 Data

Figure 1.1 shows a map of Kenya with the two Counties, Nyandarua and Kirinyaga, where the three towns Ol Kalou, Njabini and Mwea are located and where our research was undertaken.

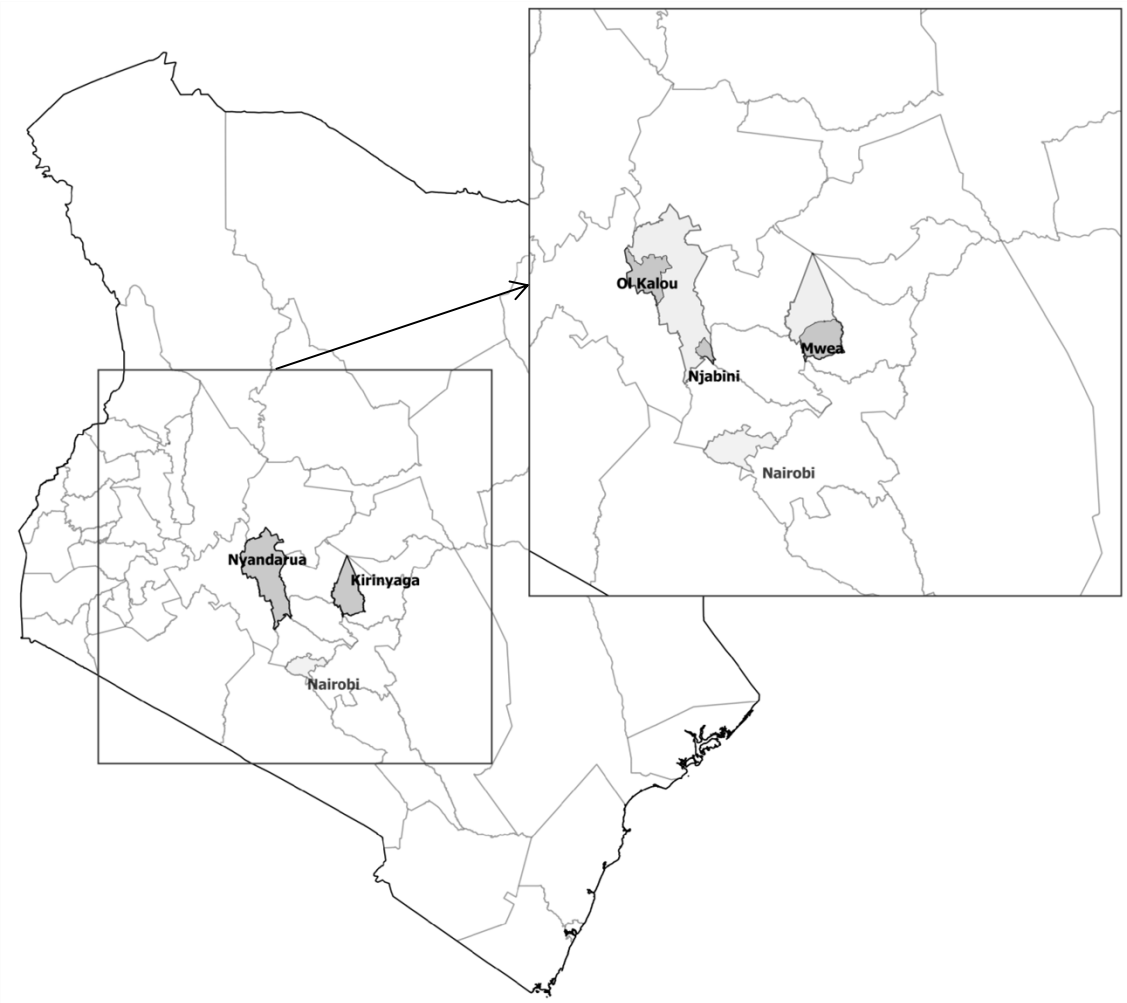

Figure 1.1. Map of Kenya with the study sites in the Counties Nyandarua and Kirinyaga. The zoomed in box shows the three towns Ol Kalou, Njabini and Mwea and their location in the two Counties. Map was created with QGIS (2015) based on data provided by Global Administrative Areas (2012).

All research questions are addressed by using data from the same three towns in urban Central Kenya in the years 2012 and 2015. In 2012, data collection was initiated, organized and implemented by Simon Kimenju and Ramona Rischke using systematic random sampling

techniques in order to identify households and individuals. The team from 2012 kindly provided the collected data and allowed us to use it. [1] The follow-up data collection in 2015 was planned and implemented by me. Here the same three towns and dwellings where followed up (see *General Appendix*, Maps of the Study Sides in Central Kenya). While comprehensive data on household and individual level, concerning socio demographic factors, food consumption, nutrition knowledge, and anthropometrics (de Haen et al., 2011) were collected in both rounds, measurements of bio-medical data (fasting blood glucose and blood pressure) were only performed in the year 2015 (see *General Appendix*, Household Survey 2015). In accordance with the ethical principles for research involving human subjects we obtained study approval from the Ethics-committee of the University Medical Center Goettingen, Germany (25/9/14), and the Kenyatta National Hospital Ethics and Research Committee (P192/04/2015) in Nairobi, Kenya. Permissions in the Kenyan Counties were obtained from Nyandarua (for the towns Ol Kalou and Njabini) and Kirinyaga (for Mwea) County Department of Health. Local authorizations were obtained from the County Commission and the respective deputy commissioner and chiefs in town. Leaders and elders were informed of the study.[2]

The essay in Chapter 2 is based on self-collected cross-sectional data from 2015 and includes all adults older than 18 years (n = 550). The panel data set, containing data collected by Simon Kimenju and Ramona Rischke in 2012 and self-collected data from 2015 was the basis of the essays in Chapter 3 and 4. For the analysis in Chapter 3 all adults (> 18 years) from both years are included (n = 1,199). The essay in Chapter 4 is based on the sample of children and adolescents between 5-18 years out of the panel data set (n = 426). Further details on the study design and the methodological approach can be found in the individual Chapters.

[1] Further details on the initiated data collection in 2012 can be found in Kimenju (2014) and Rischke (2014).

[2] In accordance with the Declaration of Helsinki (World Medical Association, 2013) all participants were asked of their written consent in order to participate in the study before interview and measurements (see *General Appendix*, Household Survey 2015, Declaration of Consent, p. 168). All results were reported for the study and copied for the participant's record. No human samples were kept. Follow-up care for detected clinical conditions was facilitated by referral to nearby district and county hospitals, respectively.

2 Supermarket Purchase Contributes to Nutrition-Related Non-Communicable Diseases in Urban Kenya[3]

Abstract

While undernutrition and related infectious diseases are still pervasive in many developing countries, non-communicable diseases (NCD), typically associated with high body mass index (BMI), are rapidly on the rise. The fast spread of supermarkets and related shifts in diets were identified as possible factors contributing to overweight and obesity in developing countries. Potential effects of supermarkets on people's health have not been analyzed up till now. This study investigates the effects of purchasing food in supermarkets on people's BMI, as well as on health indicators such as fasting blood glucose (FBG), blood pressure (BP), and the metabolic syndrome. This study uses cross-section observational data from urban Kenya. Demographic, anthropometric, and bio-medical data were collected from 550 randomly selected adults. Purchasing food in supermarkets is defined as a binary variable that takes a value of one if any food was purchased in supermarkets during the last 30 days. In a robustness check, the share of food purchased in supermarkets is defined as a continuous variable. Instrumental variable regressions are applied to control for confounding factors and establish causality. Purchasing food in supermarkets contributes to higher BMI (+ 1.8 kg/m²) (P<0.01) and an increased probability (+ 20 percentage points) of being overweight or obese (P<0.01). Purchasing food in supermarkets also contributes to higher levels of FBG (+ 0.3 mmol/L) (P<0.01) and a higher likelihood (+ 16 percentage points) of suffering from pre-diabetes (P<0.01) and the metabolic syndrome (+ 7 percentage points) (P<0.01). Effects on BP could not be observed. Supermarkets and their food sales strategies seem to have direct effects on people's health. In addition to increasing overweight and obesity, supermarkets contribute to nutrition-related NCDs. Effects of supermarkets on nutrition and health can mainly be ascribed to changes in the composition of people's food choices.

[3] This chapter is co-authored by Stephan Klasen, Jonathan M. Nzuma, and Matin Qaim. The authors' contributions are as follows: KMD, SK, and MQ designed the research. KMD collected, analyzed, and interpreted the data. JMN provided assistance in data collection. SK, JMN and MQ assisted in the analysis and interpretation of the results. KMD wrote the paper. All authors read and approved the final manuscript.

2.1 Introduction

While undernutrition and related infectious diseases are still widespread problems in many developing countries (Food and Agriculture Organization of the United Nations (FAO), 2015), overweight, obesity, and nutrition-related non-communicable diseases (NR-NCD) are growing epidemically (NCD Risk Factor Collaboration, 2016; Ng et al., 2014; World Health Organization (WHO), 2015c, 2016a). Seventy-five percent of all people with diabetes live in developing countries (International Diabetes Federation, 2015; World Health Organization (WHO), 2006a). Africa has the world's highest prevalence of hypertension (World Health Organization (WHO), 2013). Almost three-quarters of all worldwide NCD-related deaths occur in low-income and middle-income countries (World Health Organization (WHO), 2016a). These problems will likely grow further in the years and decades to come (Popkin, 2015; Popkin and Slining, 2013), also because most developing countries have little experience with diagnosing, treating, and preventing NCDs (Dalal et al., 2011; Narayan et al., 2010; Okafor, 2012). NCDs are placing a substantial economic and social burden on countries in terms of human suffering, increased health care costs, and reduced labor productivity (Herman, 2013; World Economic Forum, 2011).

It is widely known that "unhealthy" diets and physical inactivity contribute to overweight and obesity and hence higher prevalences of NR-NCDs (Institute of Medicine (U.S.), 2005). Depending on the stage of transition in a given society, changes in lifestyle and eating habits lead to an increased intake of processed foods, saturated and total fats, salt, sugar, and caloric beverages (Popkin and Ng, 2007; Popkin et al., 2012; Roemling and Qaim, 2013; Traill et al., 2014). The globalization of agri-food systems, with its rapid spread of supermarkets in developing countries, may contribute to the observed nutrition transition and thus also to overweight, obesity, and related NR-NCDs (Hawkes, 2008; Popkin, 2014; Qaim, 2017; Tilman et al., 2011). In this study, we analyze possible links between the spread of supermarkets, people's body mass index (BMI), and several other indicators of NR-NCDs.

What type of diets people consume and where they buy their food depends on their income, education, lifestyles, and various other socioeconomic factors. However, the food retail environment and the accessibility to different types of markets and shops can also play important roles (Qaim, 2017; Timmer, 2009). Modernization in the food retail sector is typically associated

with changes in the types of foods offered, prices, packaging sizes, and shopping atmosphere. Especially in urban areas of developing countries, consumers increasingly buy their food in supermarkets instead of wet markets or other traditional retail outlets (Chege et al., 2015; Thomas Reardon et al., 2012; T Reardon et al., 2012; Timmer, 2009). Except for a few large supermarket stores in big cities, where fresh foods are also offered, many supermarket chains in developing countries primarily concentrate on selling processed foods, especially when they open up new stores in smaller towns (Minot et al., 2015; Rischke et al., 2015).

Recent research revealed significant associations between supermarket purchase and dietary shifts in different developing countries (Asfaw, 2008; Kimenju et al., 2015; Rischke et al., 2015; Tessier et al., 2008; Toiba et al., 2015; Umberger et al., 2015). While the concrete results differ and depend on the particular context, several studies showed that people buying in supermarkets tend to consume more energy and a higher share of processed foods (Asfaw, 2008; Rischke et al., 2015; Toiba et al., 2015; Traill et al., 2014). The consumption of highly processed food is often associated with higher overweight and obesity (Asfaw, 2011; Zhou et al., 2015). Studies carried out in Guatemala and Kenya suggested indeed that purchasing food in supermarkets tends to increase BMI and the likelihood of overweight and obesity, even after controlling for income and other possible confounding factors (Asfaw, 2008; Kimenju et al., 2015). We are not aware of any study that went beyond nutritional status and analyzed possible links between supermarkets and NR-NCDs. Better understanding possible health implications of the rapid spread of supermarkets could help in designing food and nutrition policies aimed at curbing the epidemic of NR-NCDs.

We contribute to the literature by investigating the effects of purchasing food in supermarkets on nutrition and health in Kenya. Kenya has experienced a rapid growth of supermarkets in recent years (Rischke et al., 2015). The share of national grocery sales through supermarkets in Kenya is about 10%; when only focusing on larger cities the share is already much higher (Planet Retail, 2016). Kenya is still struggling with relatively high rates of child undernutrition. At the same time, NR-NCDs are growing problems. More than 26% of all adults in Kenya are either overweight or obese (World Health Organization (WHO), 2015a). The national prevalence of diabetes and hypertension is estimated at 2.5% and 35%, respectively (International Diabetes Federation, 2015; World Health Organization (WHO), 2015b). For this study, we collected data on food purchase and consumption behavior, other socioeconomic characteristics, nutrition, and

health from randomly selected adults in urban areas of Central Kenya. We use regression models to estimate the effects of supermarket purchase on BMI, blood glucose, pre-diabetes, blood pressure, pre-hypertension, and the metabolic syndrome. Since BMI and the prevalence of NCDs can also be influenced by factors other than supermarket purchase, it is important to control for such confounding factors in the statistical analysis. We employ an instrumental variable (IV) approach, which helps to reduce endogeneity bias and establish causality with observational data.

2.2 Materials and Methods

2.2.1 Ethics Statement

This study was approved by the Ethics Commission of the University Medical Center Goettingen (http://www.ethikkommission.med.uni-goettingen.de/; study ID 25/9/14) and the Ethics and Research Committee of the Kenyatta National Hospital in Nairobi (http://erc.uonbi.ac.ke; study ID P192/04/2015). Written consent was obtained from each study participant.

2.2.2 Study Design

This study uses cross-sectional data collected in 2015 from households and individual household members in three small towns in Central Kenya. A focus on small towns was chosen because some of these towns already have a supermarket, while others have not. The three towns, Ol Kalou and Njabini in Nyandarua County and Mwea in Kirinyaga County, where purposively selected due to their supermarket characteristics. In Kenya, as in other developing countries, supermarket chains started their business in the big cities, now they are also expanding to smaller towns (Rischke et al., 2015). Ol Kalou has had a supermarket already since 2002 and Mwea since 2011. Njabini did not yet have a supermarket in 2015, although there were concrete plans to open one in the near future and the building was already constructed. Beyond having or not having a supermarket, the three towns are similar in terms of size, ethnic structure of the population, infrastructure conditions, and financial and social institutions (Kenya National Bureau of Statistics, 2010). This setup provides a quasi-experimental setting, allowing the comparison of consumers with varying degrees of supermarket exposure.

The sampling strategy for this study builds on an earlier household survey that was conducted in the same three towns in 2012 (Demmler et al., 2017; Kimenju et al., 2015; Rischke et al., 2015). In each town, households for inclusion were selected using systematic random sampling. Since

recent census data were not available, population statistics and the help of local administrators were used. First, all neighborhoods (residential estates) were listed in each town. Then, for each neighborhood, household lists were compiled, from which households were selected randomly. To obtain a representative sample at town level and avoid clustering, households were selected from all neighborhoods. The 2012 data were collected to analyze the effects of supermarkets on consumers' diets and nutrition. Health indicators to analyze effects on NR-NCDs were not collected in 2012, but were added to the survey in 2015.

The 2015 data, which are used in this study, were collected between May and July 2015. The survey comprised 433 randomly selected households. In these households, interviews were conducted and measurements were taken from 550 male and female adult household members above 18 years of age. The interviews were conducted in local languages (Kikuyu, Kiswahili, and English). All measurements, including weight, height, waist- and hip circumference, blood pressure, and fasting blood glucose, were taken by experienced local nurses, which were trained according to standards of anthropometric measurements by the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention, 2007).

Interviews and measurements took place in participants' homes. Each household was visited twice. During the first visit, the interviews were conducted and appointments made for the second visit, during which measurements were taken. The second visits took place a few days later during early morning hours, as participants had to be fasting for the blood glucose measurements. In some cases, it was not possible to take fasting measurements. For the analysis of fasting blood glucose, pre-diabetes, and the metabolic syndrome only 496 adults from 400 households could be used, as non-fasting measurements had to be dropped. The means of key variables between the full sample and the smaller subsample were compared, without finding significant differences. About 5% of the randomly selected women were pregnant. We carried out all analyses with and without including pregnant women. As results were very similar in terms of directions and magnitudes, we decided to keep pregnant women in the sample, as the larger number of observations adds to statistical efficiency.

Power calculations showed that the sample with 550 observations, observed effect sizes, and a significance criterion of 95%, yields statistical power ranging between 0.88 and 0.97 for the different nutrition and health indicators, thus exceeding common standards for adequacy.

2.2.3 Data

Body weight measurements were taken from all adult individuals with an accuracy of 0.1 kg in minimum clothing and without shoes on a digital scale (range: 10-150 kg). Height was measured with portable stadiometers (SECA; range: 20-205 cm) with accuracy of 0.7 cm while standing upright, barefoot, and without headgear according to international standards (Centers for Disease Control and Prevention, 2007; de Onis et al., 2004). BMI was calculated from the body weight and height (BMI = body weight in kg / body height in meters squared) and classified according to WHO criteria (World Health Organization (WHO), 2014).

Fasting blood glucose (FBG), which is an indicator of diabetes, was determined through one capillary blood drop using the finger prick procedure. Diabetes and pre-diabetes were defined according to criteria by the American Diabetes Association: a person was classified as being diabetic or pre-diabetic if his/her FBG exceeded 7.0 mmol/L or 5.6 mmol/L, respectively (American Diabetes Association, 2006). Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were determined by using a digital auscultatory blood pressure cuff. A SBP $\geq$ 140 mmHg or a DBP $\geq$ 90 mmHg were defined as hypertensive state; a SBP $\geq$ 120 mmHg and a DBP $\geq$ 80 mmHg were defined as pre-hypertensive state (World Health Organization (WHO), 2013). The metabolic syndrome (MetS) was defined according to the classifications of the International Diabetes Federation (International Diabetes Federation, 2006). As triglyceride levels and high-density-lipoprotein cholesterols were not measured, a person was classified as suffering from MetS when the following three conditions were all fulfilled: central obesity (waist circumference males $\geq$ 94 cm; females $\geq$ 80 cm), raised FBG ($\geq$ 5.6 mmol/L), and raised blood pressure (SBP $\geq$ 130 mmHg; DBP $\geq$ 85 mmHg).

Food purchase and consumption decisions were captured through a 30-day food consumption recall at the household level. The person responsible for food purchases and food preparation was asked which of the 176 foods and drinks listed in the questionnaire had been consumed by any household member during the 30 days prior to the interview. Respondents were also asked to specify the quantities consumed of each food item, the source (supermarket, wet market, small shop, own production etc.), and the price. Household expenditures for non-food goods and services were also captured during the interviews. Total per capita consumption expenditures for food and non-food goods and services were used to measure household living standards. In the

development economics literature, consumption expenditures are generally considered a more reliable indicator of living standards than income (Rischke et al., 2015).

2.2.4 Statistical Methods

All statistical analyses were conducted using Stata version 13 (StataCorp, College Station, Texas). The unit of analysis is the individual adult. At first, mean values of the nutrition and health outcome variables of interest are compared between individuals in households that did and did not buy food items in supermarkets. Buying in supermarkets means that at least some of the food items consumed during the 30 days prior to the survey were obtained from a supermarket. Not buying in supermarkets means that all of the food items consumed were obtained from traditional retail outlets or other sources. The nutrition and health outcomes considered for individual i (NH_i) are BMI (kg/m²), FBG (mmol/L), SBP (mmHg), and DBP (mmHg), all measured as continuous variables. In addition, being classified as overweight/obese, pre-diabetic (including pre-diabetes and diabetes), pre-hypertensive (including pre-hypertension and hypertension), and suffering from MetS is captured through binary outcome variables.

Simple comparisons between households with and without supermarket purchase can provide a first impression of possible nutrition and health effects, but they should not be overinterpreted because observed differences in outcomes may also be caused by other factors. To control for possible confounding factors and estimate net effects of purchasing in supermarkets, regression models of the following type are estimated:

$$NH_i = \beta_0 + \beta_1 S_j + \beta_2 \boldsymbol{X}_{ij} + u_{ij} \quad (2.1)$$

where S_j is the binary "treatment" variable defined as 1 if household j (in which individual i lives) purchased food items in a supermarket and 0 otherwise. $\boldsymbol{X}_{ij}$ is a vector of individual and household characteristics, including age, education, sex, living standard, and levels of physical activity, among others. u_{ij} is a random error term.

As individuals and households decide themselves whether or not they purchase food in supermarkets, S_j is likely endogenous. In particular, S_j may be correlated with unobserved characteristics that could themselves have an effect on nutrition and health outcomes. Such a correlation could lead to selection bias (or omitted variable bias) in the estimation of the treatment effect, β_1. For instance, unobserved lifestyle factors could potentially cause such bias.

To reduce selection bias and other possible problems of endogeneity, an instrumental variable approach is applied (Hill et al., 2008; Wooldridge, 2003).

Instrumental Variable Approach

The interpretation of causal effects with cross-section, observational data is possible when using an instrumental variable (IV) approach (Deaton, 2010). The IV approach helps to overcome problems of endogeneity with the treatment variable by replacing the potentially endogenous variable with predicted values, using one or more valid instruments in a two-stage estimation procedure. IV models are widely used in applied economics (Angrist and Krueger, 2001; Duflo, 2001; Gruber, 2000), but also in the nutrition and public health literature (Kimenju et al., 2015; Leigh and Schembri, 2004; Vellakkal et al., 2015). An instrument is valid if it is exogenous, correlated with the treatment variable, and uncorrelated with all outcome variables (Wooldridge, 2003). Previous studies that analyzed the effect of supermarket purchase on food choices and nutrition had used distance to the nearest supermarket as an instrument (Asfaw, 2008; Kimenju et al., 2015; Rischke et al., 2015). The same instrument is also employed here. Distance to the nearest supermarket from each individual home was measured through Global Positioning System (GPS) coordinates.

While the placement of supermarkets is not a random process, the decision is made by supermarket owners based on criteria that cannot be influenced by individual consumers. Both towns with a supermarket (Ol Kalou and Mwea) only had one supermarket, which was located in the town center, where many other shops were also found. Hence, the location of supermarkets was exogenously determined and not linked to socioeconomic characteristics of a particular neighborhood within the town. In order to double-check this assumption we used data from Njabini, the town where no supermarket had opened until 2015, and computed the correlation between supermarket purchase (some households in Njabini use supermarkets in other towns) and distance to the town center of Njabini (exactly the point where the building for the new supermarket was constructed). The correlation was insignificant (r=0.03; P>0.10).

Distance to the nearest supermarket is closely correlated with supermarket purchase (r=0.67). Table A2.1 in the Appendix A2 also confirms that distance to the nearest supermarket is highly significant in the first stage regression of the IV model, passing the test for a strong instrument. To examine whether distance to supermarket is correlated with any of the nutrition and health

outcomes through mechanisms other than supermarket purchase, we used a simple test by additionally including the instrument in the set of models described in equation (2.1). While not being a standard overidentification test, this approach is widely used in the literature to evaluate the plausibility of the exclusion restriction when only one instrument is available (Andersson et al., 2015; Di Falco et al., 2011). Test results are shown in Tables A2.2 and A2.3 in the Appendix A2. Supermarket distance was not statistically significant in any of these models (P>0.10). Hence, distance to supermarket seems to fulfill all requirements for a valid instrument.

The IV models are specified as follows:

$$S_j = \propto_0 + \propto_1 D_j + \propto_2 \boldsymbol{X}_{ij} + \varepsilon_{ij} \quad (2.2)$$

$$NH_i = \delta_0 + \delta_1 \hat{S}_j + \delta_2 \boldsymbol{X}_{ij} + \omega_{ij} \quad (2.3)$$

Equation (2.2) is the first stage selection equation, whereas equation (2.3) is the outcome equation. D_j is the instrument, distance to the nearest supermarket measured in km. $\hat{S}_j$ is the instrumented treatment variable resulting from predictions based on the selection equation. Thus, δ_1 can be interpreted as the unbiased treatment effect. ε_{ij} and ω_{ij} are random error terms. The other variables are defined as above. These models were estimated with Stata IV estimators. For the binary outcome variables, a linear probability IV specification was used. For comparison, ordinary least-squares (OLS) estimators without instrumental variable were also employed. In all models, standard errors are cluster-corrected at town level to avoid problems of heteroskedasticity.

Robustness Checks

Several tests are used to check how robust the estimation results are to variations in model specifications or changes in some of the other underlying assumptions. A first test relates to the models with binary outcome variables. Instead of the linear probability specifications that we use in the main part of the analysis, we re-run the models with standard probit and IV probit specifications, in order to see whether the estimated effects change.

A second test relates to the definition of purchasing food in supermarkets as treatment variable. In the main analysis, we use a binary treatment variable that takes a value of 1 if the household purchased any food in a supermarket during the last 30 days and 0 otherwise. However,

supermarket users typically also use traditional retail outlets, meaning that they only purchase parts of their total food in supermarkets. If supermarkets affect people's diets, nutrition, and health, we would expect that the effects increase with higher shares of food purchased in supermarkets. Such a dose dependency is tested by using a continuous treatment variable "share of supermarket purchase", defined as the percentage share of supermarket food expenditures in total household food expenditures during the last 30 days.

A third test relates to the assumptions in the IV modeling approach. IV models are a common statistical tool to reduce endogeneity bias and establish causality in impact evaluations with observational data. However, the reliability of results depends on the validity of the instrument, which is hard to prove beyond any possible doubt. An alternative approach to reduce issues of endogeneity without the need for an instrument is to use a statistical differencing technique with individual fixed effects (Wooldridge, 2003). This requires panel data. While we do not have panel data for the health outcomes of interest, we do have panel data for the socioeconomic and nutrition variables by combining the 2015 survey with the data collected in 2012 in the same three towns (Kimenju et al., 2015; Rischke et al., 2015). The sample in 2012 and 2015 was not identical, but there was a significant overlap in households and individuals, so that panel data models can be estimated. We use a panel data model for BMI with fixed effects and random effects specifications to check the robustness of the IV results. The advantage of the fixed effects specification is that any time-invariant heterogeneity at individual, household, or town level, whether observed or unobserved, is properly controlled for.

2.3 Results

Out of all 550 study participants, more than half (292) lived in households that purchased food in supermarkets; the rest (258) lived in households that did not buy any food in supermarkets during the 30 days prior to the survey. Descriptive statistics and definitions for the nutrition and health outcomes and the explanatory variables used in the analysis are shown in Table 2.1.

Table 2.1. Descriptive statistics for adults in households that buy and do not buy food in supermarkets

Variable	Definition	All	Does not buy in SM	Buys in SM
Body mass index	Body mass index in kg/m²	25.99 (5.23)	25.15 (4.92)	26.74*** (5.38)
Underweight	=1 if BMI (in kg/m²) < 18.5	0.04 (0.20)	0.04 (0.20)	0.04 (0.19)
Overweight	=1 if BMI (in kg/m²) ≥ 25.0 and < 30.0	0.32 (0.47)	0.26 (0.44)	0.36** (0.48)
Obese	=1 if BMI (in kg/m²) ≥ 30.0	0.22 (0.41)	0.18 (0.39)	0.25* (0.43)
Overweight/obese	=1 if BMI (in kg/m²) ≥ 25.0	0.53 (0.50)	0.45 (0.50)	0.61*** (0.49)
Fasting blood glucose [a]	Fasting blood glucose in mmol/L	5.04 (1.37)	4.99 (1.54)	5.07 (1.20)
Pre-diabetic [a]	=1 if FBG (in mmol/L) ≥ 5.6	0.15 (0.36)	0.10 (0.30)	0.20*** (0.40)
Diabetic [a]	=1 if FBG (in mmol/L) ≥ 7.0	0.03 (0.18)	0.03 (0.18)	0.03 (0.18)
Systolic blood pressure	Systolic blood pressure in mmHg	132.42 (21.57)	134.54 (23.69)	130.54** (19.35)
Diastolic blood pressure	Diastolic blood pressure in mmHg	86.65 (13.06)	87.48 (14.02)	85.91 (12.13)
Pre-hypertensive	=1 if SBP/DBP (in mmHg) ≥ 120 / ≥ 80	0.82 (0.38)	0.83 (0.38)	0.82 (0.39)
Hypertensive	=1 if SBP/DBP (in mmHg) ≥ 140 / ≥ 90	0.41 (0.49)	0.43 (0.50)	0.39 (0.49)
Metabolic syndrome [a]	=1 if all 3 of the following criteria are fulfilled: waist circumference (in cm) for F/M > 80 / > 94; SBP/DBP (in mmHg) ≥ 130 / ≥ 85; FBG (in mmol/L) ≥ 5.6	0.07 (0.26)	0.06 (0.23)	0.08 (0.28)
Share of supermarket purchase (%)	Share of total household food expenditures from food purchases in supermarkets within the last 30d	7.25 (11.01)	0.00 (0.00)	13.65*** (11.88)
Expenditure per capita	Total (food and non-food) expenditures per capita of the last 30 d in 1000 Kenyan shilling	14.16 (9.34)	11.70 (7.36)	16.33*** (10.32)
Education	School education in years of attendance	9.67 (3.49)	8.72 (3.61)	10.52*** (3.14)
Intensive work	Physical effort demanded for work within the last 7 d (self-estimated on a scale 1-4) multiplied by typical amount of work (considering occupational activities within the last 6 mo) in h/wk	123.02 (77.35)	124.47 (85.32)	121.74 (69.68)
Physical activity	All leisure time physical activity (including walking) within the last 30 d in h/wk	15.98 (11.06)	16.85 (11.24)	15.21* (10.86)
Distance to hospital	Distance to nearest district hospital from home [b], in km	10.57 (7.09)	12.82 (3.92)	8.57*** (8.53)
Age	Age in y	38.10 (12.29)	40.18 (14.09)	36.26*** (10.11)
Female	=1 if being female	0.75 (0.43)	0.71 (0.46)	0.79** (0.41)
Married	=1 if being married	0.75 (0.43)	0.73 (0.45)	0.76 (0.43)
Household size	Count of all household members that were either household head or ≥ 180 d present in the household within the last 365 d	4.45 (1.97)	4.79 (2.29)	4.15*** (1.58)
History diabetes	=1 if either mother, father, grandparents or siblings suffer(ed) from diabetes type 2	0.21 (0.41)	0.20 (0.40)	0.22 (0.42)

Notes: Values are means with SD in parentheses. [a] Limited sample size n =496 with non-supermarket buyers (n = 230) and supermarket buyers (n = 266). [b] Measured through GPS coordinates. DBP, diastolic blood pressure; FBG, fasting blood glucose; GPS, Global Positioning System; KES, Kenyan shilling; n, number of observations; SBP, systolic blood pressure; SM, supermarket. * Difference between those shopping and not shopping in supermarkets is significant at 10% level, ** Difference between those shopping and not shopping in supermarkets is significant at 5% level; *** Difference between those shopping and not shopping in supermarkets is significant at 1% level.

Mean BMI is significantly higher among those that purchased food in supermarkets. Similarly, prevalences of overweight and obesity are also significantly higher among individuals that purchased food in supermarkets. For the health variables, the comparison is more mixed. While supermarket buyers are more likely to be pre-diabetic, they have lower mean blood pressure levels than non-supermarket buyers. For the other health indicators, no significant differences between the two groups can be observed.

2.3.1 Supermarket Effects on Nutrition and Health

Tables 2.2 and 2.3 provide results of the IV model estimates for the continuous and binary nutrition and health outcome variables. Looking at Table 2.2, statistically significant effects of purchasing food in supermarkets on BMI and FBG can be seen. After controlling for confounding factors, purchasing food in supermarkets increases BMI by 1.82 kg/m² and FBG by 0.30 mmol/L.

Table 2.2. Regression results forthe effects of supermarkets on BMI, fasting blood glucose, systolic and diastolic blood pressure

	BMI (kg/m²)	FBG (mmol/L)	SBP (mmHg)	DBP (mmHg)
Buys in supermarket	1.82*** (0.24)	0.30*** (0.06)	1.98 (1.33)	1.23 (0.86)
Expenditure per capita, 1000 KES	0.11*** (0.02)	0.01*** (0.00)	-0.03 (0.05)	0.03 (0.04)
Education, y	-0.00 (0.10)	-0.01 (0.01)	-0.42*** (0.14)	-0.21** (0.10)
Intensive work, h/wk	0.01** (0.00)	0.00 (0.00)	0.00 (0.01)	-0.00 (0.00)
Physical activity, h/wk	-0.02** (0.01)	0.00 (0.00)	-0.01 (0.02)	-0.01 (0.01)
Age, y	0.11*** (0.03)	0.02*** (0.00)	0.88*** (0.02)	0.41*** (0.02)
Distance to hospital, km	0.05*** (0.00)	0.02*** (0.00)	-0.09 (0.10)	0.01 (0.07)
Female	3.59*** (0.28)	0.20** (0.09)	-4.84** (2.31)	-2.81** (1.39)
Married	1.01** (0.45)	-0.11 (0.13)	-0.04 (1.41)	0.56 (0.51)
Household size	-0.12*** (0.04)	-0.01 (0.04)	-1.21*** (0.25)	-0.54*** (0.09)
Smoking	-2.14*** (0.65)	-0.17 (0.14)	-12.57*** (1.40)	-7.30*** (1.78)
History diabetes		0.26* (0.14)		
History heart attack			-0.08 (0.36)	-0.49 (1.94)
Constant	15.31*** (2.15)	3.46*** (0.19)	112.80*** (5.62)	76.73*** (2.92)
R-squared	0.23	0.07	0.28	0.17
Number of observations	550	496	550	550

Notes: Coefficient estimates of instrumental variable (IV) models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. “Distance to nearest supermarket” was used as instrument for “buys in supermarket”. BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood glucose; SBP, systolic blood pressure. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

These effects are further underlined by the results in Table 2.3, showing that purchasing food in supermarkets increases the prevalence of overweight and obesity, pre-diabetes, and MetS. Buying food in a supermarket increases the likelihood of overweight/obesity by 20 percentage points, the likelihood of being pre-diabetic by 16 percentage points, and the likelihood of suffering from MetS by 7 percentage points, holding all other factors constant. For comparison, OLS estimates of the same models are shown in Tables A2.4 and A2.5 in the Appendix A2.

Table 2.3. Regression results for the effects of supermarkets on the probability of being overweight/obese, pre-diabetic, pre-hypertensive, and suffering from metabolic syndrome

	Overweight/obese	Pre-diabetic	Pre-hypertensive	MetS
Buys in supermarket	0.204*** (0.02)	0.164*** (0.01)	-0.014 (0.02)	0.068*** (0.01)
Expenditure per capita, 1000 KES	0.008*** (0.00)	0.001 (0.00)	-0.000 (0.00)	0.000 (0.00)
Education, y	0.014* (0.01)	-0.001 (0.00)	-0.001 (0.00)	-0.006** (0.00)
Intensive work, h/wk	0.001** (0.00)	0.000 (0.00)	-0.000 (0.00)	0.000 (0.00)
Physical activity, h/wk	-0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.000 (0.00)
Age, y	0.010*** (0.00)	0.006*** (0.00)	0.006*** (0.00)	0.005*** (0.00)
Distance to hospital, km	0.005*** (0.00)	0.001* (0.00)	-0.003*** (0.00)	0.001*** (0.00)
Female	0.258*** (0.04)	0.008 (0.01)	-0.050*** (0.02)	0.017 (0.02)
Married	0.077 (0.05)	0.021*** (0.01)	-0.034** (0.02)	0.041 (0.03)
Household size	-0.005 (0.01)	0.004 (0.01)	-0.013 (0.01)	-0.001 (0.00)
Smoking	-0.204*** (0.03)	0.034*** (0.01)	-0.002 (0.03)	-0.050*** (0.02)
History diabetes		0.096** (0.04)		
History heart attack			0.105*** (0.03)	
History diabetes/heart attack				0.071*** (0.01)
Constant	-0.537*** (0.16)	-0.289** (0.12)	0.776*** (0.04)	-0.172*** (0.03)
R-squared	0.18	0.07	0.05	0.08
Number of observations	550	496	550	496

Notes: Coefficient estimates of instrumental variable (IV) linear probability models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. "Distance to nearest supermarket" was used as instrument for "buys in supermarket". Overweight/obese: BMI ≥ 25 kg/m²; Pre-diabetic: FBG (in mmol/L) ≥ 5.6 (also includes diabetic with FBG ≥ 7.0); Pre-hypertensive: SBP/DBP (in mmHg) ≥ 120/80 (also includes hypertensive with SBP/DBP ≥ 140/90); Metabolic syndrome (MetS): defined through three parameters: waist circumference (in cm) F/M > 80 /94 plus SBP/DBP (in mmHg) ≥ 130/85 and FBG (in mmol/L) ≥ 5.6. DBP, diastolic blood pressure; FBG, fasting blood glucose; MetS, metabolic syndrome; SBP, systolic blood pressure * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

2.3.2 Other Factors influencing Nutrition and Health Outcomes

Looking at the socioeconomic control variables in Tables 2.2 and 2.3, it can be seen that household per capita expenditure, which is used to measure living standards, has a significantly positive effect on BMI, as well as on the likelihood of being overweight or obese. Similarly,

positive effects on BMI and overweight/obesity are found for being female and being married. Holding other factors constant, female adults have a 3.6 kg/m² higher BMI and are 26 percentage points more likely to be overweight/obese than male adults. Being female is also positively related with FBG, but negatively related with blood pressure. Smoking is negatively related with BMI and overweight/obesity, but also with blood pressure, which is rather unexpected as smoking was identified as one of the major contributors to any coronary heart diseases (World Health Organization (WHO), 2013). It should be mentioned that the number of self-reported smokers in our sample is very small; the negative association of smoking with blood pressure may possibly be due to measurement error and/or unobserved lifestyle factors. Family histories of diabetes and heart attack are positively associated with the likelihood of suffering from pre-diabetes, pre-hypertension, and MetS. Age is positively associated with all nutrition and health outcomes, implying that older people are more likely to be overweight/obese and to suffer from NR-NCDs.

2.3.3 Robustness Checks

Standard probit and IV probit specifications for the models with binary outcome variables are shown in Table A2.6 in the Appendix A2. These alternative estimates lead to similar results as the linear probability models in Table 2.3.

The results with the continuous treatment variable "share of supermarket purchase" are summarized in Tables 2.4 and 2.5 (full results are shown in Tables A2.7 and A2.8). These alternative estimates confirm the general findings obtained with the binary treatment variable: the signs and significance levels of the treatment effects are identical to those in Tables 2.2 and 2.3. A one percentage point increase in the share of food purchased in supermarkets leads to a 0.15 kg/m² higher BMI and a 0.02 mmol/L increase in fasting blood glucose (Table 2.4). Similarly, a one percentage point increase in the share of food purchased in supermarkets raises the probability of being overweight/obese by 1.6 percentage points, the probability of being pre-diabetic by 1.3 percentage points, and the probability of suffering from MetS by 0.5 percentage points (Table 2.5). It should be stressed that for many households in the sample the share of supermarket purchase is still quite low (14% on average). The continuous treatment effects are point estimates, which should not be extrapolated linearly over wide variations of the treatment variable. Nevertheless, the estimates clearly suggest that there is a dose dependency. We also

estimated alternative models with the continuous treatment variable, but only using the subsample of supermarket users. These alternative models yielded results that are very similar to the full-sample results in Tables 2.4 and 2.5.

Table 2.4. Regression results for the effects of supermarket purchase (%) on BMI, fasting blood glucose, systolic and diastolic blood pressure

	BMI (kg/m²)	FBG (mmol/L)	SBP (mmHg)	DBP (mmHg)
Share of supermarket purchase, %	0.15*** (0.02)	0.02*** (0.00)	0.16 (0.11)	0.10 (0.07)
Constant	14.22*** (2.18)	3.30*** (0.21)	111.61*** (6.34)	75.99*** (3.32)
Number of observations	550	496	550	550

Notes: Coefficient estimates of instrumental variable (IV) models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. "Distance to nearest supermarket" was used as instrument for "share of supermarket purchase". Control variables are not shown for brevity. Full results are provided in Table A2.7. BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood glucose; SBP, systolic blood pressure. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table 2.5. Regression results for the effects of supermarket purchase (%) on the probability of being overweight/obese, pre-diabetic, pre-hypertensive, and suffering from metabolic syndrome

	Overweight/Obese	Pre-diabetic	Pre-hypertensive	MetS
Share of supermarket purchase, %	0.016*** (0.00)	0.013*** (0.00)	-0.001 (0.00)	0.005*** (0.00)
Constant	-0.660*** (0.16)	-0.379*** (0.13)	0.784*** (0.05)	-0.209*** (0.03)
Number of observations	550	496	550	496

Notes: Coefficient estimates of instrumental variable (IV) linear probability models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. "Distance to nearest supermarket" was used as instrument for "share of supermarket purchase". Control variables are not shown for brevity. Full results are provided in Table A2.8. MetS, metabolic syndrome. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

As explained, in a final robustness check we used a panel data model for BMI to estimate the effect of supermarket purchase without the need for an instrument. Fixed effects and random effects specifications of this panel data model confirm a positive and significant effect of supermarket purchase on BMI (Table A2.9). These robustness checks suggest that the general findings are not driven by a particular type of model specification, by the definition of the treatment variables, the choice of instrument, or unobserved lifestyle factors.

2.4 Discussion

2.4.1 Study Limitations

We have analyzed the effects of purchasing food in supermarkets on NR-NCDs among urban adults in Kenya. The methodological approach used has a few limitations. First, the observational data are cross-section in nature, which complicates the identification of causal effects. We used an IV modeling approach to control for confounding factors and reduce possible issues of endogeneity. For BMI, the effects were also confirmed with a panel data model, but for the health outcomes no panel data were available. Repeated collection of data for all relevant outcome variables through additional survey rounds would help to further test the robustness of the estimation results. Second, and related to the previous point, classifying health status based on single measurements can be imprecise, especially for health outcomes such as diabetes or hypertension. Employing well-trained and experienced nurses, using reliable clinical instruments, and taking all measurements at the same time of the day, as done in this study, can reduce sources of imprecision, but not completely. Third, due to budget constraints we were only able to collect certain health indicators and not others that could have been useful as well. For instance, the classification of MetS here was based on only three factors, instead of five that are commonly used (Alberti et al., 2006). Only considering three factors may lead to an underestimation of the true number of people suffering from MetS. Fourth, data were only collected in three towns. While these three towns are typical for medium-sized urban municipalities in Central Kenya, the sample is not representative for the country as a whole.

2.4.2 Rising Rates of Nutrition-Related Non-Communicable Diseases

In spite of the mentioned limitations, the results contribute to the literature because this is the first study that has attempted to analyze the effects of the spread of supermarkets on NR-NCDs in developing countries. In Kenya, as in many other developing countries, rapidly rising prevalence rates of obesity and NR-NCDs are observed, so that a better understanding of causes and contributing factors is important from public health and policy perspectives. In the study region in Central Kenya, mean BMI among adults was 26.0 kg/m² during the survey in 2015. The 2012 data collected in the same three towns showed a mean BMI of 24.9 kg/m² (Kimenju et al., 2015). Hence, mean BMI increased considerably within a period of only three years. Similarly, between

2012 and 2015 the prevalence of overweight has increased from 27% to 32%, and the prevalence of obesity from 14% to 22%.

A study with data collected in 2010 in Nairobi reported a prevalence of hypertension of 23% (Joshi et al., 2014), compared to a prevalence of hypertension of 41% in the 2015 sample used here. Furthermore, 15% of the individuals in the sample used here suffered from pre-diabetes and 7% from MetS in 2015. Our estimated prevalence of pre-diabetes is higher than other available estimates for Kenya: according to the 2015 estimates of the International Diabetes Federation (IDF), the national prevalence of pre-diabetes in Kenya is 9.5% (International Diabetes Federation, 2015). While we do not claim to have nationally representative data, our higher prevalence of 15% may still be more realistic. For most developing countries, IDF statistics are based on estimates and extrapolations using doctors' records rather than data from representative samples (Bommer et al., 2017; International Diabetes Federation, 2015). Doctors' records may underestimate the prevalence of NR-NCDs, because many people in developing countries do not see a doctor on a regular basis.

2.4.3 Summary of Supermarket Effects

The regression results suggest that the spread of supermarkets contributes to rising body weight. Buying food in supermarkets instead of (or in addition to) traditional retail outlets was shown to increase BMI by 1.82 kg/m², after controlling for confounding factors. Relatedly, supermarket purchase increases the likelihood of being overweight or obese by 20 percentage points. The directions and the magnitudes of these results are consistent with earlier studies carried out in Kenya and Guatemala (Asfaw, 2008; Kimenju et al., 2015). The analysis also revealed that buying food in supermarkets increases FBG by 0.30 mmol/L and the likelihood of being pre-diabetic and suffering from MetS by 16 and 7 percentage points, respectively. The general findings were also confirmed in a robustness check using the share of supermarket food purchases as a continuous treatment variable. We found no evidence that buying in supermarkets increases BP or the likelihood of suffering from pre-hypertension. The insignificant effect on hypertension might be due to the multifactorial character of this medical condition, which is not yet well examined, especially not in Africa.

Even though our results are consistent with the literature, the estimated effects in our study (for nutrition and health outcomes) as well as in previous studies (confined to nutrition outcomes) are

relatively large in magnitude. Since all the results derive from cross-sectional data, one should be careful not to over-interpret the precision of the estimates. However, regardless of the exact magnitude of effects, the estimates and robustness checks depict a clear tendency, namely that supermarkets influence consumers' nutrition and health, also after controlling for other relevant socioeconomic and lifestyle factors.

2.4.4 Expected Mechanisms of Supermarket Effects

The observed effects of supermarkets on nutrition and health can be explained by changing food offers and shopping environments that influence consumer choices and diets. Supermarkets in developing countries tend to offer different types of foods than wet markets and other traditional retail outlets. Levels of processing, packaging sizes, and prices are often different as well. Previous research has shown that people who buy in supermarkets consume more calories and a higher share of processed foods (Asfaw, 2008; Hawkes, 2008; Kimenju et al., 2015; Qaim, 2017; Rischke et al., 2015; Toiba et al., 2015). And energy-dense, processed foods and beverages are known to contribute to overweight and obesity (Popkin and Ng, 2007; Popkin et al., 2012; Popkin and Slining, 2013).

These general relationships are also true in Kenya. Figure 2.1 shows differences in dietary patterns between households that buy and do not buy food in supermarkets. The observed differences in the consumption of various food groups are not very large, which is due to the fact that most of the households so far only buy part of their total foods consumed in supermarkets. Nevertheless, many of the differences are statistically significant. Households that purchase food in supermarkets consume higher quantities of processed snacks, fats and oils, soft drinks, meat and fish, and processed grains. On the other hand, they consume significantly lower quantities of vegetables and unprocessed grains. These differences in diets may contribute to increased overweight and obesity among supermarket buyers and thus also to a higher prevalence of NR-NCDs.

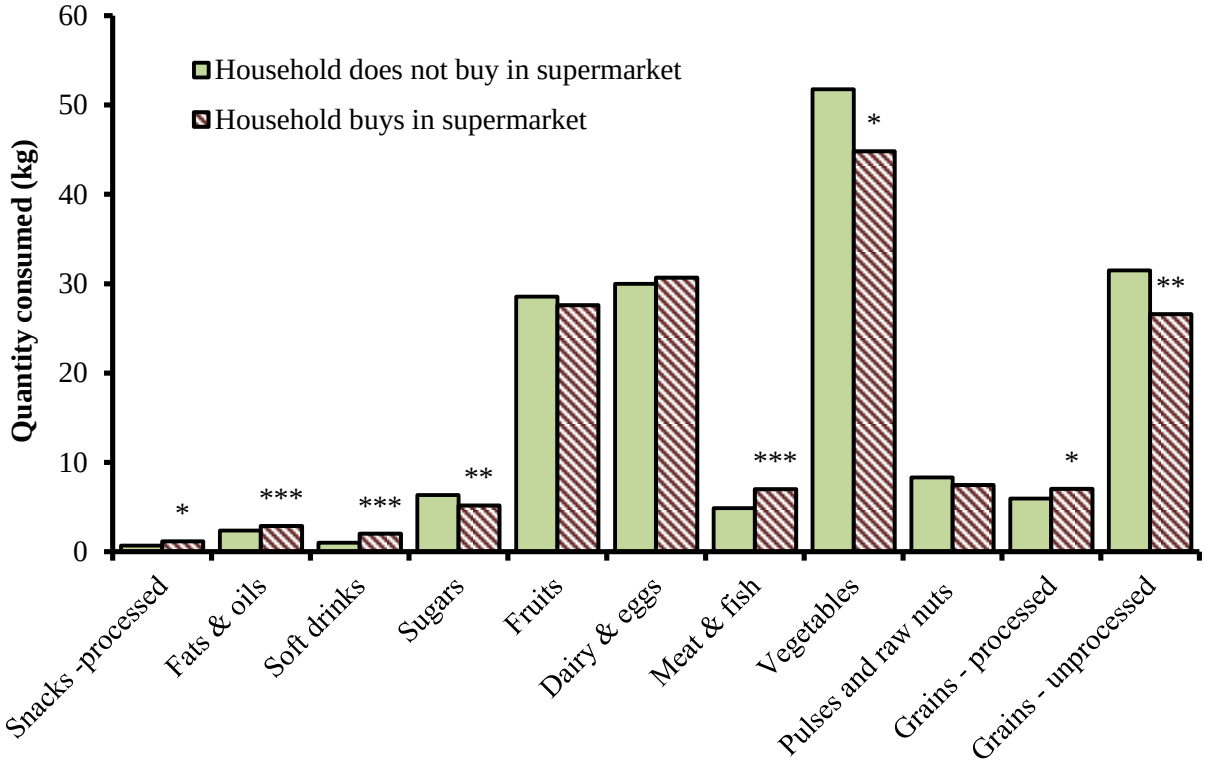

Figure 2.1. Comparison of mean food consumption within last 30d in households that buy and do not buy food in supermarkets (n = 433). *Mean is different at $P < 0.10$; ** Mean is different at $P < 0.05$; *** Mean is different at $P < 0.01$.

That such differences in diets are likely caused by supermarkets and their particular food offers was shown in another recent study with data from Kenya (Demmler et al., 2017). Demmler et al. (Demmler et al., 2017) confirmed that supermarkets contribute to increased consumption of highly processed foods, meats, dairy, and vegetable oils. They also showed that supermarkets decreased the amounts of energy obtained from unprocessed food items such as fresh vegetables and grains. While traditional retailers also sell processed foods, the processed food items purchased in supermarkets seem to be of additional nature. That is, supermarket users purchase additional quantities of processed foods without necessarily reducing processed food purchases from traditional shops. This may possibly be explained by supermarkets selling popular brands or larger packaging sizes that are not available in traditional shops. Also pricing and advertising strategies and the self-service character of supermarkets may incentivize consumers to use supermarkets and buy additional quantities (Demmler et al., 2017).

We expect that most of the effects of supermarkets on NR-NCDs are channeled through higher BMI. However, there are also other possible mechanisms. One other possible mechanism is the reduced amount of bioactive compounds in "supermarket" diets that contain lower quantities of vegetables and unprocessed foods. There is evidence that bioactive compounds – including phytochemicals, vitamins, minerals, and fibers – can reduce the risk of diabetes and other chronic diseases even after controlling for BMI (Liu, 2013).

2.4.5 Policy Implications

Results of this study suggest that the rapid spread of supermarkets contributes to the nutrition transition and the rising epidemic of NR-NCDs in developing countries. However, this does not mean that supermarkets should be prohibited, as they may also have positive effects for public health and development. Compared to traditional food markets in developing countries, supermarket supply chains are often more efficient, which can make food more accessible for poor population segments (Kimenju et al., 2015; Qaim, 2017; Timmer, 2009). Recent studies showed that supermarkets can contribute to reduced rates of child undernutrition in some situations (Kimenju et al., 2015; Kimenju and Qaim, 2016). Food quality, food diversity, and food safety may also be higher in supermarkets than in traditional markets (Mergenthaler et al., 2009; Minot et al., 2015; Tessier et al., 2008). Finally, studies have shown that small-scale farmers in developing countries may benefit from participating in newly emerging supermarket supply chains (Chege et al., 2015; T Reardon et al., 2012). Against this background, it will be important for policymakers to strengthen the positive aspects of supermarket growth, while reducing negative implications to the extent possible. A critical aspect is to shape food environments that allow and instigate consumers to make more healthy food choices. This may require broader awareness building and education towards healthy nutrition, as well as appropriate regulation. For instance, outside of the big cities, supermarkets in developing countries often only sell processed foods. Requiring or supporting supermarkets to also offer fresh fruits and vegetables, and to position such a fresh produce section in a key place within the store, could be one possible route for nutrition-sensitive policymaking.

2.5 Conclusion

This study suggests that buying food in supermarkets increases BMI, fasting blood glucose, and the probability of being overweight/obese, pre-diabetic, and suffering from the metabolic

syndrome. Since supermarket users consume larger quantities of highly processed and energy-dense foods, we reckon that the nutrition and health effects are mainly driven by supermarkets influencing people's dietary choices. This would mean that the rapid spread of supermarkets in developing countries directly contributes to the nutrition transition. However, premature judgements should be avoided, as supermarkets can also have positive effects for public health and development. We have highlighted new aspects and dimensions of the effects of supermarkets on nutrition and health in developing countries. This is a new research direction where the available evidence is still relatively thin. Given the rapidly rising prevalence of NR-NCDs in many developing countries, more research on the role of changing food environments and appropriate policy responses that account for the complexity of effects will be needed.

2.5 Appendix A2

Table A2.1. First stage results of instrumental variable model

	Buys in supermarket
Distance to supermarket, km	-0.014*** (0.001)
Expenditure per capita	0.009** (0.004)
Education, y	0.011*** (0.001)
Intensive work, h/wk	-0.000*** (0.000)
Physical activity, h/wk	0.000 (0.001)
Age, y	-0.002 (0.001)
Distance to hospital, km	-0.009** (0.004)
Female	0.040*** (0.005)
Married	0.047 (0.054)
Household size	0.002 (0.005)
Smoking	0.004 (0.033)
Constant	0.656*** (0.108)
R-squared	0.52
F-statistic	123.51
Number of observations	550

Notes: First stage of instrumental variable estimation (selection equation), where "distance to nearest supermarket" is used as an instrument for "buys in supermarket". Coefficient estimates are shown with robust standard errors in parentheses. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.2. Validity test of instrument in models for continuous nutrition and health outcomes

	BMI (kg/m²)	FBG (mmol/L)	SBP (mmHg)	DBP (mmHg)
Buys in supermarket	0.71 (0.57)	0.07 (0.22)	-3.28 (2.44)	-1.19 (1.58)
Distance to supermarket, km	-0.02 (0.01)	-0.00 (0.00)	-0.07 (0.05)	-0.03 (0.04)
Constant	16.04*** (1.39)	3.60*** (0.30)	116.22*** (6.04)	78.30*** (3.85)
R-squared	0.23	0.08	0.28	0.18
Number of observations	550	496	550	550

Notes: Coefficients are shown with robust standard errors in parentheses. Not all control variables are shown for brevity. Included control variables are the same as in all other models: expenditure, education, intensive work, physical activity, age, distance to hospital, being female, being married, household size, smoking, history of diabetes, and history of heart attack. DBP, diastolic blood pressure; FBG, fasting blood glucose; SBP, systolic blood pressure. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.3. Validity test of instrument in models for binary nutrition and health outcomes

	Overweight/obese	Pre-diabetic	Pre-hypertensive	MetS
Buys in supermarket	0.062 (0.06)	0.068 (0.04)	0.024 (0.06)	0.035 (0.03)
Distance to supermarket, km	-0.002 (0.00)	-0.001 (0.00)	0.001 (0.00)	-0.000 (0.00)
Constant	-0.444*** (0.14)	-0.228* (0.12)	0.470*** (0.16)	-0.152 (0.09)
R-squared	0.19	0.08	0.05	0.08
Number of observations	550	496	550	496

Notes: Coefficients of linear probability models are shown with robust standard errors in parentheses. Overweight/obese: BMI ≥ 25 kg/m²; Pre-diabetic: FBG (in mmol/L) ≥ 5.6; Pre-hypertensive: SBP/DBP (in mmHg) ≥ 120/80; Metabolic syndrome (MetS): defined through three parameters: waist circumference (in cm) F/M > 80 /94 plus SBP/DBP (in mmHg) ≥ 130 / ≥ 85 and FBG (in mmol/L) ≥ 5.6. Not all control variables are shown for brevity. Included control variables are the same as in all other models: expenditure, education, intensive work, physical activity, age, distance to hospital, being female, being married, household size, smoking, history of diabetes, and history of heart attack. DBP, diastolic blood pressure; FBG, fasting blood glucose; MetS, metabolic syndrome; SBP, systolic blood pressure * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.4. Regression results for the effects of supermarkets on BMI, fasting blood glucose, systolic and diastolic blood pressure comparing OLS and IV estimations

	BMI (kg/m²)		FBG (mmol/L)		SBP (mmHg)		DBP (mmHg)	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Buys in supermarket	1.15** (0.18)	1.82*** (0.24)	0.16 (0.12)	0.30*** (0.06)	-1.20 (1.03)	1.98 (1.33)	-0.23 (0.54)	1.23 (0.86)
Expenditure per capita	0.11* (0.03)	0.11*** (0.02)	0.01* (0.00)	0.01*** (0.00)	-0.00 (0.04)	-0.03 (0.05)	0.04 (0.05)	0.03 (0.04)
Education, y	0.01 (0.12)	-0.00 (0.10)	-0.00 (0.02)	-0.01 (0.01)	-0.36 (0.20)	-0.42*** (0.14)	-0.18 (0.14)	-0.21** (0.10)
Intensive work, h/wk	0.01 (0.00)	0.01** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	0.00 (0.01)	-0.00 (0.00)	-0.00 (0.00)
Physical activity, h/wk	-0.02 (0.01)	-0.02** (0.01)	0.00 (0.01)	0.00 (0.00)	-0.02 (0.03)	-0.01 (0.02)	-0.01 (0.01)	-0.01 (0.01)
Age, y	0.11* (0.04)	0.11*** (0.03)	0.02** (0.01)	0.02*** (0.00)	0.87*** (0.03)	0.88*** (0.02)	0.40*** (0.02)	0.41*** (0.02)
Distance to hospital, km	0.04 (0.02)	0.05*** (0.00)	0.02** (0.00)	0.02*** (0.00)	-0.15* (0.04)	-0.09 (0.10)	-0.02 (0.04)	0.01 (0.07)
Female	3.68*** (0.30)	3.59*** (0.28)	0.22 (0.11)	0.20** (0.09)	-4.38 (3.08)	-4.84** (2.31)	-2.60 (1.84)	-2.81** (1.39)
Married	1.04 (0.50)	1.01** (0.45)	-0.11 (0.16)	-0.11 (0.13)	0.08 (1.85)	-0.04 (1.41)	0.61 (0.66)	0.56 (0.51)
Household size	-0.13 (0.05)	-0.12*** (0.04)	-0.01 (0.05)	-0.01 (0.04)	-1.28* (0.35)	-1.21*** (0.25)	-0.57** (0.11)	-0.54*** (0.09)
Smoking	-2.09 (0.79)	-2.14*** (0.65)	-0.16 (0.18)	-0.17 (0.14)	-12.31** (1.88)	-12.57*** (1.40)	-7.18* (2.25)	-7.30*** (1.78)
History diabetes			0.27 (0.19)	0.26* (0.14)				
History heart attack					-0.72 (1.09)	-0.08 (0.36)	-0.79 (2.60)	-0.49 (1.94)
Constant	15.71** (2.60)	15.31*** (2.15)	3.53*** (0.23)	3.46*** (0.19)	114.64*** (6.65)	112.80*** (5.62)	77.57*** (3.21)	76.73*** (2.92)
R-squared	0.23	0.23	0.07	0.07	0.28	0.28	0.18	0.17
Durbin-Wu-Hausman	2.44		4.37		3.80		4.10	
Number of observations	550	550	496	496	550	550	550	550

Notes: Coefficient estimates of OLS and IV models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. In the IV regressions, "distance to nearest supermarket" was used as instrument for "buys in supermarket". BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood glucose; IV, instrumental variable model; OLS, ordinary least squares; SBP, systolic blood pressure. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.5. Regression results for the effects of supermarkets on the probability of being overweight/obese, pre-diabetic, pre-hypertensive, and suffering from metabolic syndrome comparing OLS and IV estimations

	Overweight/Obese		Pre-diabetic		Pre-hypertensive		MetS	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Buys in supermarket	0.119* (0.03)	0.204*** (0.02)	0.108** (0.02)	0.164*** (0.01)	0.006 (0.04)	-0.014 (0.02)	0.048** (0.01)	0.068*** (0.01)
Expenditure per capita	0.008 (0.00)	0.008*** (0.00)	0.002 (0.00)	0.001 (0.00)	-0.001 (0.00)	-0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Education, y	0.015 (0.01)	0.014* (0.01)	0.000 (0.00)	-0.001 (0.00)	-0.002 (0.01)	-0.001 (0.00)	-0.005 (0.00)	-0.006** (0.00)
Intensive work, h/wk	0.001 (0.00)	0.001** (0.00)	0.000 (0.00)	0.000 (0.00)	-0.000 (0.00)	-0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Physical activity, h/wk	-0.002 (0.00)	-0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.000 (0.00)	0.000 (0.00)
Age, y	0.010* (0.00)	0.010*** (0.00)	0.006** (0.00)	0.006*** (0.00)	0.006* (0.00)	0.006*** (0.00)	0.005** (0.00)	0.005*** (0.00)
Distance to hospital, km	0.004 (0.00)	0.005*** (0.00)	-0.000 (0.00)	0.001* (0.00)	-0.003 (0.00)	-0.003*** (0.00)	0.000 (0.00)	0.001*** (0.00)
Female	0.270** (0.05)	0.258*** (0.04)	0.014 (0.02)	0.008 (0.01)	-0.053 (0.03)	-0.050*** (0.02)	0.019 (0.02)	0.017 (0.02)
Married	0.080 (0.06)	0.077 (0.05)	0.025** (0.00)	0.021*** (0.01)	-0.035 (0.02)	-0.034** (0.02)	0.042 (0.04)	0.041 (0.03)
Household size	-0.007 (0.01)	-0.005 (0.01)	0.003 (0.01)	0.004 (0.01)	-0.012 (0.01)	-0.013 (0.01)	-0.002 (0.00)	-0.001 (0.00)
Smoking	-0.197** (0.03)	-0.204*** (0.03)	0.038 (0.02)	0.034*** (0.01)	-0.004 (0.03)	-0.002 (0.03)	-0.048 (0.02)	-0.050*** (0.02)
History diabetes			0.097 (0.05)	0.096** (0.04)				
History heart attack					0.109* (0.03)	0.105*** (0.03)		
History diabetes/heart attack							0.070*** (0.01)	0.071*** (0.01)
Constant	-0.487 (0.20)	-0.537*** (0.16)	-0.258 (0.14)	-0.289** (0.12)	0.764*** (0.04)	0.776*** (0.04)	-0.162* (0.04)	-0.172*** (0.03)
R-squared	0.18	0.18	0.08	0.07	0.05	0.05	0.08	0.08
Durbin-Wu-Hausman	2.42		9.48*		0.12		1.13	
Number of observations	550	550	496	496	550	550	496	496

Notes: Coefficient estimates of linear probability models estimated with OLS and IV are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. In the IV regressions, "distance to nearest supermarket" was used as instrument for "buys in supermarket". Overweight/obese: BMI ≥ 25 kg/m²; Pre-diabetic: FBG (in mmol/L) ≥ 5.6; Pre-hypertensive: SBP/DBP (in mmHg) ≥ 120/80; Metabolic syndrome (MetS): defined through three parameters: waist circumference (in cm) F/M > 80 /94 plus SBP/DBP (in mmHg) ≥ 130 / ≥ 85 and FBG (in mmol/L) ≥ 5.6. DBP, diastolic blood pressure; FBG, fasting blood glucose; IV, instrumental variable; OLS, ordinary least squares; MetS, metabolic syndrome; SBP, systolic blood pressure * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.6. Regression results for the effects of supermarkets on the probability of being overweight/obese, pre-diabetic, pre-hypertensive, and suffering from metabolic syndrome comparing probit and IV probit estimations

	Overweight/obese		Pre-diabetic		Pre-hypertensive		MetS	
	Probit	IV probit	Probit	IV probit	Probit	IV probit	Probit	IV probit
Buys in supermarket	0.114*** (0.03)	0.112*** (0.02)	0.116*** (0.03)	0.138*** (0.01)	0.003 (0.03)	-0.085*** (0.03)	0.061*** (0.01)	0.055*** (0.02)
Expenditure per capita	0.010*** (0.00)	0.009*** (0.00)	0.002 (0.00)	0.001*** (0.00)	-0.001 (0.00)	0.000 (0.00)	0.000 (0.00)	-0.000 (0.00)
Education, y	0.013* (0.01)	0.012 (0.01)	0.000 (0.00)	-0.001 (0.00)	-0.003 (0.01)	0.000 (0.01)	-0.005* (0.00)	-0.004 (0.00)
Intensive work, h/wk	0.001* (0.00)	0.001* (0.00)	0.000 (0.00)	0.000 (0.00)	-0.000* (0.00)	-0.000** (0.00)	0.000 (0.00)	0.000 (0.00)
Physical activity, h/wk	-0.002 (0.00)	-0.002 (0.00)	0.001 (0.00)	0.001 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Age, y	0.010*** (0.00)	0.010*** (0.00)	0.006*** (0.00)	0.006*** (0.00)	0.008*** (0.00)	0.008*** (0.00)	0.005*** (0.00)	0.005*** (0.00)
Distance to hospital, km	0.003 (0.00)	0.004** (0.00)	0.000 (0.00)	0.002*** (0.00)	-0.003*** (0.00)	-0.006*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
Female	0.275*** (0.04)	0.273*** (0.05)	0.017 (0.02)	0.011 (0.02)	-0.051** (0.02)	-0.037*** (0.01)	0.031 (0.03)	0.034 (0.03)
Married	0.087 (0.06)	0.076 (0.07)	0.032*** (0.01)	0.020 (0.02)	-0.045* (0.02)	-0.033 (0.02)	0.067* (0.03)	0.062** (0.03)
Household size	-0.006 (0.01)	-0.007 (0.01)	0.001 (0.01)	0.002 (0.01)	-0.018* (0.01)	-0.020* (0.01)	-0.002 (0.00)	-0.001 (0.00)
Smoking	-0.200*** (0.02)	-0.204*** (0.02)	0.027 (0.02)	0.035 (0.03)	-0.002 (0.04)	-0.003 (0.04)	-0.052* (0.03)	-0.051** (0.02)
History diabetes			0.083** (0.03)	0.083** (0.03)				
History heart attack					0.159* (0.08)	0.137 (0.10)		
History diabetes/heart attack							0.062*** (0.01)	0.062*** (0.00)
Pseudo R^2	0.15		0.09		0.07		0.18	
Wald statistics	4.36**		4.07**		0.34		1.86	
Number of observations	550	550	496	496	550	550	496	496

Notes: Marginal effects are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. In the IV probit models, "distance to nearest supermarket" was used as instrument for "buys in supermarket". Overweight/obese: BMI ≥ 25 kg/m²; Pre-diabetic: FBG (in mmol/L) ≥ 5.6; Pre-hypertensive: SBP/DBP (in mmHg) ≥ 120/80; Metabolic syndrome (MetS): defined through three parameters: waist circumference (in cm) F/M > 80 /94 plus SBP/DBP (in mmHg) ≥ 130 / ≥ 85 and FBG (in mmol/L) ≥ 5.6. DBP, diastolic blood pressure; FBG, fasting blood glucose; IV, instrumental variable; MetS, metabolic syndrome; SBP, systolic blood pressure * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.7. Full regression results for the effects of supermarket purchase (%) on BMI, fasting blood glucose, systolic and diastolic blood pressure

	BMI (kg/m²)	FBG (mmol/L)	SBP (mmHg)	DBP (mmHg)
Share of supermarket purchase, %	0.15*** (0.02)	0.02*** (0.00)	0.16 (0.11)	0.10 (0.07)
Expenditure per capita	0.09* (0.04)	0.01 (0.00)	-0.05 (0.05)	0.02 (0.04)
Education, y	-0.00 (0.11)	-0.01 (0.01)	-0.43** (0.15)	-0.21 (0.11)
Intensive work, h/wk	0.01* (0.00)	0.00 (0.00)	0.00 (0.01)	-0.00 (0.00)
Physical activity, h/wk	-0.03* (0.01)	-0.00 (0.00)	-0.02 (0.03)	-0.01*** (0.00)
Age, y	0.12*** (0.03)	0.03*** (0.00)	0.89*** (0.02)	0.41*** (0.02)
Distance to hospital, km	0.12*** (0.01)	0.03*** (0.01)	-0.02 (0.15)	0.05 (0.10)
Female	3.80*** (0.37)	0.24*** (0.06)	-4.61 (2.41)	-2.67 (1.45)
Married	0.95* (0.47)	-0.12 (0.12)	-0.10 (1.43)	0.52 (0.50)
Household size	-0.08 (0.07)	-0.00 (0.04)	-1.17*** (0.28)	-0.51*** (0.11)
Smoking	-2.07*** (0.60)	-0.15 (0.12)	-12.49*** (1.37)	-7.25*** (1.78)
History diabetes		0.29 (0.18)		
History heart attack			-0.05 (0.62)	-0.47 (2.03)
Constant	14.22*** (2.18)	3.30*** (0.21)	111.61*** (6.34)	75.99*** (3.32)
Number of observations	550	496	550	550

Notes: Coefficient estimates of instrumental variable models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. "Distance to nearest supermarket" was used as instrument for "supermarket purchase". DBP, diastolic blood pressure; FBG, fasting blood glucose; SBP, systolic blood pressure. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.8. Full regression results for the effects of supermarket purchase (%) on the probability of being overweight/obese, pre-diabetic, pre-hypertensive, and suffering from metabolic syndrome

	Overweight/ Obese	Pre-diabetic	Pre-hypertensive	MetS
Share of supermarket purchase, %	0.016*** (0.00)	0.013*** (0.00)	-0.001 (0.00)	0.005*** (0.00)
Expenditure per capita	0.006 (0.00)	-0.000 (0.00)	-0.000 (0.00)	-0.000 (0.00)
Education, y	0.013* (0.01)	-0.001 (0.00)	-0.001 (0.00)	-0.006** (0.00)
Intensive work, h/wk	0.001** (0.00)	0.000 (0.00)	-0.000 (0.00)	0.000 (0.00)
Physical activity, h/wk	-0.003*** (0.00)	0.000 (0.00)	0.001 (0.00)	-0.000 (0.00)
Age, y	0.011*** (0.00)	0.007*** (0.00)	0.006*** (0.00)	0.005*** (0.00)
Distance to hospital, km	0.013*** (0.00)	0.007*** (0.00)	-0.004** (0.00)	0.003*** (0.00)
Female	0.282*** (0.05)	0.026 (0.02)	-0.051*** (0.02)	0.024 (0.02)
Married	0.070 (0.05)	0.020*** (0.01)	-0.034** (0.02)	0.041 (0.03)
Household size	-0.001 (0.01)	0.007 (0.01)	-0.013 (0.01)	-0.000 (0.00)
Smoking	-0.195*** (0.04)	0.045** (0.02)	-0.003 (0.03)	-0.045*** (0.01)
History diabetes		0.113** (0.05)		
History heart attack			0.104*** (0.03)	
History diabetes/heart attack				0.077*** (0.00)
Constant	-0.660*** (0.16)	-0.379*** (0.13)	0.784*** (0.05)	-0.209*** (0.03)
Number of observations	550	496	550	496

Notes: Coefficient estimates of instrumental variable linear probability models are shown with standard errors in parentheses. Standard errors are cluster-corrected at town level. "Distance to nearest supermarket" was used as instrument for "supermarket purchase". MetS, metabolic syndrome. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A2.9. Regression results for the effects of supermarkets on BMI with panel data model

	BMI (kg/m²)	
	Fixed effects	Random effects
Buys in supermarket	0.59* (0.34)	0.63** (0.28)
Expenditure per capita, deflated [a]	-0.02 (0.02)	0.06*** (0.01)
Physical activity, h/wk	-0.03*** (0.01)	-0.02*** (0.01)
Age, y	-0.02 (0.04)	0.10*** (0.01)
Female		3.40*** (0.33)
Married	1.02** (0.51)	1.00*** (0.29)
Ol Kalou		-0.75** (0.38)
Njabini		-0.78* (0.42)
Year 2015	0.37** (0.19)	-0.04 (0.13)
Constant	25.51*** (1.50)	18.37*** (0.69)
Wald-chi2		224.91***
F-value	3.58***	
Hausman test	54.47***	
Number of observations	1161	1161

Notes: Coefficient estimates of fixed effects and random effects panel data models are shown with standard errors in parentheses. Hausman test was performed in order to see significant differences between fixed and random effects. Total number of observations for the unbalanced panel data set is 1161 adults (>18 y), including 611 from 2012 and 550 from 2015. [a] 2015 expenditures were adjusted for inflation using official consumer price indices. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

3 Supermarket Shopping and Nutritional Outcomes: A Panel Data Analysis for Urban Kenya[4]

Abstract

Overweight and obesity are growing health problems in many developing countries. Rising obesity rates are the result of changes in people's diets and lifestyles. Income growth and urbanization are factors that contribute to these changes. Modernizing food retail environments may also play a certain role. For instance, the rapid spread of supermarkets in many developing countries could affect consumer food choices and thus nutritional outcomes. However, concrete evidence about the effects of supermarkets on consumer diets and nutrition is thin. A few existing studies have analyzed related linkages with cross-sectional survey data. We add to this literature by using panel data from households and individuals in urban Kenya. Employing panel regression models with individual fixed effects and controlling for other factors we show that shopping in supermarkets significantly increases body mass index (BMI). We also analyze impact pathways. Shopping in supermarkets contributes to higher consumption of processed and highly processed foods and lower consumption of unprocessed foods. These results confirm that the retail environment affects people's food choices and nutrition. However, the effects depend on the types of foods offered. Rather than thwarting modernization in the retail sector, policies that incentivize the sale of more healthy foods – such as fruits and vegetables – in supermarkets may be more promising to promote desirable nutritional outcomes.

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3.1 Introduction

Overweight and obesity are growing health problems worldwide. During 1980-2013, the global proportion of overweight or obese adults increased from 29% to 37% in men, and from 30% to 38% in women (Ng et al., 2014). Developing countries are also increasingly affected. The rapid rise in people's body mass index (BMI) strongly contributes to various non-communicable diseases (NCDs), such as diabetes, hypertension, and some forms of cancer (NCD Risk Factor Collaboration, 2016). Obesity and NCDs are associated with morbidity and mortality, lost labor productivity, and high healthcare costs (Bommer et al., 2017; Herman, 2013; IFPRI, 2016; Withrow and Alter, 2011; World Economic Forum, 2011).

Rising rates of obesity are caused by income growth, urbanization, and related changes in people's lifestyles and diets. The 'nutrition transition' is particularly characterized by higher consumption of processed foods that are dense in sugar, fat, and salt (Popkin et al., 2012). Changes in the food retail environment may also play a role. In many developing countries, modern supermarkets are spreading rapidly (Reardon et al., 2003). As supermarkets sometimes offer different types of products than traditional markets and shops, such modernization of the retail sector could possibly contribute to negative nutrition and health outcomes (Hawkes, 2008; Popkin, 2014; Qaim, 2017).

Concrete evidence about the effects of supermarket shopping on people's diets in developing countries is thin. Very few studies analyzed related linkages, with mixed results. Tessier et al. (2008) showed that supermarket shopping is associated with improved dietary quality in Tunis, Tunisia. However, average living standards in Tunisia are higher than in most other African countries. Moreover, data from a large city, such as Tunis, may not be representative for other regions. Studies with data from Kenya and Guatemala revealed that supermarkets contribute to higher overall energy consumption and a larger share of energy from processed foods (Asfaw, 2008; Kimenju et al., 2015; Rischke et al., 2015). The same studies for Kenya and Guatemala also suggested that supermarket shopping increases adult BMI and the likelihood of being overweight or obese. A study with data from Indonesia found no significant association between supermarket shopping and BMI (Umberger et al., 2015). These existing studies used cross-sectional survey data, partly employing instrumental variable (IV) approaches to draw causal inference. However, finding a valid instrument that is correlated with supermarket shopping but

uncorrelated with diets and nutrition is very difficult. Hence, causal inferences based on cross-section observational data remain tentative (Bound et al., 1995).

We contribute to this research direction by using panel data and panel regression models for more robust causal inference. The main aim is to get a better understanding of the effects that the spread of supermarkets in developing countries has on consumers' diets and nutrition. In particular, we use data collected in urban Kenya in 2012 and 2015 to analyze the effects of supermarket shopping on adult BMI and dietary composition. Kenya has one of the most prospering supermarket sectors in sub-Saharan Africa (Neven et al., 2009; Rischke et al., 2015). The share of grocery sales through supermarkets is about 10% at national level, but already much higher in large urban centers (Planet Retail, 2016). A rapid growth of supermarkets is also expected in other parts of Africa. Better understanding the nutrition effects of modernizing retail environments can help to design policies aimed at reducing negative health externalities.

3.2 Food Environment and Dietary Choices

Food choices are determined by various biological, socioeconomic, and psychological factors (Nestle et al., 1998). Food availability, price, type of display, quality, personal income, attitudes, taste, time constraints, and several other factors play a role when people decide on what to eat (Dover and Lambert, 2016; Ventura and Worobey, 2013). Economic development is typically associated with profound changes in people's diets. Income growth, urbanization, technological change, advances in food preservation, and advertising through mass media, all contribute to higher consumption of relatively energy-dense processed foods and beverages. These dietary shifts are often referred to as the 'nutrition transition' (Popkin, 2014; Popkin et al., 2012). In most developed countries, this nutrition transition already occurred several decades ago. In many developing countries, it is now happening at a relatively fast pace.

The nutrition transition can contribute to increases in body weight in two ways. First, consuming energy-dense foods will likely lead to higher overall energy intakes. Second, nutrient composition and processing levels play important roles for the human body's energy usage during food digestion and storage. On average, the human body's energy use for food digestion and storage makes up around 15% of total daily energy expenditures (Barr and Wright, 2010). However, this value varies with dietary composition. For instance, the body requires more energy for digesting proteins than for carbohydrates and fats (Westerterp, 2004). Also, the digestion of

fresh and whole foods with higher fiber contents requires more energy than the digestion of processed foods (Barr and Wright, 2010). Higher energy intakes and lower body energy expenditures may have positive nutrition effects in situations where people suffer from energy deficiency. However, for people with sufficient energy consumption, the nutrition transition contributes to overweight and obesity (Popkin et al., 2012).

Changing retail environments may possibly speed up the nutrition transition. In developing countries, supermarkets and other modern retail outlets are spreading rapidly, partly crowding out more traditional markets and small shops (Reardon et al., 2003). Supermarkets tend to be larger than traditional outlets, and they usually offer a bigger range of products under one roof. Another major difference is that supermarkets have self-service character, providing greater freedom of choice for customers. Supermarkets respond to changing consumer preferences and lifestyles, offering the types of foods that customers with rising incomes and appeal for modernity demand. However, it is likely that supermarkets do not only react to changing consumer preferences but, in turn, also shape these preferences to some extent. Influence on consumer food choices can occur through locational factors, the range of products offered, the positioning of items in the shelves, packaging sizes, promotional campaigns, and general shopping atmosphere (Battersby and Peyton, 2014; Hawkes, 2008; Timmer, 2009).

Compared to small traditional shops, supermarkets can better exploit economies-of-scale. Hence, certain foods can be offered at lower prices (Drewnowski et al., 2012; Rischke et al., 2015). This is especially relevant for non-perishable processed food items. In fact, outside of bigger cities, supermarkets in developing countries often concentrate primarily on the sale of processed foods.[5] Cheaper access to processed foods can improve food security and nutrition for very poor population segments (Kimenju and Qaim, 2016; Reardon et al., 2003). However, heavy reliance on processed foods does not necessarily improve dietary quality and can intensify the obesity pandemic. Hence, the spread of supermarkets in developing countries can have both positive and negative nutrition and health effects.

[5] In big cities, many supermarkets and hypermarkets also have large fresh fruit and vegetable sections, but in smaller cities and towns this is rare up till now, at least in low-income countries of Asia and Africa (Rischke et al. 2015).

3.3 Materials and Methods

3.3.1 Data

We use data from a survey of households and individuals carried out in two rounds in Central Kenya. The first round was carried out in 2012, the second in 2015. The survey concentrated on small towns (<70 thousand inhabitants), because this is the typical size of towns that supermarket chains currently enter in Kenya. All larger cities in the nation already have one or more supermarkets, whereas in rural areas supermarkets are not yet observed. In 2012, we purposively selected three towns in Central Kenya with differences in the availability of supermarkets.[6] The three towns are Ol Kalou and Njabini in Nyandarua County, and Mwea in Kirinyaga County. Ol Kalou has had a supermarket since 2002. In Mwea, a supermarket was opened in 2011. Njabini had no supermarket, neither in 2012 nor in 2015. This provides a quasi-experimental setting for the analysis of supermarket impacts on diets and nutrition.[7] Except for these differences, the three towns are similar in terms of infrastructure and other economic development indicators (Kenya National Bureau of Statistics, 2010).

Systematic random sampling was used to select households for interview within the urban and peri-urban areas of the three towns. Since recent census data did not exist, we used available population statistics and the help of local administrators. At first, all neighborhoods (residential estates) in each town were listed. Then, household lists were compiled for each neighborhood, from which we randomly selected the required number of households. We selected households from all neighborhoods, in order to avoid clustering and obtain a representative sample at town level.

In each selected household, whenever available one male and one female adult (>18 years) were included in the study for interviews and anthropometric measurements. In 2012, we included 432 randomly selected households and 601 adults. In 2015, we tried to reach the same households and individuals, but were only able to track 219 households and 286 adult individuals of those that were also included in 2012. Unlike in rural areas, where extended families often live in the same

[6] The cross-sectional data collected in 2012 was also used by Kimenju et al. (2015) and Rischke et al. (2015). This study builds up on this earlier research with panel data.

[7] Living in a town with supermarket is not perfectly correlated with supermarket use. Not all households in Ol Kalou and Mwea use supermarkets to buy food, and a few households in Njabini occasionally buy food in supermarkets elsewhere. However, this deliberate choice of towns provides exogenous variation in supermarket use that is very useful for the impact evaluation.

place for several generations, in urban areas households are often much smaller and relocate more frequently. Hence, higher attrition rates in urban panels are commonplace. Attrition households were replaced with other randomly selected ones in the same towns and neighborhoods. In total, in 2015 we collected data from 430 households and 598 adult individuals. Thus, the total sample includes 1,199 individual adult observations.

Table 3.1 in the Appendix A3 compares key variables for individuals that were included in both survey rounds (balanced panel) and those that had to be excluded and newly included in 2015 due to attrition. While small differences occur for age and gender, no significant differences are found for consumption expenditures and other indicators of living standard. Against this background, we use the unbalanced panel in the further analysis, even though we test key results for possible attrition bias.

3.3.2 Statistical Methods

Our main objective is to analyze the effects of supermarket shopping on adult nutritional outcomes. For this purpose, we estimate panel data regression models of the following type:

$$N_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 \boldsymbol{X_{it}} + \varepsilon_{it} \quad (3.1)$$

where N_{it} is the nutritional outcome variable for individual *i* at time *t*, such as BMI or being overweight or obese. The main explanatory variable of interest is S_{it}, a dummy variable that indicates whether or not the individual (or the household in which individual *i* lives) purchased any food in supermarkets (see below for details of variable definitions). $\boldsymbol{X_{it}}$ is a vector of control variables, and ε_{it} is a random error term. We are particularly interested in the coefficient estimate for β_1. A positive and significant estimate for β_1 would indicate that shopping in supermarkets has a net-increasing effect on BMI, or on the likelihood of being overweight or obese.

One important question is what type of control variables to include in the vector $\boldsymbol{X_{it}}$. Especially relevant are variables that may be jointly correlated with N_{it} and S_{it}, as omitting such variables could lead to biased estimates for β_1. We include a range of factors, such as individual age, gender, marital status, and physical activity levels, as well as household living standard (economic status). In developing countries, living standard is often positively correlated with BMI (Popkin et al., 2012). At the same time, richer households are more likely to buy food in supermarkets, because they can afford a wider range of processed and convenience foods.

Moreover, consumers in developing countries often associate supermarkets with western brands and modern lifestyles (Batra et al., 2000). Hence, not controlling for living standard would likely lead to an overestimated coefficient β_1. Similarly, physical activity levels may also be jointly correlated with supermarket shopping and nutritional outcomes. Finally, we include a time trend as part of vector $\boldsymbol{X_{it}}$, and town dummy variables to control for possible regional differences.

In addition to equation (3.1) with nutritional outcomes as dependent variables, we estimate models with diet-related dependent variables as follows:

$$D_{it} = \gamma_0 + \gamma_1 S_{it} + \gamma_2 \boldsymbol{X_{it}} + \varepsilon_{it} \tag{3.2}$$

where D_{it} is a dietary indicator of individual *i* at time *t*, such as the share of energy consumed from highly processed foods, or the energy consumed from specific food groups. The coefficient γ_1 characterizes the net effects of supermarket shopping on dietary choices and thus helps to better understand the mechanisms for nutritional outcomes.

The models in equations (3.1) and (3.2) can be estimated with random effects (RE) panel estimators. However, one potential issue is that the individual decision where to buy food is not random and may be influenced by unobserved factors. If such unobserved factors are also correlated with the nutritional outcomes or the dietary dependent variables, the estimated supermarket effects would be biased. This type of bias due to unobserved heterogeneity is also the main reason why IV approaches are commonly employed in impact evaluations with cross-sectional data. When panel data are available, as in our case, estimators with individual fixed effects (FE) can alternatively be used. FE estimators use differencing techniques, so that time-invariant heterogeneity is cancelled out, even if unobserved (Wooldridge, 2010). Time-variant heterogeneity may still bias the results, which is why we control for living standards and levels of physical activity that can change over time. Much more difficult to capture are individual lifestyle factors and attitudes that may also influence the decision where to buy food. However, such unobserved factors are not expected to change within three years (the period in-between our two survey rounds), so that they can be considered as time-invariant in this analysis. Hence, we argue that FE estimators properly control for unobserved heterogeneity in our context without the need for instruments.

FE panel estimators require data variability within individuals over time. Hence, while unbalanced panel data can be used, the FE specifications rely on those individuals that were included in both survey rounds. We run all models with both FE and RE estimators and compare results using the Hausman test (Hausman, 1978). A significant Hausman test statistic means that there is unobserved heterogeneity, so that the FE specification is preferred. For all model estimations, we use standard errors that are cluster-corrected at the household level, which is important because in most households we observed more than one individual. All statistical analyses are conducted using Stata version 13.

3.3.3 Supermarket Dummy Variable

The main explanatory variable of interest in the regression models is the supermarket dummy variable (S_{it}), which takes a value of one if any food consumed in the household of individual *i* during the 30 days prior to the survey was purchased in a supermarket, and zero if all the food consumed was obtained from traditional sources. Traditional sources include traditional retailers, such as daily markets, small shops, and kiosks, as well as food from own production or obtained through gifts. Table 3.2 in the Appendix A3 shows characteristics of the different sources of food (retail outlets), including typical food groups obtained from these sources.

Information on food consumption was obtained at the household level through a 30-day recall covering 168 food items. The recall interviews were conducted with the household member that was mainly responsible for food purchases and food preparation. In addition to the quantities consumed, information on sources and monetary expenditures was collected separately for each food item.

In the total sample with 1,199 observations, 668 individuals had consumed food purchased in supermarkets, whereas the other 531 had not. The proportion of supermarket shoppers varies by town. As one could expect, most non-supermarket shoppers live in Njabini, where no supermarket had been opened until 2015. A certain proportion of non-supermarket shoppers is also found in the other two towns, Mwea and Njabini. There is also variation in supermarket shopping over time, which is important for efficient FE estimations. As mentioned, in Mwea a supermarket was only established in 2011, shortly before the first survey round was conducted in 2012. As people first have to get used to this new retail format, some of the households in Mwea that had not yet used the supermarket in 2012 had started to use it by 2015. Some variation in

supermarket shopping over time was also observed in the other two towns. Out of those individuals that were included in both survey rounds (n=286), 44 (15%) had switched their supermarket shopping status during 2012-15.

3.3.4 Nutritional Outcomes and Dietary Variables

We use the body mass index (BMI) as the main indicator of nutritional outcomes for adults. BMI is the most common indicator to classify overweight and obesity (Nelms et al., 2011). Anthropometric measurements of individual weight and height were obtained during both rounds of the survey according to international standards (Centers for Disease Control and Prevention, 2007). Using these measurements, we calculated BMI (BMI = body weight in kg / body height in meters squared) for each individual. Using common international thresholds for BMI, we also classified individuals according to their nutritional status (WHO, 2014). Adults with a BMI $\geq$ 25 kg/m² and < 30 kg/m² are defined as overweight. With a BMI $\geq$ 30 kg/m² individuals are defined as obese. We club the two categories and define individuals with BMI $\geq$ 25 kg/m² as overweight/obese.

For the dietary analysis, we used the food consumption data from the 30-day recall. Quantities of each food item consumed by the household were converted to amounts of energy using national food composition tables for Kenya and other countries in Africa (2012, FAO, 2010; Sehmi, 1993). Energy consumption from each food item at the household level was divided by 30 to obtain daily values and then converted to individual levels with the help of adult equivalent scales. Adult equivalents (AE) were calculated based on average energy requirements, taking individual age, sex, and body height into account (FAO, 2004).

In addition to total energy consumption per person (expressed in kcal/AE/day), we also look at energy consumption from specific food groups that may be affected by supermarket shopping. As supermarkets in small towns offer very few fresh and unprocessed foods, we are particularly interested in effects on energy from unprocessed staples (grains, pulses, roots, and tubers) and fruits and vegetables. These groups are generally considered as 'healthy' foods, because they are high in dietary fiber. Fruits and vegetables are also rich in vitamins and minerals. Other food groups, such as meats and fish, dairy and eggs, and vegetable oils, are more energy-dense and often further processed. High consumption of such energy-dense foods can more easily contribute to overweight and obesity (Swinburn et al., 2004). Furthermore, we look at the share of highly

processed foods (see Table A3.3 in the Appendix A3) in total daily energy consumption, as this may also be influenced by supermarket shopping.

3.3.5 Control Variables

In the individual-level regression models to explain nutritional outcomes and diets we control for typical sociodemographic factors such as age, sex, and marital status. In addition, we include a year dummy variable for observations in 2015 and town variables for Ol Kalou and Njabini (Mwea is the reference category). It should be noted that all time-invariant variables drop out in the FE specifications. In all models, we also control for household living standard, measured in terms of per capita consumption expenditures in Kenyan Shillings (KES). These expenditures comprise the value of all food and non-food goods and services consumed over a period of 30 days, including home-produced foods. To make monetary values comparable between survey years, expenditures in 2015 were deflated to 2012 using official consumer price indices (Kenya National Bureau of Statistics, 2016).

Finally, we control for individual physical activity, as this can also influence food consumption and nutritional outcomes. In the survey, respondents were asked for the number of hours of physical activity during leisure time. These data were used to calculate leisure time physical activity ratios (PAR).[8] PAR is a continuous variable taking values larger than 1. Bigger values indicate higher levels of physical activity.

3.4 Results

3.4.1 Descriptive Statistics

Descriptive statistics for key variables used in this analysis are shown in Table 3.1, for the total sample and also disaggregated for supermarket shoppers and non-shoppers. The upper part of the table shows the nutrition and dietary indicators.

[8] PAR is defined as a multiple of the basal metabolic rate. In the nutritional sciences, PAR is often used to calculate physical activity levels (PAL), which are one ingredient in determining individual energy requirements (FAO, 2004).

Table 3.1. Sample descriptive statistics

Variable	Total	Shopping in supermarkets	Not shopping in supermarkets
Body mass index (kg/m²)	25.33	25.80***	24.73
	(5.07)	(5.08)	(5.00)
Overweight/obese (1,0)	0.47	0.52***	0.40
	(0.50)	(0.50)	(0.49)
Energy consumption (kcal/AE/day)	3164.61	3300.71***	2993.41
	(1439.11)	(1388.74)	(1483.75)
Energy from unprocessed staples (kcal/AE/day)	408.66	387.46**	435.34
	(386.15)	(421.46)	(335.01)
Energy from fruits and vegetables (kcal/AE/day)	375.32	392.05***	354.26
	(250.35)	(245.02)	(255.58)
Energy from meats and fish (kcal/AE/day)	121.84	148.28***	88.59
	(112.00)	(123.06)	(85.49)
Energy from dairy and egg (kcal/AE/day)	39.75	47.60***	29.89
	(45.90)	(51.67)	(35.02)
Energy from oils (kcal/AE/day)	133.26	187.68***	64.79
	(190.58)	(208.80)	(137.12)
Share of energy from highly processed foods (%)	7.60	8.57***	6.37
	(5.59)	(5.25)	(5.76)
Expenditure per capita (1000 KES)	11.90	14.02***	9.24
	(9.19)	(10.67)	(5.88)
Age (years)	36.54	34.60***	38.99
	(12.20)	(9.92)	(14.21)
Female (1,0)	0.65	0.67	0.63
	(0.48)	(0.47)	(0.48)
Married (1,0)	0.74	0.76**	0.70
	(0.44)	(0.43)	(0.46)
Physical activity ratio (PAR)	2.23	2.21**	2.27
	(0.49)	(0.47)	(0.51)
Ol Kalou (1,0)	0.32	0.50***	0.09
	(0.47)	(0.50)	(0.29)
Mwea (1,0)	0.29	0.41***	0.14
	(0.46)	(0.49)	(0.35)
Njabini (1,0)	0.39	0.08***	0.77
	(0.49)	(0.28)	(0.42)
Share of supermarket purchase (%)	8.39	15.06***	0.00
	(11.24)	(11.25)	(0.00)
Number of observations	1199	668	531

Notes: Mean values are shown with standard deviations in parentheses. ** Difference between those shopping and not shopping in supermarkets is significant at 5% level; *** Difference between those shopping and not shopping in supermarkets is significant at 1% level.

Even though Kenya is still facing problems of undernutrition and child stunting, rates of adult overweight and obesity are high. In our sample, 47% of the adults were overweight or obese. This is higher than the average of 26% found in recent statistics for Kenya (IFPRI, 2016; Kenya National Bureau of Statistics, 2014; WHO, 2015a). However, these national statistics refer to all of the country's regions, including poor rural areas where undernutrition is still more widespread.

Regionally disaggregated official statistics are only available for women. For Central Kenya, where the three towns included in this study are located, the prevalence of overweight/obesity among female adults was estimated at 47% in 2014 (Kenya National Bureau of Statistics, 2014). Hence, the nutritional outcomes measured in our survey seem to be reasonable for urban areas in Central Kenya.

Looking at the disaggregated groups in Table 3.1, we see that those shopping in supermarkets have a significantly higher mean BMI and are also more likely to be overweight or obese than those not shopping in supermarkets. Figure 3.1 breaks these comparisons down by survey year. During 2012-15, BMI of both groups increased considerably, but the increase was more pronounced for those shopping in supermarkets.[9] The data in Table 3.1 also show that supermarket shoppers have significantly higher total energy consumption than non-supermarket shoppers and a larger share of this energy comes from animal products and highly processed foods. However, these comparisons do not control for other factors that may also influence diets and nutrition. As can be seen in the lower part of Table 3.1, there are also significant differences in living standard and other sociodemographic variables. Below, we control for such differences through estimation of panel regression models.

[9] While the growth rates in BMI and in the prevalence of overweight/obesity during 2012-15 are higher for supermarket shoppers, the growth rate differences between the two groups are not statistically significant.

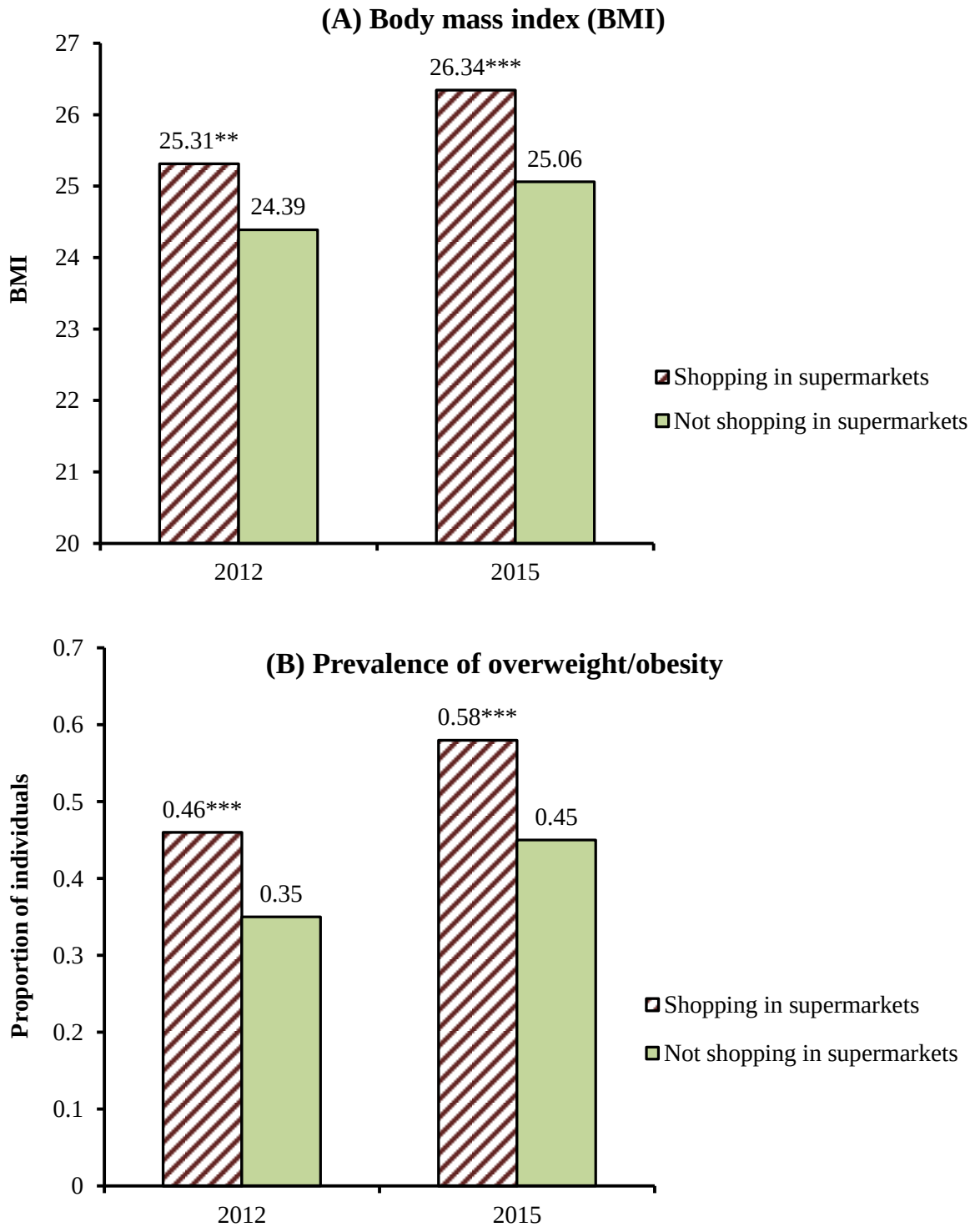

Figure 3.1. Differences in nutritional outcomes between individuals shopping and not shopping in supermarkets. ** Difference between those shopping and not shopping in supermarkets is significant at 5% level; *** Difference between those shopping and not shopping in supermarkets is significant at 1% level.

3.4.2 Supermarket Effects on BMI

Table 3.2 shows results of panel regression models with BMI as dependent variable. Model (1) refers to the unbalanced panel with all observations included. Two versions are shown, one with FE and the other with RE specifications. The Hausman test statistic, which is shown in the lower part of the table, suggests that the FE specification is preferred. Shopping in supermarkets increases individual BMI by 0.64 kg/m². The finding of a net-increasing effect of supermarkets on BMI is consistent with Asfaw (2008) and Kimenju et al. (2015), who had used cross-sectional data. However, our estimate is smaller in magnitude. For instance, Kimenju et al. (2015), who used the same data from Central Kenya collected in 2012, estimated that supermarket shopping increases BMI by 1.69 kg/m². As argued above, the FE panel estimator used here is more reliable because it does not depend on assumptions about the validity of an instrument. However, in spite of the smaller effect found here, we confirm the hypothesis that supermarkets contribute to BMI increases, even after controlling for unobserved heterogeneity and other confounding factors.

The other results of model (1) in Table 3.2 show that being married also contributes to higher BMI. Furthermore, the RE specification, which includes the time-invariant characteristics that drop out from the FE specification, suggests that females have a much higher BMI than males. This is consistent with existing statistics from Kenya and elsewhere (Kenya National Bureau of Statistics, 2014; Ng et al., 2014). BMI is also positively associated with age and living standard, as one would expect. Looking at the town variables, we see that people living in Ol Kalou have a higher BMI than those living in Mwea, which is the reference town in this model. As mentioned, Ol Kalou is the town where a supermarket had already opened in 2002. On the other hand, people in Njabini, where no supermarket had been opened until 2015, have a significantly lower BMI. This correlation between the town variables and nutritional status is likely the result of our sampling strategy where we deliberately chose towns with differences in supermarket access. It implies that the town variables may possibly capture some of the effects of supermarket shopping. Indeed, when excluding the town variables from the RE specification of model (1), the supermarket effect on BMI increases to 0.72.

Table 3.2. Effects of supermarket shopping on body mass index

	Body mass index (kg/m²)			
	(1)		(2)	
	FE	RE	FE	RE
Shopping in supermarkets (1,0)	0.64* (0.38)	0.61** (0.29)	0.64* (0.38)	0.70** (0.36)
Married (1,0)	1.07* (0.56)	1.06*** (0.30)	1.07* (0.56)	0.93** (0.44)
Physical activity ratio	-0.22 (0.18)	-0.25 (0.16)	-0.22 (0.18)	-0.27 (0.17)
Female (1,0)		3.29*** (0.28)		3.29*** (0.49)
Age (years)	-0.02 (0.04)	0.10*** (0.02)	-0.02 (0.04)	0.08*** (0.02)
Expenditure per capita (1000 KES)	-0.01 (0.02)	0.06*** (0.02)	-0.01 (0.02)	0.03 (0.02)
Ol Kalou (1,0)		-0.84** (0.39)		-0.46 (0.75)
Njabini (1,0)		-0.82* (0.43)		-1.01 (0.76)
Year 2015	0.38** (0.17)	-0.00 (0.13)	0.38** (0.17)	0.03 (0.14)
Constant	25.26*** (1.50)	18.63*** (0.74)	25.89*** (1.62)	20.30*** (1.15)
Wald χ^2		236.38***		75.25***
F-value	2.50**		2.48**	
Hausman test χ^2	58.43***		48.39***	
Number of observations	1199	1199	572	572

Notes: Coefficient estimates are shown with standard errors cluster-corrected at household level in parentheses. Model (1) uses the unbalanced panel with all observations. Model (2) only uses observations from the balanced panel. FE, fixed effects; RE, random effects. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

We carry out a few additional tests to check the robustness of the results. A first test relates to the possible effects of sample attrition. Model (2) in Table 3.2 shows FE and RE specifications of the BMI model with only the observations from the balanced panel included. Except for the constant term, the FE results are identical to those in model (1), which is not surprising. Although all observations were included in model (1), FE estimation of the treatment effect only considers individuals that were included in both survey rounds, as the FE estimator exploits the variation within individuals over time. But also for the RE specifications, results of models (1) and (2) are quite similar, which we take as evidence that sample attrition does not lead to systematic bias.

A second test relates to the relatively small number of supermarket switchers. As mentioned in section 3, there are only 44 individuals in the sample who were included in both survey rounds and switched their supermarket shopping status during 2012-15 (88 observations). The FE estimates rely on these switchers, so it is important to know how representative they are for the rest of the sample. Table A3.4 in the Appendix A3 compares key socioeconomic characteristics of these switchers with the total sample. The switchers are more likely to be female. In terms of

the other variables, including household living standards, no significant differences are observed. Of course, a larger number of switching observations could lead to more efficient FE estimates. But the similarity of the switchers with the rest of the sample suggests at least that the FE estimates do not suffer from significant selection bias.

A third test relates to the possible role of traditional retail outlets, which are not uniform. As shown in Table A3.2 in the Appendix A3, traditional retailers include daily markets, kiosks, and small shops. In terms of some characteristics, small shops are similar to supermarkets: while supermarkets are larger and offer a wider variety of processed foods, some small shops also have a self-service option. To analyze the possible role of small shops, we include an additional dummy variable for shopping in these small shops in the BMI models. Results are shown in Table A3.5 in the Appendix A3. Shopping in small shops does not seem to affect individual BMI, neither in the FE nor in the RE specification. At the same time, the supermarket effects remain significant and similar in magnitude to those in Table 3.2.

3.4.3 Supermarket Effects on the Prevalence of Overweight/Obesity

Table 3.3 shows results of model estimates where being overweight/obese is used as a dummy dependent variable. We use linear probability models for these estimates.[10] The FE and RE specifications of model (1) show positive coefficients for supermarket shopping, but these are not statistically significant. This is surprising because Figure 3.1 shows that supermarket shoppers are significantly more likely to be overweight/obese than individuals who obtained all of their food from traditional sources. Interesting to see in Table 3.3, however, is that people in Njabini are significantly less likely to be overweight/obese than people in Mwea, even after controlling for other factors. Njabini is the town where no supermarket had opened until 2015. In model (2) of Table 3.3, we exclude the town variables and suddenly see a significant positive coefficient for supermarket shopping. According to this model, shopping in supermarkets increases the probability of being overweight/obese by 7 percentage points.[11]

We admit that the evidence of an overweight/obesity increasing net effect of supermarket shopping in our data is not very strong, also because the RE specifications do not control for

[10] Alternatively, one could have estimated probit models. The reason why we prefer linear probability models is that these also allow fixed effects specifications, which is not possible with probit models in most software packages.

[11] This is in line with findings by Asfaw (2008) and Kimenju et al. (2015), even though the estimated effects in these earlier cross-sectional studies were larger. For instance, Kimenju et al. (2015) estimated that supermarket shopping increases the probability of being overweight/obese by 13 percentage points.

unobserved heterogeneity. That the supermarket effect is not showing up more clearly is due to the fact that many adults have a BMI around 25 kg/m^2. Of course, supermarkets are not the only factors contributing to BMI increases, so that crossing the overweight/obesity threshold occurs in both groups, supermarket shoppers and non-shoppers (Figure 3.1). However, the finding that supermarket shopping significantly increases BMI as such already implies that this will also contribute to more overweight/obesity. We presume that this would be more visible with a larger number of switching observations in the balanced panel.

Table 3.3. Effects of supermarket shopping on the probability of being overweight/obese

	Being overweight/obese (1,0)		
	(1)		(2)
	FE	RE	RE
Shopping in supermarkets (1,0)	0.01 (0.04)	0.03 (0.03)	0.07** (0.03)
Married (1,0)	0.07 (0.05)	0.09*** (0.03)	0.09*** (0.03)
Physical activity ratio	-0.04 (0.03)	-0.04** (0.02)	-0.04** (0.02)
Female (1,0)		0.25*** (0.03)	0.26*** (0.03)
Age (years)	-0.01 (0.01)	0.01*** (0.00)	0.01*** (0.00)
Expenditure per capita (1000 KES)	-0.00 (0.00)	0.01*** (0.00)	0.01*** (0.00)
Ol Kalou (1,0)		-0.06 (0.04)	
Njabini (1,0)		-0.10** (0.04)	
Year 2015	0.09*** (0.03)	0.04** (0.02)	0.05** (0.02)
Constant	0.80*** (0.30)	-0.07 (0.08)	-0.15* (0.08)
Wald χ^2		215.99***	201.00***
F-value	2.17**		
Hausman test χ^2	26.32***		
Number of observations	1199	1199	1199

Notes: Coefficient estimates of linear probability models are shown with standard errors cluster-corrected at household level in parentheses. Being overweight/obese includes individuals with BMI > 25 kg/m². FE, fixed effects; RE, random effects. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

3.4.4 Supermarket Effects on Dietary Choices

To better understand how supermarkets contribute to rising BMI, we analyze effects on consumers' dietary choices. Several studies had used cross-sectional data to show that supermarket shopping contributes to higher total energy consumption (Asfaw, 2008; Kimenju et al., 2015; Rischke et al., 2015; Toiba et al., 2015). Rischke et al. (2015) showed that the average price of calories purchased in supermarkets is lower than the price per calorie purchased in traditional outlets. This could explain some of the calorie consumption effects. Our descriptive

statistics confirm that supermarket shoppers consume significantly more calories than people who obtain all of their food from traditional sources (Table 3.1). However, panel model estimates that we tried revealed that these differences in total energy consumption cannot be interpreted as a net effect of supermarket shopping. After controlling for other factors, supermarket shopping does not increase total energy consumption significantly.

However, beyond total energy consumption we find significant effects of supermarkets on dietary composition. The FE specification in Table 3.4 shows that shopping in supermarkets increases the share of energy from highly processed foods in total energy consumption by about 3 percentage points. This increase is plausible given that supermarkets in the small towns considered here primarily sell processed and highly processed foods. Higher consumption of highly processed foods with more sugar, fat, and lower fiber content can contribute to rising BMI even without significant effects on total energy consumption.

A tendency of supermarkets to contribute to dietary shifts toward more processed foods was also found by Asfaw (2008), Kimenju et al. (2015), and Rischke et al. (2015). Coefficient estimates are not directly comparable across studies, because of differences in the exact specification of the dependent variables and functional forms. Yet, in general, the earlier studies with cross-sectional data suggested larger effects on dietary composition, underlining again the importance of panel data for identifying reliable net impacts of supermarket shopping.

Table 3.5 analyzes further details of supermarket effects on people's diets beyond highly processed foods. The models shown have absolute energy consumption from different food groups as dependent variables. In all models, the supermarket dummy variable has significant coefficients, either in the FE or RE specifications. The FE specifications suggest that supermarket shopping reduces energy consumption from unprocessed staples by 112 kcal/AE/day, and from fresh fruits and vegetables by 124 kcal/AE/day. These are substantial effects, accounting for more than one-third of total average energy consumption from these two food groups.

Table 3.4. Effects of supermarket shopping on the share of energy consumed from highly processed foods

	Share of energy from highly processed foods (%)	
	FE	RE
Shopping in supermarkets (1,0)	3.07*** (1.13)	0.45 (0.87)
Married (1,0)	-3.08 (2.62)	-1.61** (0.78)
Physical activity ratio	0.65 (0.57)	-0.20 (0.48)
Female (1,0)		-1.46** (0.59)
Age (years)	0.11 (0.13)	-0.23*** (0.02)
Expenditure per capita (1000 KES)	0.06 (0.06)	0.18*** (0.04)
Ol Kalou (1,0)		-0.68 (0.80)
Njabini (1,0)		-1.90* (1.07)
Year 2015	2.33*** (0.60)	2.76*** (0.45)
Constant	4.71 (4.95)	19.77*** (2.09)
Wald χ^2		177.89***
F-value	5.96***	
Hausman test χ^2	23.10***	
Number of observations	1199	1199

Notes: Coefficient estimates are shown with standard errors cluster-corrected at household level in parentheses. FE, fixed effects; RE, random effects. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

For the other food groups in Table 3.5, the supermarket dummy variable is only significant in the RE specifications. Yet the Hausman test statistics suggest that unobserved heterogeneity is not an issue in these models, so that the RE estimator produces unbiased estimates.

Table 3.5. Effects of supermarket shopping on energy consumption from different food groups

	Energy consumption from different food groups (kcal/AE/day)									
	Unprocessed staples		Fruits and vegetables		Meats and fish		Dairy and egg		Vegetable oils	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
Shopping in supermarkets (1,0)	-111.61*	-22.43	-124.30**	-16.53	5.70	24.17***	7.88	8.94***	9.03	59.81***
	(59.27)	(30.58)	(56.82)	(21.34)	(11.28)	(7.30)	(6.16)	(3.45)	(27.39)	(15.31)
Married (1,0)	-56.69	-47.46*	-97.29	-28.78*	41.23	-5.02	-20.66	-5.34	-37.27	-27.66**
	(154.93)	(27.56)	(93.22)	(16.81)	(32.21)	(8.01)	(17.11)	(4.10)	(63.46)	(13.26)
Physical activity ratio	21.69	8.07	13.04	31.96**	-10.54	-3.80	1.99	-0.86	-5.80	2.82
	(41.86)	(17.65)	(24.79)	(13.06)	(10.84)	(6.43)	(4.17)	(3.21)	(19.16)	(11.25)
Female (1,0)		49.31***		24.12**		1.13		-3.63		21.06***
		(15.59)		(9.74)		(4.94)		(2.33)		(7.39)
Age (years)	3.04	2.83***	-2.99	1.40**	0.04	-0.35	0.17	-0.26**	-1.16	1.24***
	(9.48)	(1.04)	(4.60)	(0.62)	(1.14)	(0.26)	(0.44)	(0.13)	(2.00)	(0.46)
Expenditure p.c. (1000 KES)	15.13***	7.92***	18.92***	11.26***	6.12***	6.23***	1.55***	1.69***	9.70***	7.75***
	(5.00)	(2.05)	(3.07)	(1.76)	(1.25)	(1.48)	(0.55)	(0.42)	(2.42)	(1.38)
Ol Kalou (1,0)		80.82**		-86.66***		14.06		8.71*		-118.73***
		(34.40)		(21.44)		(9.23)		(4.60)		(16.97)
Njabini (1,0)		130.68***		-68.36***		3.87		6.20		-112.32***
		(35.16)		(24.85)		(10.21)		(3.90)		(17.71)
Year 2015	-199.37***	-170.79***	78.92***	72.35***	5.13	9.10	6.26**	6.26***	34.11**	35.76***
	(53.87)	(24.16)	(23.63)	(15.38)	(7.63)	(5.77)	(2.93)	(2.37)	(14.10)	(9.67)
Constant	272.37	217.03***	331.75*	151.57***	34.82	47.73*	18.44	24.18**	78.65	25.26
	(379.24)	(66.29)	(169.25)	(51.71)	(57.97)	(28.89)	(23.67)	(11.35)	(117.63)	(40.36)
Wald- χ^2		109.05***		119.49***		94.13***		51.21***		248.89***
F-value	5.40***		9.42***		5.81***		3.25***		54.99***	
Hausman test χ^2	4.23		21.42***		6.41		5.75		8.43	
Number of observations	1199	1199	1199	1199	1199	1199	1199	1199	1199	1199

Notes: Coefficient estimates are shown with standard errors cluster-corrected at household level in parentheses. AE, adult equivalent; FE, fixed effects; RE, random effects. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Supermarket shopping increases the consumption of meats and fish by 24 kcal/AE/day, of dairy and eggs by 9 kcal/AE/day, and of vegetable oils by 60 kcal/AE/day. Together with highly processed foods, these are also the food groups that supermarket shoppers actually purchase most in supermarkets (Figure 3.2). Table 3.5 and Figure 3.2 also reveal a few other interesting phenomena.

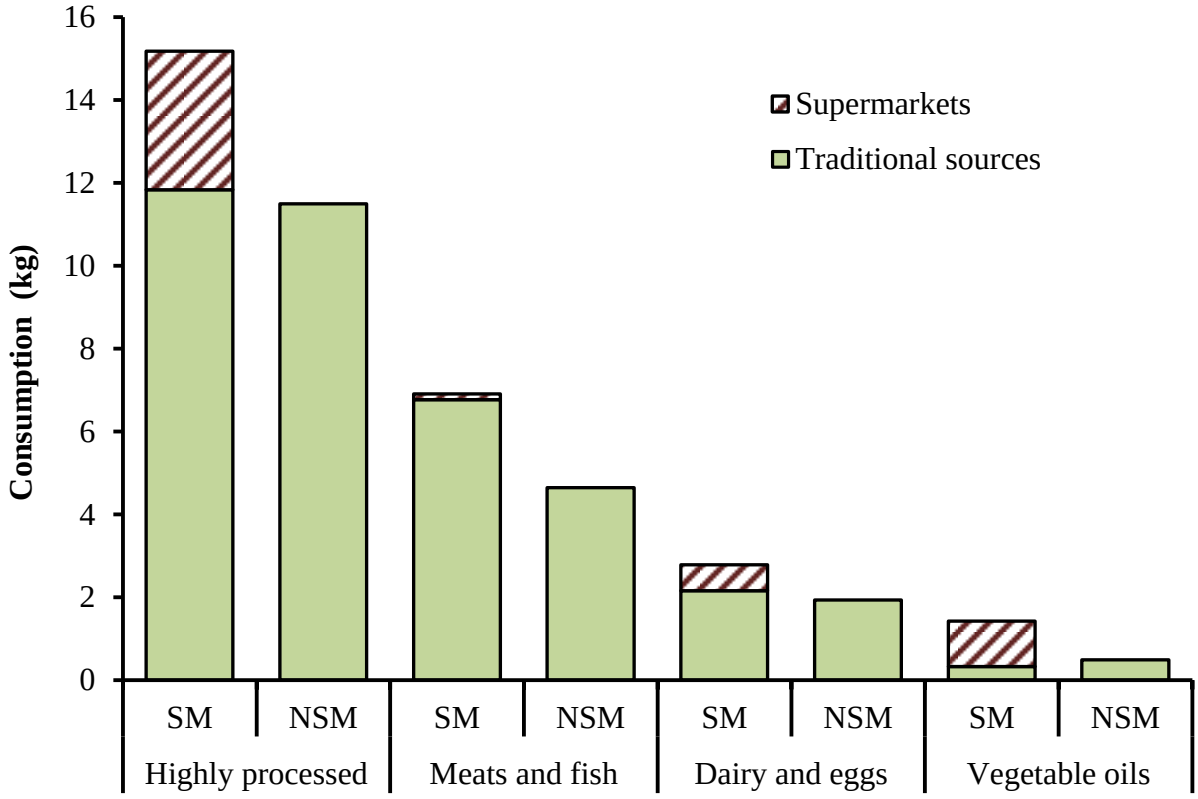

Figure 3.2. Quantity of food consumed from different food groups and food sources.
Notes: Quantities refer to consumption at the household level over a 30-day period. Total quantity consumed per household is split up by quantity purchased in supermarkets and quantity obtained from traditional sources. SM, refers to individuals who purchased some of their food in supermarkets; NSM, refers to individuals who did not use supermarkets at all. Pooled data for 2012 and 2015.

Households that use supermarkets purchase only some of their food in supermarkets. Of course, certain foods that are hardly sold in supermarkets but that people still want to consume have to be obtained from traditional sources. Cases in point are unprocessed staples and fresh fruits and vegetables. Results in Table 3.5 show that supermarket shoppers reduce the consumption of these

groups, but they do not abandon them completely. But even for the types of foods that are sold in supermarkets, traditional sources continue to play an important role for all consumers. Interestingly, the quantities of highly processed foods, dairy, and vegetable oils consumed from traditional sources are more or less the same for those shopping and not shopping in supermarkets. Only that supermarket shoppers consume extra quantities of these foods that they purchase in supermarkets (Figure 3.2). Hence, the quantities of these foods obtained from supermarkets seem to be of additional nature. This may possibly be explained by supermarkets selling popular brands that are not available in traditional outlets. Larger packaging sizes, product placement, pricing, advertising, and the self-service character of supermarkets may also incentivize customers to buy additional quantities.

The establishment of supermarkets in small towns of Kenya is a relatively recent development, and the range of products offered in these supermarkets is still limited, at least when compared to much larger stores in big cities. Our data do not allow us to analyze how dietary behavior of small-town consumers may change when the number of supermarkets, as well as store sizes, continue to grow. However, even at this early stage, the results clearly support the hypothesis that supermarkets contribute to the nutrition transition, rather than only reacting to shifting consumer preferences.

3.5 Conclusion

Many developing countries currently experience profound transformations in the food retail sector, with modern supermarkets massively gaining in importance. While developments are already more advanced in some parts of Asia and Latin America, the share of supermarkets in food retailing is still relatively low in most sub-Saharan African countries, even though it is increasing rapidly. Possible dietary and nutrition implications are not yet sufficiently understood. We have analyzed effects on food consumers in Kenya, which is among the countries with the fastest growth of supermarkets in Africa. Using panel data from small towns in Central Kenya, we have shown that supermarkets significantly affect nutritional outcomes. After controlling for other relevant factors, our results suggest that shopping food in supermarkets increases adult BMI by 0.64 kg/m^2. That supermarkets tend to increase consumer BMI in developing countries was also shown in a few previous studies (Asfaw, 2008; Kimenju et al., 2015). These previous studies had even suggested larger effects, but they built on cross-section observational data where

controlling for possible bias due to unobserved heterogeneity is more difficult. We argue that our estimates with panel data models are more realistic and reliable. However, regardless of the exact magnitude of effects, results confirm that the growth of supermarkets contributes to the nutrition transition in Africa.

To better understand the underlying mechanisms, we have also analyzed effects of supermarkets on consumer dietary choices. Unlike a few previous studies (Asfaw, 2008; Rischke et al., 2015, Toiba, Umberger, & Minot, 2015), we did not find that supermarkets contribute to net increases in total calorie consumption. However, our panel data models revealed significant shifts in dietary composition. Supermarket shopping contributes to a sizeable decrease in energy consumption from unprocessed staples and from fresh fruits and vegetables. These food groups are hardly sold in the small-town supermarkets in Central Kenya that primarily concentrate on processed foods. Accordingly, we found significant increases of supermarket shopping on energy consumption from dairy, vegetable oil, processed meat products (sausages etc.), and highly processed foods (bread, pasta, snacks, soft drinks etc.). These shifts toward processed and highly processed foods lead to less healthy diets, with higher sugar, fat, and salt contents, and probably lower amounts of micronutrients and dietary fibers. Some of the effects are still relatively small in magnitude, but they may increase with supermarkets further gaining in importance. The observed changes in dietary composition can also explain the increasing effect on BMI, even without a rise in total calorie consumption. The reason is that the human body requires less energy for the digestion of processed and highly processed foods.

These results are alarming from a nutrition and health perspective. Even though we failed to establish a clear effect of supermarket shopping on the likelihood of being overweight or obese, rising BMI will inevitably aggravate nutrition status in situations where many people are already near or above the BMI threshold of 25 kg/m^2, as is the case for adults in Central Kenya. Overweight and obesity are responsible for various non-communicable diseases that cause high economic costs, human suffering, and lost quality of life.

It would be wrong to attribute the obesity pandemic in developing countries to the expansion of supermarkets alone. There are many factors that contribute to the nutrition transition. However, our results suggest that supermarkets are not only a symptom of this transition, but they influence dietary habits to a significant extent. Nevertheless, a modernizing retail sector should not be

condemned, because – if properly managed – it can also have important positive nutrition effects. For instance, in a recent study in Kenya, Chege, Andersson, & Qaim (2015) showed that smallholder farmers benefit from marketing contracts with supermarkets in terms of higher incomes that also contribute to better quality diets in these farm households. Depending on initial nutrition status and access to food diversity, the establishment of new supermarkets can also improve the nutrition of consumers. A few studies showed that better access to supermarkets is associated with healthier diets in some regions in the US (Drewnowski et al., 2012; Laraia et al., 2004; Morland et al., 2006). In these situations, supermarkets offer fresh foods that are otherwise more difficult to access, especially for lower income consumers living in so-called 'food desert' neighborhoods (Michimi and Wimberly, 2010). This is different from typical situations in Africa, but these examples underline that modern retail is not inevitably associated with negative nutrition and health implications.

The expansion of supermarkets in Africa and other parts of the developing world will likely continue. Hence, from a food policy perspective it is important to understand the diet and nutrition implications and intervene where necessary to avoid undesirable outcomes. Intervening does not imply banning supermarkets. But certain types of regulations and economic incentives may be appropriate in some situations. For instance, supermarkets in small African towns so far hardly sell fresh fruits and vegetables, because this does not yet seem to be profitable. Regulations that incentivize supermarket stores to also offer certain fresh products at reasonable prices could be a possible policy intervention. Alternatively, traditional fruit and vegetable vendors could be encouraged to set up stalls near the supermarket entrances, possibly through contractual arrangements. Other measures to promote dietary diversity and nutrition-sensitive food environments are also worth considering. Apart from regulations, this may also include consumer awareness building for the importance of fruits and vegetables in healthy diets.

Finally, we would like to point out a few limitations of our study. First, while the use of panel data has clear advantages over cross-sectional data, our panel suffered from significant attrition. While we tested for attrition bias to the extent possible, a balanced panel with a larger number of observations would be beneficial to analyze further details. Especially a sample with a larger number of individuals switching their supermarket shopping behavior over time would be useful for more robust causal inference with fixed effects estimators. Second, the geographic range of

our data is limited and the time period considered relatively short. More comprehensive and longer term data may help to better understand impact heterogeneity and dynamics. Third, the 30-day food consumption recall at the household level that we used has certain drawbacks in terms of data accuracy (Schoeller, 1995). We chose this relatively long recall period because some of the more durable food items are only purchased once a month. However, shorter and repeated recalls at individual level are preferable when the focus is on analyzing actual food and nutrient intakes (Shim et al., 2014). Hence, there is clearly scope for follow-up research to better understand the nutrition and health effects of the modernizing retail sector in various developing-country situations.

3.6 Appendix A3

Table A3.1. Comparison of balanced panel with excluded and newly included observations in 2015

	(1) Total sample	(2) Balanced panel	(3) Excluded and newly included in 2015	(4) Difference between (2) and (3)
Female (1,0)	0.65 (0.48)	0.68 (0.47)	0.63 (0.48)	-0.06** (0.03)
Age, y	36.54 (12.20)	39.44 (12.77)	33.89 (11.02)	-5.55*** (0.69)
Married (1,0)	0.74 (0.44)	0.76 (0.43)	0.72 (0.45)	-0.04* (0.03)
Physical activity ratio	2.23 (0.49)	2.25 (0.50)	2.22 (0.48)	-0.02 (0.03)
Energy availability (kcal/AE/day)	3164.61 (1439.11)	3205.28 (1513.14)	3127.51 (1368.26)	-77.77 (83.60)
Expenditure per capita (1000 KES)	11.90 (9.19)	12.04 (8.28)	11.78 (9.94)	-0.26 (0.53)
Education (school years)	11.08 (5.01)	11.08 (5.26)	11.07 (4.78)	-0.01 (0.29)
Number of observations	1199	572	627	1199

Notes: Mean values are shown with standard deviations in parentheses. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

Table A3.2. Different sources of food and their characteristics

Source of food	Characteristics	Main food groups obtained from this source	Average share of total energy consumption (%)	Number of observations using source
Supermarket (modern retail)	Self-service; Large variety of foods and brands; Highly processed foods; Refrigerated and frozen food; Limited offer of fresh foods; Non-food products; No credit possibility	Bread, pasta, cereals, instant noodles, snacks, fats, oils, dairy products, sugar	12.7	668
Small shop (traditional retail)	Semi self-service; Limited variety of foods and brands; Some refrigerated foods; Sometimes credit possibility	Rice, flour, sugar, fats	5.4	485
Market/kiosk (traditional retail)	Over the counter service; Very limited variety of brands; Fresh fruits and vegetables; Unprocessed staples; Credit possibility	Maize, other staple foods, fruits, vegetables, meat, milk	65.7	1199
Own production/gift	Own plot or garden; In a few cases own farms; Gifts from friends	Maize, potatoes, poultry, eggs, milk	16.3	1014

Table A3.3. Food groups by level of processing

Food groups	Examples
Unprocessed	
Eggs & milk	Eggs, fresh whole milk, natural yoghurt
Fruits & vegetables	Mango, orange, green leafy vegetables, tomatoes, onions
Meats	Beef, pork meat, fresh chicken, fresh fish
Pulses	Lentils, black beans, cowpea etc.
Roots, tuber, plantain	Arrow roots, cassava, yams, potato, cooking bananas
Traditional staples	Amaranth, sorghum, green maize
Medium processed	
Fats & oils	Butter, margarine, vegetable oils
Meats	Frozen fish, frozen chicken, dried fish
Staples	Rice, maize flour, wheat flour, oats
Sugars	Sugar, jaggery
Highly processed	
Bread & pasta	Bread, cornflakes, pasta
Dairy	Flavored yoghurt/milk, tinned baby milk
Fats & oils	Peanut butter
Meats	Sausages, bacon, ham
Miscellaneous	Mandazi, samosa, ketchup
Sugars	Glucose powder
Sweet drinks and snacks	Chips, soft drinks, cake, popcorn

Note: The food items mentioned are only examples. In total, 168 food items were included in the survey. All of them were classified by level of processing following the same principle.

Table A3.4. Comparison of total sample with supermarket switchers

Variable	Total sample	Supermarket switchers	Difference
Female (1,0)	0.65 (0.48)	0.77 (0.42)	-0.13*** (0.05)
Age, y	36.54 (12.20)	36.99 (11.02)	-0.48 (1.23)
Married (1,0)	0.74 (0.44)	0.75 (0.44)	-0.01 (0.05)
Physical activity ratio	2.23 (0.49)	2.24 (0.45)	-0.01 (0.05)
Expenditure per capita (1000 KES)	11.90 (9.19)	12.63 (6.02)	-0.78 (0.70)
Number of observations	1199	88	

Notes: Mean values are shown with standard deviations in parentheses (standard errors in the last column). Supermarket switchers are those who changed their supermarket shopping status during 2012-15.
*** Difference significant at 1% level.

Table A3.5. Effects of supermarket shopping on body mass index with additional controls

	Body mass index (kg/m²)	
	FE	RE
Shopping in supermarkets (1,0)	0.65* (0.38)	0.61** (0.29)
Shopping in small shops (1,0)	-0.14 (0.20)	0.03 (0.19)
Married (1,0)	1.07* (0.56)	1.06*** (0.30)
Physical activity ratio	-0.22 (0.18)	-0.25 (0.16)
Female (1,0)		3.29*** (0.28)
Age (years)	-0.02 (0.04)	0.10*** (0.02)
Expenditure per capita (1000 KES)	-0.01 (0.02)	0.06*** (0.02)
Ol Kalou (1,0)		-0.85** (0.40)
Njabini (1,0)		-0.83* (0.44)
Year 2015	0.38** (0.17)	-0.01 (0.14)
Constant	25.34*** (1.53)	18.63*** (0.74)
Wald χ^2		247.67***
F-value	2.17**	
Hausman test χ^2	59.85***	
Number of observations	1199	1199

Notes: Coefficient estimates are shown with standard errors cluster-corrected at household level in parentheses. FE, fixed effects; RE, random effects. * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

4 Maternal Nutrition Knowledge and Child Nutritional Outcomes in Urban Kenya[12]

Abstract

We examine the link between maternal nutrition knowledge and nutritional outcomes of children and adolescents (5-18 years) measured in terms of height-for-age Z-scores (HAZ). One particular focus is on the role of different types of nutrition knowledge. The analysis builds on household-level and individual-level data collected in urban Kenya in 2012 and 2015. Various regression models are developed and estimated. Results show that maternal nutrition knowledge – measured through an aggregate knowledge score – is positively associated with child HAZ, even after controlling for other influencing factors such as household living standard and general maternal education. However, disaggregation by type of knowledge reveals important differences. Maternal knowledge about food ingredients only has a weak positive association with child HAZ. For maternal knowledge about specific dietary recommendations, no significant association is detected. The strongest positive association with child HAZ is found for maternal knowledge about the health consequences of not following recommended dietary practices. These findings have direct relevance for nutrition and health policies, especially for designing the contents of educational campaigns and training programs.

[12] This paper is published in Appetite; 116:518-526. https://doi.org/10.1016/j.appet.2017.05.042. It is co-authored by Bethelhem Legesse Debela, Ramona Rischke, and Matin Qaim. The authors' contributions are as follows: BLD, KMD, RR, and MQ designed the research. KMD and RR collected the data. BLD organized the data and performed the analysis. BLD, KMD, RR, and MQ wrote the paper.

4.1 Introduction

This study analyzes the link between maternal nutrition knowledge and child nutritional outcomes in urban households in Kenya. Malnutrition in all its forms affects one out of three individuals worldwide (IFPRI, 2016). While overnutrition rates are rising, undernutrition remains a major concern in many countries. It is estimated that 25% of all children in developing countries are stunted, an indication of sustained episodes of energy and micronutrient deficiencies. In spite of the progress made elsewhere, in Africa the number of stunted children continues to increase (IFPRI, 2016; UNICEF et al., 2015).

Various interventions are commonly implemented to improve child nutrition and promote healthy living environments for poor households. Among others, these interventions include food and cash transfers, supplementary feeding programs, and nutrition education campaigns (Hirvonen et al., 2016; Tabbakh and Freeland-Graves, 2016; World Bank, 2010). While the evidence for the effect of transfer programs on child health outcomes is mixed (Burchi et al., 2016; de Groot et al., 2017), there is a potential for an increased impact on child nutrition if conditional cash transfer programs are combined with nutrition education programs (Burchi et al., 2016). Positive associations between maternal nutrition knowledge and child nutritional outcomes are well documented for young children (Appoh and Krekling, 2005; Burchi, 2010; Webb and Block, 2004). For older children and adolescents, the effects have hardly been analyzed. Moreover, existing studies typically do not differentiate by type of nutrition knowledge, which would be useful to better understand how nutrition education programs should be designed to make them most effective.

Studies on the effects of maternal nutrition knowledge in developing countries are mainly restricted to children under five years of age (e.g. Appoh and Krekling, 2005; Burchi, 2010; Webb and Block, 2004). It is assumed that nutritional improvements are most beneficial for young children (Black et al., 2013; Leroy et al., 2014; Ruel et al., 2008). Appoh and Krekling (2005), for instance, used data from Ghana to illustrate positive associations between mothers' nutritional knowledge and the nutritional status of children under three. In that study on Ghana, maternal nutrition knowledge was measured with a composite knowledge score, calculated using answers to questions on breastfeeding, complementary feeding, and causes of Kwashiorkor. Burchi (2010) found positive effects of maternal knowledge on preschool children based on

nationally representative data from Mozambique. Burchi (2010) constructed a nutrition and health knowledge variable by considering respondents' awareness of vitamin A, HIV/AIDS, oral rehydration, and family planning.

A few studies identified positive links between maternal nutrition knowledge and child nutrition also for older children, but this evidence is limited to developed countries. Variyam et al. (1999) used data from the US and showed that maternal health awareness and knowledge about nutrient contents of foods had positive effects on dietary quality of children between 2 and 17 years of age. Also using data from households in the US, Tabbakh and Freeland-Graves (2016) measured maternal nutrition knowledge based on awareness of nutrient contents and dietary recommendations, finding a positive association with adolescents' dietary quality and a negative association with adolescents' body mass index.

Here, we contribute to this literature by analyzing associations between different types of maternal nutrition knowledge and older children's nutritional status in a developing country. We use primary survey data collected in urban Kenya in 2012 and 2015. Specifically, we aim to answer the following two research questions: (1) Is maternal nutrition knowledge positively associated with height-for-age Z-score (HAZ) of children and adolescents? (2) Do different types of maternal nutrition knowledge produce dissimilar results?

Kenya is an interesting example for this type of research because malnutrition in all its forms is prevalent. Especially in urban areas, traditional diets are increasingly shifting towards more processed foods, which was shown to contribute to overweight and obesity among adults (Rischke et al., 2015; Kimenju et al., 2015). At the same time, rates of stunting remain relatively high among children and adolescents. The coexistence of different forms of malnutrition in the same setting and the same households is common also in other parts of Africa. In such situations, it is especially important to better understand the role of nutrition knowledge. This can help to design more effective food and nutrition policies.

4.2 Materials and Methods

4.2.1 Conceptual Framework

Theoretical and empirical research suggests that maternal nutrition knowledge is necessary but not sufficient for healthy child nutrition and for inducing related behavioral change (e.g.

Contento, 2008; Hawkes et al., 2015). Mothers are particularly important for nutritional outcomes of children and other household members, because in most situations mothers are primarily responsible for dietary choices and food preparation.

There are two main pathways how children can be affected by the nutrition knowledge of their mother. First, the quantity, quality, and diversity of the food prepared in the household, as well as the sanitary practices, influence child nutritional outcomes directly (Campbell et al., 2014; Variyam et al., 1999). Second, the dietary and sanitary practices observed and experienced during childhood can also have an indirect effect through forming attitudes towards nutrition and health (Hoddinott et al., 2016; Vereecken and Maes, 2010; Yabancı et al., 2014). Attitudes developed during childhood are known to affect own dietary practices in later life (Kigaru et al., 2015). This already starts with older children and adolescents making their own choices for food consumed away from home. Against this background it is very plausible that different types of maternal nutrition knowledge can have different effects on child nutrition.

Household and contextual variables – such as living standard and food environment – can influence maternal nutrition knowledge and also child nutritional outcomes (Hawkes et al., 2015). In our empirical analysis, we control for such factors through including appropriate covariates in regression models. The main nutritional outcome of interest is child HAZ, which measures long-term nutritional outcomes. Maternal nutrition knowledge is expected to influence the nutrition of children and adolescents in the long run.

4.2.2 Study Context and Data

The data for this study were collected in two rounds of a household survey conducted in Kenya in 2012 and 2015. Kenya's child undernutrition rates are high, with 35% of all children being stunted, 7% wasted, and 16 % underweight (Matanda et al., 2014; Ministry of Public Health and Sanitation, 2012). Our research was conducted in Central Kenya, where child undernutrition has seen only moderate improvement over the last two decades (Matanda et al., 2014).

We concentrated on urban and peri-urban areas and used a two-stage sampling procedure. At the first stage, we purposively selected three towns in Central Kenya, namely Ol Kalou, Njabini, and Mwea. These three towns have similar characteristics in terms of the size of the urban center, infrastructure conditions, and availability of social institutions (hospitals etc.). Yet some variation in terms of the type of available food retail outlets was observed (Kimenju et al., 2015; Rischke

et al., 2015). At the second stage, around 150 households were randomly selected in each of the three towns. In 2012, the total sample comprised 453 households. In 2015, the sample included 450 households. For the 2015 survey round, about half of the 2012 households were revisited, the other half were newly selected, again using random sampling.

In both survey rounds, a structured questionnaire was used to collect data on various socioeconomic characteristics, including household composition, income sources, food and non-food consumption expenditures, the health of household members, and access to various types of services. In addition to the household-level data we took anthropometric measures from one randomly selected child (aged 5-18) in each household and his/her mother or caretaker.[13] Body measurements were taken according to international standards (Centers for Disease Control and Prevention, 2007) with an accuracy of 0.1 kg for body weight and 0.7 cm for height (de Onis et al., 2004). Maternal nutrition knowledge was captured through a series of diet and nutrition related questions, as explained in more detail below.

Not all sample households had children between 5 and 18 years of age. In a few cases, there were children in the households but we were unable to trace them, even after repeated visits. For the analysis, we pool the sample from the two survey rounds and construct a child-level data set. Sixty-four children were observed during both survey rounds (128 observations), while 298 children were observed only in 2012 or in 2015. In total, we have 426 observations from children and adolescents (aged 5-18) with complete data for all relevant variables.

4.2.3 Measuring Child Nutritional Outcomes

We used the WHO growth references for school-aged children and adolescents (de Onis, 2007) to generate height-for-age Z-scores (HAZ) for all children and adolescents in our sample. HAZ refers to the standard deviation from the median height of a child or adolescent of the same age and sex in a reference population. A child or adolescent is considered stunted (extremely stunted; mildly stunted) if the Z-score is below the cutoff of -2 (-3;-1) standard deviations below the reference population (O'Donnell et al., 2008; WHO, 2006b). A low HAZ reflects a status of sub-optimal growth due to long-term adverse nutrition and health conditions (WHO, 2016b, WHO, 1995). While child growth largely depends on nutrition and health during early childhood,

[13] In cases where the child's mother was unavailable, data from another female caretaker in the same household were taken. This happened in 12% of the sample households.

conditions during later childhood and adolescence also matter, and some catch-up growth is possible (Adair, 1999; Darnton-Hill et al., 2004; Prentice et al., 2013; Stein et al., 2010).

In our sample, we only consider children above 5 years of age, without assuming that the association between mothers' nutrition knowledge and HAZ is directly transferable to younger children. As mentioned, however, a positive association for younger children has been shown in previous studies (e.g. Appoh and Krekling, 2005; Burchi, 2010; Webb and Block, 2004).

4.2.4 Measuring Maternal Nutrition Knowledge

In the survey, we asked the children's mothers various questions concerning nutrition knowledge. Building on the 'stages of change' model (Glanz et al., 1994), which illustrates that changes in dietary behavior have different types of information needs, our knowledge questions were subdivided into three categories: (a) knowledge about food ingredients (particularly focusing on sugar, fat, and salt), (b) knowledge about specific dietary recommendations (focusing on the consumption of fresh fruits and vegetables and on breastfeeding), and (c) knowledge about the health consequences of not following recommended dietary practices. Details of the questions asked are shown in Table 4.1.

Responses to each question were classified as correct or incorrect. Based on the number of correct responses, we generated different types of nutrition knowledge scores. First, for each respondent we used the sum of correct responses for the different questions belonging to the same knowledge category. This sum was then divided by the number of correct responses at the 95% distribution of correct responses among all individuals. To standardize values in a range between 0 and 1, we replaced any value greater than one with the value 1. This procedure results in an individual nutrition knowledge score for each category (a), (b), and (c), which we use in order to analyze the role of each type of nutrition knowledge. Second, for each respondent we calculate an aggregated nutrition knowledge score as the arithmetic mean of the knowledge scores for all three categories.

4.2.5 Statistical Analysis

We use non-parametric and parametric statistical approaches to analyze the data. Non-parametric approaches that we use include local polynomial regression and kernel density plots to visualize the association between maternal nutrition knowledge and child HAZ. A local polynomial regression smooths a scatter plot of the two variables by using a polynomial fit. The analysis

applies a weighted least squares regression with greater weights given to data points closer to the polynomial fit (Cleveland, 1979).

Kernel density plots smooth kernel density functions of each data point, whereby the kernel estimates vary depending on the number of observations in the neighborhood of each data point (Silverman, 1986; Wand and Jones, 1995). In our density plot, we use a univariate kernel density estimation of HAZ for households with different levels of nutrition knowledge. For this purpose, we take the arithmetic mean of the aggregated maternal nutrition knowledge score and split the sample into two: households with a high (above average) and households with a low (below average) nutrition knowledge score. We also use a modified threshold in a robustness check.

For the parametric statistical analysis, we use ordinary least squares (OLS) regression models of the following form:

$$HAZ_{it} = \beta_0 + \beta_1 N_{ht} + \beta_2' \boldsymbol{Z}_{it} + \beta_3' \boldsymbol{X}_{ht} + \beta_4' E_{ht} + \beta_4 T + \varepsilon_i \qquad (4.1)$$

where subscript *i* denotes child-level and subscript *h* household-level variables, measured at time *t.* HAZ_{it} is the height-for-age Z-score of children and adolescents. N_{ht} is the maternal nutrition knowledge score. $\boldsymbol{Z}_{it}$ is a vector of child characteristics such as age, sex, and the incidence of infectious diseases during the month prior to each survey round. $\boldsymbol{X}_{ht}$ is a vector of household characteristics such as age and sex of the household head and height of the mother. $\boldsymbol{E}_{ht}$ is a vector of human capital and living standard variables, where we specifically include maternal education and household consumption expenditures[14]. Maternal education refers to the schooling years of the mother and is therefore different from the more specific maternal nutrition knowledge score. T is a time dummy representing the survey year and taking a value of 1 for 2015. ε_i is a random error term with mean zero.

We are particularly interested in the estimate for β_1 and hypothesize a positive association between maternal nutrition knowledge and child HAZ. To test for the role of different types of nutrition knowledge, we run the model in four different versions. In model (1), N_{ht} is the aggregate nutrition knowledge score, whereas in models (2), (3), and (4) we use the

[14] Household consumption expenditures include expenditures for all food and non-food items consumed by the household over a period of one month. To make values comparable across households of different size, we express consumption expenditures per adult equivalent. Monetary values for 2015 were deflated to 2012 using the consumer price index.

disaggregated scores for the three knowledge categories explained above. Furthermore, variants of each model are estimated, with and without including $\boldsymbol{E}_{ht}$. Maternal education and household consumption expenditures are important control variables, but due to their expected correlation with N_{ht} they may capture some of the maternal knowledge effects. Comparing the estimates with and without E_{ht} allows us to examine whether maternal nutrition knowledge has a significant association with child HAZ even after controlling for maternal education and household living standard.

We estimate model (1) in four variants. Model (1A) presents the base model without $\boldsymbol{E}_{ht}$ included. Models (1B) and (1C) respectively include maternal education and consumption expenditures, whereas Model (1D) includes both these variables together. For brevity, Models (2) to (4) are only presented in two variants, namely with and without both variables in $\boldsymbol{E}_{ht}$ included.

Although one may expect the nutrition knowledge variable to be endogenous, we control for relevant confounding factors in estimating HAZ of children and adolescents. Note that we do not claim causality but seek to explore associations. To control for heteroscedasticity, we use robust standard errors based on White's heteroscedasticity correction (White, 1980). We are looking at *current* maternal nutrition knowledge, which has likely formed over a longer period of time, and relate this to *current* child nutritional outcomes, which are also the result of a longer-term process. The implicit assumption is that maternal nutrition knowledge and child nutritional outcomes have similar time horizons.

4.3 Results

4.3.1 Descriptive Results

Table 4.1 shows the questions that were asked in the survey to calculate the maternal nutrition knowledge scores, as well as the share of respondents giving correct answers. The highest average share of correct responses is observed for knowledge about the health consequences of not following dietary recommendations (79%). For the other two categories of nutrition knowledge, the average shares of correct responses are lower. Comparing between the two survey years, the share of correct responses on food ingredients and on dietary recommendations was somewhat lower in 2015 than in 2012, while the share of correct responses on health

consequences was higher in 2015. Hence, it is not possible to establish a clear time trend for maternal nutrition knowledge.

Table 4.1. Nutrition knowledge questions and percentages of correct answers

	Percentage correct			Correct answer
	All years	2012	2015	
Knowledge about food ingredients	**35**	**37**	**30**	
Do you think these food products are high, medium or low in added sugar?				
Natural yoghurt	29	37	21	Low
Flavored yoghurt	26	28	25	High
Fresh juice	24	33	14	Low
White bread	47	50	43	Low
Tomato ketchup	16	20	12	High
Do you think these food products are high, medium or low in fat?				
Chips	79	88	70	High
Margarine	62	68	56	High
Crisps	30	29	31	High
Fried beef sausage	46	46	46	High
Honey	53	70	36	Low
Raw nuts	12	12	13	High
White bread	64	70	58	Low
Cake	27	36	19	High
Do you think these food products are high, medium or low in salt?				
Sausages	22	19	25	High
Brown bread	6	4	8	High
Popcorn	26	28	25	High
Tomato ketchup	15	16	14	High
Instant noodles	14	13	15	High
Knowledge about dietary recommendations	**52**	**56**	**49**	
How many servings of fruits and vegetables together do you think experts advise people to eat every day?	8	16	1	4-6
What do you think is the recommended period of exclusively breastfeeding infants?	96	96	96	6 months
Knowledge about the health consequences of not following dietary recommendations	**79**	**72**	**86**	
Are you aware of any health problems associated with eating none or too little fresh fruits and vegetables?	78	74	82	
Are you aware of any health problems or diseases associated with excess body weight?	92	88	96	
Which health problems or diseases do you think are associated with not exclusively breastfeeding infants?	67	54	81	
Observations [a]	399	200	199	

Notes: [a] The number of observations refers to the number of unique households.

The average number of correct responses for the three categories and the calculated nutrition knowledge scores are presented in Table 4.2. The average aggregate nutrition knowledge score is 0.59, which means that the average respondent had 59% of the knowledge of the best-performing individuals (95th percentile of correct answers) in the sample.

Table 4.2. Number of correct responses and maternal nutrition knowledge scores

	All years	2012	2015
Number of correct responses			
Knowing food ingredients [a]	5.96 (2.94)	6.63 (2.81)	5.30 (2.92)
Knowing dietary recommendations [b]	1.05 (0.34)	1.12 (0.43)	0.97 (0.21)
Knowing health consequences [c]	2.37 (0.81)	2.15 (0.87)	2.60 (0.67)
Standardized knowledge scores			
Knowing food ingredients	0.46 (0.22)	0.47 (0.20)	0.44 (0.24)
Knowing dietary recommendations	0.52 (0.17)	0.56 (0.21)	0.49 (0.11)
Knowing health consequences	0.79 (0.27)	0.72 (0.29)	0.87 (0.22)
Aggregate nutrition knowledge score	0.59 (0.13)	0.58 (0.15)	0.60 (0.12)

Notes: Values are means with SD in parentheses. [a] The total number of questions in this category was 18. [b] The total number of questions in this category was 2. [c] The total number of questions in this category was 3.

Table 4.3 shows descriptive statistics for the other variables used in the empirical analysis. The average height-for-age Z-score of children and adolescents in our sample is -0.85, with lower values in 2012 (-1.05) than in 2015 (-0.66). HAZ of boys (-0.92) is lower than of girls (-0.78), which is consistent with other studies in Africa and Asia (Christiaensen and Alderman, 2004; Debela et al., 2015; Webb and Block, 2004).

Table 4.3. Descriptive statistics

Variables	All	Year		By maternal nutrition knowledge [c]		
		2012	2015	High nutrition knowledge	Low nutrition knowledge	Difference
Height-for-age Z-scores	-0.85 (1.20)	-1.05 (1.30)	-0.66 (1.19)	-0.69 (1.07)	-1.01 (1.31)	0.31***
Height-for-age Z-scores, boys	-0.92 (1.22)	-1.15 (1.21)	-0.66 (1.18)	-0.74 (1.13)	-1.09 (1.29)	0.35**
Height-for-age Z-scores, girls	-0.78 (1.26)	-0.94 (1.38)	-0.66 (1.01)	-0.65 (1.02)	-0.92 (1.33)	0.27*
Prevalence of stunting (%) [a]	16	21	12	13	19	-0.06*
Prevalence of mildly stunting (%) [a]	43	50	36	37	49	-0.12**
Prevalence of extreme stunting (%) [a]	4	7	2	1	7	-0.06***
Age of child in months	120 (41.13)	117 (42.44)	123 (39.78)	120 (41.93)	120 (40.37)	-0.78
Sex of child (1=female)	0.52 (0.50)	0.48 (0.50)	0.56 (0.50)	0.53 (0.50)	0.51 (0.50)	0.03
Infection during past month (1/0)	0.08 (0.26)	0.09 (0.29)	0.06 (0.24)	0.10 (0.30)	0.05 (0.22)	0.04*
Sex of household head (1=female)	0.28 (0.45)	0.29 (0.45)	0.27 (0.44)	0.23 (0.42)	0.33 (0.47)	-0.10**
Age of household head (years)	41 (10.55)	40 (10.57)	41 (10.53)	40 (9.69)	41 (11.42)	-0.58
Height of mother (cm)	159 (5.81)	158 (5.81)	159 (5.78)	159 (5.35)	158 (6.26)	0.70
Education of mother (schooling years)	9.63 (4.62)	9.81 (4.96)	9.47 (4.30)	10.49 (4.88)	8.72 (4.15)	1.77***
Consumption expenditure (KES/month/AE) [b]	6770 (3945)	7031 (4595)	6540 (3258)	7230 (4447)	6284 (3274)	947**
Ol Kalou	0.34 (0.47)	0.36 (0.48)	0.32 (0.47)	0.33 (0.47)	0.34 (0.47)	-0.00
Mwea	0.28 (0.45)	0.23 (0.42)	0.32 (0.47)	0.31 (0.46)	0.25 (0.43)	0.06
Njabini	0.39 (0.49)	0.42 (0.49)	0.35 (0.48)	0.36 (0.48)	0.42 (0.49)	-0.05
Number of observations	426	200	226	219	207	

Notes: Values are means with SD in parentheses. [a] Stunting is defined as HAZ<-2; mild stunting as HAZ<-1; extreme stunting as HAZ<-3. [b] 1 US dollar = 95 Kenyan Shilling (KES); average official exchange rate in 2015. Consumption expenditure value for 2015 has been deflated to 2012 values using World Bank's Consumer Price Index (2010=100). [c] Using the aggregate maternal nutrition knowledge score, households were subdivided into those with above and those with below average scores. AE, adult equivalent; HAZ, height-for-age Z-score; KES, Kenyan Shilling. * $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$.

In the right-hand part of Table 4.3, we subdivide the sample into households with high and low maternal nutrition knowledge using the average aggregate nutrition score as the cutoff point. Children and adolescents with mothers that have high nutrition knowledge have a significantly larger HAZ ($p<0.01$) than children and adolescents with mothers that have low nutrition knowledge. We also observe significant differences between the two groups for some of the other child and household characteristics, such as the incidence of infectious diseases, sex of the household head, and household consumption expenditures. These are variables that we control for in the parametric regressions.

4.3.2 Non-Parametric Estimation Results

The graphical illustration of the non-parametric analysis shows a positive link between maternal nutrition knowledge and HAZ of children and adolescents (Figure 4.1). Panel (A) depicts the local polynomial regression plot. It can clearly be seen that maternal nutrition knowledge has a positive association with HAZ. Panel (B) shows the distribution of HAZ in households with high and low maternal nutrition knowledge. In households with high nutrition knowledge, the HAZ distribution is shifted to the right, which further underlines the positive association. The subsequent analysis investigates this relationship after controlling for confounding factors.

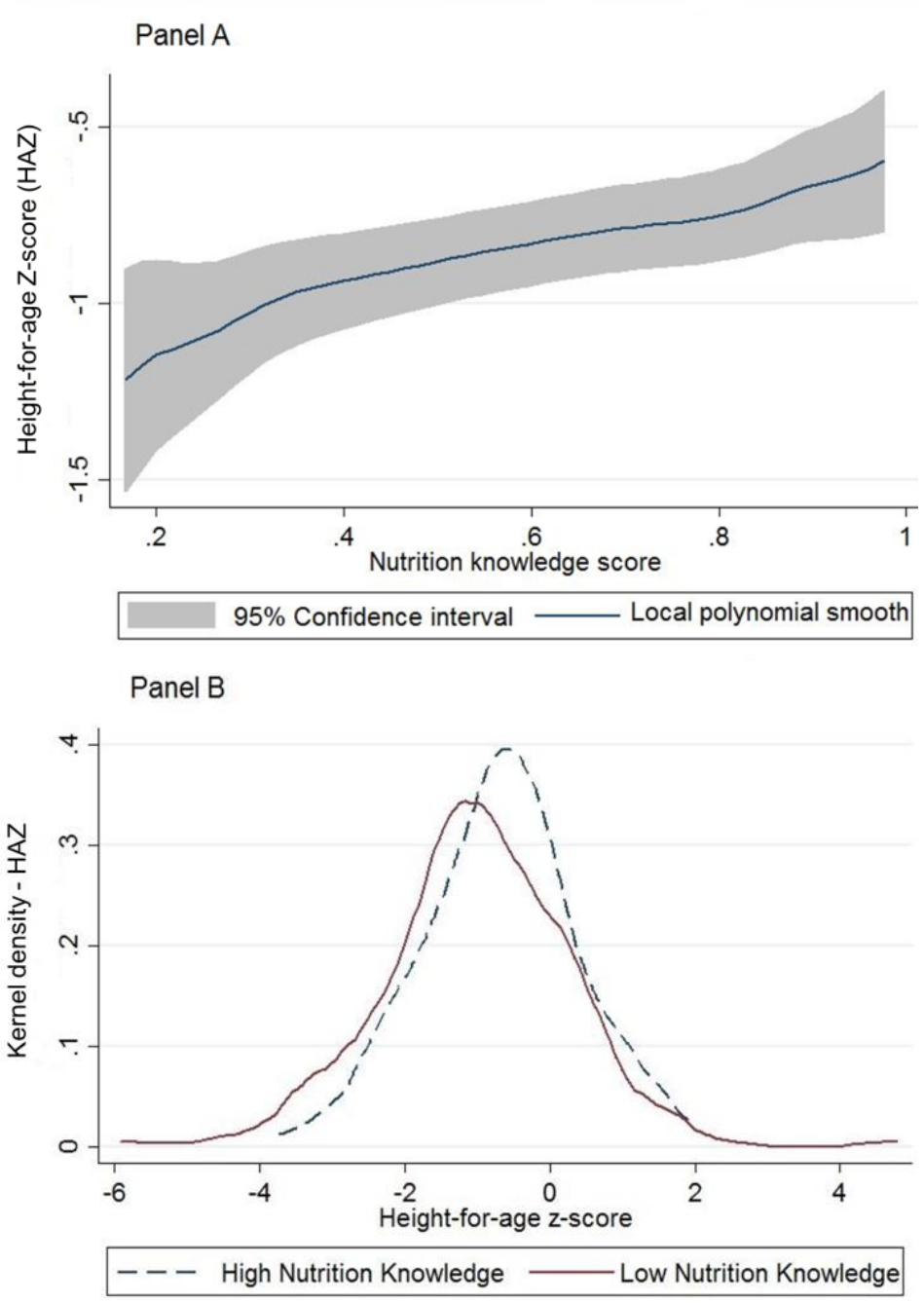

Figure 4.1. Relationship between maternal nutrition knowledge and child HAZ. Panel (A) shows a local polynomial regression with N=426 observations of children and adolescents (aged 5-18). Panel (B) shows kernel density plots of child and adolescent HAZ in households with high maternal nutrition knowledge score (N=219) and in households with low maternal nutrition knowledge score (N=207).

4.3.3 Parametric Estimation Results

Table 4.4 shows estimation results of the HAZ models using the aggregate maternal nutrition knowledge score, next to a set of child and household level covariates as explanatory variables. Model (1A) does not control for maternal education and household consumption expenditures. The estimates show that maternal nutrition knowledge is positively and significantly associated with HAZ of children and adolescents ($p<0.01$). The estimation coefficient of 1.25 implies that an increase in the knowledge score from 0 to 1 would increase child HAZ by 1.25. This is an extreme interpretation, however, because most of the observed knowledge scores are in a narrower range. As shown in Table 4.2, the aggregate nutrition knowledge score has a mean value of 0.59 and a standard deviation of 0.13. Using the 1.25 estimate from model (1A), an increase in the knowledge score by one standard deviation is associated with a 0.16 increase in HAZ.

Model (1B) in Table 4.4 additionally controls for maternal education. Results show that education of the mother positively affects HAZ of children and adolescents. In line with previous research by Burchi (2010) for younger children, we find that maternal nutrition knowledge remains positive and significant ($p<0.01$), even after accounting for maternal education. The coefficient magnitude for nutrition knowledge declines somewhat, implying that maternal nutrition knowledge and maternal education are positively correlated, as one would expect. However, the results also clearly suggest that formal school education is not the only pathway through which nutrition knowledge is acquired.

Model (1C) in Table 4.4 excludes maternal education and controls for household consumption expenditures instead. Consumption expenditures have a significantly positive effect on HAZ of children and adolescents, as one would expect. At the same time, the coefficient for maternal nutrition knowledge shrinks, but remains positive and statistically significant ($p<0.05$). This suggests that maternal nutrition knowledge plays an important role for child nutritional outcomes, even after controlling for household living standard.[15]

[15] This result of a strong positive association between maternal nutrition knowledge and HAZ of children and adolescents also holds when we use alternative indicators of nutrition knowledge. In Table A4.1 in the Appendix A4, we show results where we used the total number of correct answers to the nutrition questions instead of the standardized aggregate knowledge score.

Table 4.4. Association between aggregate maternal nutrition knowledge and child HAZ

	Model (1A)	Model (1B)	Model (1C)	Model (1D)
Aggregate nutrition knowledge score	1.25***	1.01***	0.90**	0.85**
	(0.35)	(0.36)	(0.35)	(0.35)
Age of child in months	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Sex of child(1=female)	0.15	0.16	0.17	0.17
	(0.11)	(0.11)	(0.11)	(0.11)
Infection during past month(1/0)	-0.39**	-0.40**	-0.42**	-0.42**
	(0.20)	(0.19)	(0.18)	(0.18)
Sex of household head(1=female)	-0.08	-0.04	-0.04	-0.03
	(0.12)	(0.12)	(0.12)	(0.12)
Age of household head(years)	0.00	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Height of mother(cm)	0.05***	0.05***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)
Year dummy(1=2015)	0.33***	0.35***	0.35***	0.35***
	(0.11)	(0.11)	(0.11)	(0.11)
Education of mother (years)		0.03**		0.01
		(0.01)		(0.02)
Consumption expenditures (log)			0.46***	0.43***
			(0.11)	(0.12)
Town dummies	Yes	Yes	Yes	Yes
Constant	-8.47***	-8.61***	-12.11***	-11.88***
	(1.72)	(1.72)	(1.79)	(1.89)
R-squared	0.18	0.20	0.23	0.23
Number of obs.	426	426	426	426

Notes: Coefficient estimates are shown with standard errors in parentheses. The dependent variable in all models is height-for-age Z-scores (HAZ) of children and adolescents (aged 5-18). * $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$.

In Model (1D) of Table 4.4 we control for both maternal education and consumption expenditures. Once consumption expenditures are controlled for, mother's education no longer affects HAZ of children and adolescents. This is due to the close correlation between maternal education and household consumption expenditures. As maternal education is an important determinant of household income, and income determines consumption expenditures, this close correlation between the variables should not surprise. The coefficient of the maternal nutrition knowledge score remains significant also in this model specification.

The coefficient estimates of the other control variables in Table 4.4 also reveal some interesting patterns. The age of the child is negatively associated with HAZ ($p<0.01$), which underlines the importance of including older children and adolescents in the analysis. Children who suffered from an infectious disease during the month prior to the survey have significantly lower HAZ ($p<0.05$). In children, infectious diseases often have immediate implications for body weight, which is not reflected in HAZ. However, the infectious disease dummy is probably also a proxy of health and sanitation conditions in the household more generally, so that the negative association with HAZ is not surprising. The positive and significant association between the mother's height and the child's HAZ ($p<0.01$) is also as expected. Finally, the year dummy indicates that the nutritional status of children and adolescents generally improved between 2012 and 2015.

Table 4.5 shows estimation results of the HAZ models with the disaggregated nutrition knowledge scores (for the three knowledge categories) as explanatory variables. Model (2) reveals that maternal knowledge about food ingredients is associated with a higher HAZ of children and adolescents, even though the association is relatively weak ($p<0.10$). Model (3) suggests that maternal knowledge about dietary recommendations has no significant association with HAZ of children and adolescents.

The largest and strongest positive association with HAZ is found for maternal knowledge about the health consequences of not following dietary recommendations. Given that the observed standard deviation for the knowledge score on health consequences is 0.27 (Table 4.2), the coefficient estimate of 0.54 in model (4A) implies that an increase in knowledge of this type by one standard deviation is associated with a 0.15 increase in child HAZ. This association remains weakly significant ($p<0.1$) also after controlling for maternal education and household consumption expenditures.

An important implication of comparing coefficients for the different types of knowledge in Table 4.5 is that knowledge about the negative health consequences of not following dietary recommendations seems to play a more important role than knowledge about the dietary recommendations as such.

Table 4.5. Association between different types of maternal nutrition knowledge and child HAZ

	Model (2)		Model (3)		Model (4)	
	(2A)	(2B)	(3A)	(3B)	(4A)	(4B)
Knowledge about food ingredients	0.41* (0.22)	0.32 (0.22)				
Knowledge about dietary recommendations			0.42 (0.35)	0.17 (0.34)		
Knowledge about health consequences					0.54*** (0.20)	0.35* (0.20)
Age of child in months	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
Sex of child (1=female)	0.17 (0.11)	0.19* (0.11)	0.15 (0.11)	0.18* (0.11)	0.15 (0.11)	0.18* (0.11)
Infection during past month (1/0)	-0.34* (0.20)	-0.39** (0.18)	-0.34* (0.19)	-0.39** (0.18)	-0.38* (0.20)	-0.41** (0.19)
Sex of household head (1=female)	-0.11 (0.12)	-0.04 (0.12)	-0.13 (0.12)	-0.05 (0.12)	-0.09 (0.12)	-0.03 (0.12)
Age of household head (years)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Height of mother (cm)	0.05*** (0.01)	0.04*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	0.05*** (0.01)	0.04*** (0.01)
Year dummy (1=2015)	0.37*** (0.11)	0.38*** (0.11)	0.38*** (0.11)	0.38*** (0.11)	0.27** (0.11)	0.31*** (0.11)
Education of mother (schooling years)		0.01 (0.02)		0.02 (0.02)		0.01 (0.02)
Consumption expenditures (log)		0.45*** (0.12)		0.44*** (0.12)		0.43*** (0.12)
Town dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-7.91*** (1.72)	-11.73*** (1.89)	-7.97*** (1.73)	-11.65*** (1.90)	-8.21*** (1.73)	-11.76*** (1.89)
R-squared	0.17	0.22	0.17	0.22	0.18	0.22
Number of observations	426	426	426	426	426	426

Notes: Coefficient estimates are shown with standard errors in parentheses. The dependent variable in all models is height-for-age Z-scores (HAZ) of children and adolescents (aged 5-18). * $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$.

4.3.4 Robustness Checks

In the descriptive analysis and for some of the non-parametric estimations, we subdivided the sample into households with high and low maternal nutrition knowledge, using the average aggregate nutrition score as the cutoff point. This cutoff was chosen for convenience. To check whether the results change when using a different cutoff, we classified those that correctly responded to more (less) than 50% of the nutrition questions as having high (low) nutrition knowledge. The results do not change much (see Table A4.2 and Figure A4.1, Appendix A4), underlining the robustness of the findings to changes in the cutoff point.

Another aspect that is worth some further analysis is the fact that our sample is characterized by a high attrition rate. Many children that were included in the first survey round could not be included again in the second round and were replaced by other children in the same locations. In order to check whether there is any systematic difference between the children that were included in both survey rounds and those that were only included in one of the rounds, we regressed an attrition dummy on the set of socioeconomic explanatory variables, using a probit specification (see Table A4.3, Appendix A4). Most of the socioeconomic variables are statically insignificant in this probit model, except for height and education of the mother. We do not find systematic differences for the child's own characteristics. The probit model was also used to calculate an inverse mills ratio that we included as an additional explanatory variable in model (1) to explain HAZ. This is a common approach to test and control for possible attrition bias. The inverse mills ratio in this HAZ model is statistically insignificant (see Table A4.3), so we conclude that our results are not affected by attrition bias.

4.3.5 Limitations

Two limitations of the study should be mentioned here. First, while international growth standards exist for infants and preschool children (WHO, 2006b), for children above 5 years of age the available growth references still have certain shortcomings (de Onis, 2007). Although the references for school-age children and adolescents were reconstructed recently [16], an international growth standard for this age group, designed with multi-ethnic sampling strategies, does not exist. This means that levels of optimal growth for children between 5-19 years cannot be derived

[16] The reconstructed growth references for children between 5-19 years make use of the 1977 NCHS/WHO growth reference (Hamill et al., 1977) supplemented with data from the WHO child growth standards (WHO, 2006b) and apply the state-of-the-art statistical methods (de Onis, 2007).

very accurately (Butte et al., 2007; Wells, 2014). We do not expect that this inaccuracy would affect the general relationship between maternal nutrition knowledge and child growth.

Second, the number of survey questions for each of the nutrition knowledge categories in our study was not equally distributed. In the calculation of the aggregate knowledge score, we took this into account by first calculating a score for each category separately before constructing the composite knowledge indicator. This ensures that none of the categories is under- or over-represented in the aggregate score. Nevertheless, more questions in some of the categories could have further added to our understanding of the role of different types of nutrition knowledge. In future research, it would be particularly interesting to increase the number and the variety of questions related to dietary recommendations and to the health consequences of not following such recommendations.

4.4 Discussion

It has long been established that raising awareness of balanced nutrition and nutrition-related health issues is one important avenue of reducing child undernutrition in developing countries. However, the extent to which different types of nutrition knowledge affect child nutritional outcomes is not yet sufficiently understood. We have contributed to this research direction by using survey data from Central Kenya. Results show that maternal nutrition knowledge is positively and significantly associated with HAZ of children and adolescents. This positive association is consistent with previous findings using data from younger children (e.g. Christiaensen and Alderman, 2004; Variyam et al., 1999; Webb and Block, 2004).

In addition, we have analyzed the role of different types of nutrition knowledge, which has rarely been done in previous studies. Indeed, our results differ by knowledge type. Maternal knowledge about food ingredients only has a weak positive association with HAZ of children and adolescents. For maternal knowledge about specific dietary recommendations, no significant association was detected. The strongest positive association with HAZ was found for maternal knowledge about the health consequences of not following recommended dietary practices.

These findings imply that building broader awareness of the health risks of unsuitable dietary practices among mothers and caretakers is important for improving nutrition and health of children and adolescents. Put differently, knowledge about adverse health consequences seems to be more effective in shaping dietary behavioral responses than knowledge about food ingredients

and dietary recommendations per se. Of course, nutrition education programs will always have to take into account the concrete nutritional needs and challenges in a particular setting. But our conclusion that effective nutrition education and training programs should always link dietary recommendations to concrete health consequences probably holds beyond the concrete setting.

4.5 Appendix A4

Table A4. 1. Association between maternal nutrition knowledge and child HAZ (alternative knowledge indicator)

	Height-for-age Z-score	
	Model (A4.1-1)	Model (A4.1-2)
Maternal knowledge (number of correct answers)	0.04*** (0.02)	0.03** (0.02)
Age of child in months	-0.01*** (0.00)	-0.01*** (0.00)
Sex of child (1=female)	0.16 (0.11)	0.19* (0.11)
Infection during past month (1/0)	-0.35* (0.20)	-0.40** (0.18)
Sex of household head (1=female)	-0.09 (0.12)	-0.05 (0.12)
Age of household head (years)	0.00 (0.01)	0.01 (0.01)
Height of mother (cm)	0.05*** (0.01)	0.04*** (0.01)
Year dummy (1=2015)	0.40*** (0.11)	0.40*** (0.11)
Consumption expenditure (log)		0.48*** (0.11)
Town dummies	Yes	Yes
Constant	-8.15*** (1.72)	-12.06*** (1.78)
R-squared	0.18	0.22
Number of observations	426	426

Notes: Coefficient estimates are shown with standard errors in parentheses. The dependent variable in all models is height-for-age Z-scores (HAZ) of children and adolescents (aged 5-18). * $P<0.1$; ** $P<0.05$; *** $P<0.01$.

Table A4.2. Descriptive statistics by maternal nutrition knowledge (alternative cutoff point for high and low nutrition knowledge)

Variables	All	By maternal nutrition knowledge [a]		
		High nutrition knowledge	Low nutrition knowledge	Difference
HAZ	-0.85 (1.20)	-0.61 (0.98)	-0.92 (1.26)	0.31**
HAZ, boys	-0.92 (1.22)	-0.52 (0.91)	-1.05 (1.29)	0.53***
HAZ, girls	-0.78 (1.26)	-0.71 (1.04)	-0.80 (1.23)	0.09
Prevalence of stunting [b]	0.16	0.09	0.18	-0.08**
Prevalence of mild stunting [b]	0.43	0.32	0.46	-0.14**
Prevalence of extreme stunting [b]	0.04	0.00	0.06	-0.06**
Number of observations	426	106	320	

Notes: Mean values are shown with standard deviations in parentheses. [a] Using the total number correct answers to nutrition knowledge questions, households were subdivided into those who correctly answered more than 50% of the questions (high nutrition knowledge) and those who correctly answered less than 50% of the questions (low nutrition knowledge). [b] Stunting is defined as HAZ<-2; mild stunting as HAZ<-1; extreme stunting as HAZ<-3. * $P<0.1$; ** $P<0.05$; *** $P<0.01$.

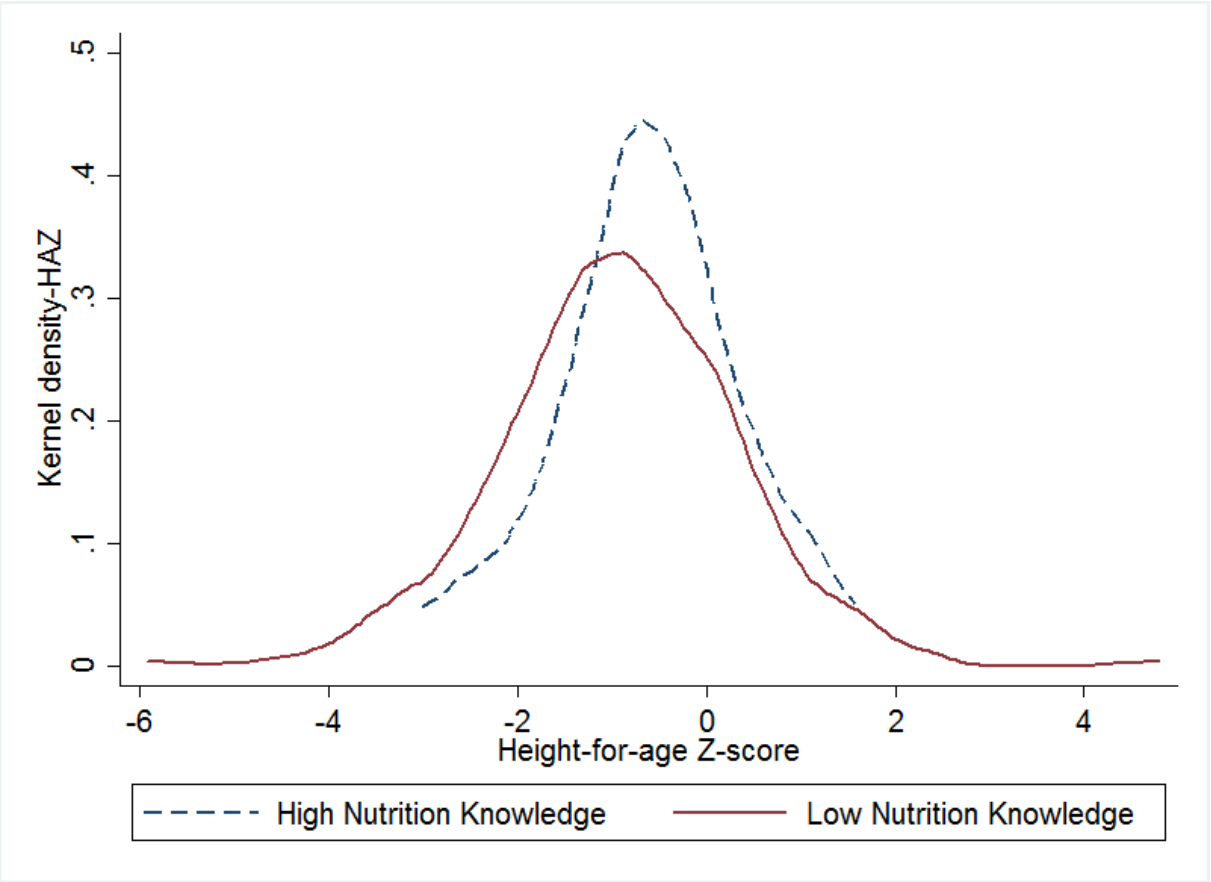

Figure A4.1. Kernel density of HAZ by alternative definition of nutrition knowledge threshold. Households with high nutrition knowledge score (N=106) correctly answered more than 50% of the questions; those with low nutrition knowledge score (N=320) correctly answered less than 50% of the questions.

Table A4.3. Attrition probit model and HAZ regression after controlling for possible attrition bias

	Attrition probit [a]	HAZ [b]
Aggregate nutrition knowledge score		0.88** (0.35)
Age in months	0.00 (0.00)	-0.01*** (0.00)
Sex of child(1=Female)	0.08 (0.13)	0.16 (0.12)
Infection during past month(1/0)	-0.02 (0.24)	-0.41** (0.18)
Sex of household head(1=Female)	0.16 (0.14)	-0.06 (0.13)
Age of household head(years)	0.00 (0.01)	0.01 (0.01)
Height of mother(cm)	-0.02* (0.01)	0.05*** (0.01)
Year dummy(1=2015)	0.13 (0.13)	0.33*** (0.12)
Ol Kalou (town with SM since 2004)	0.05 (0.16)	0.19 (0.12)
Mwea (town with SM since 2011)	-0.05 (0.17)	0.03 (0.14)
Education of mother (schooling years) [c]	0.04** (0.02)	
Consumption expenditure (log)	0.12 (0.13)	0.43*** (0.16)
Inverse mills ratio [d]		-0.28 (0.87)
Town dummies	Yes	Yes
Constant	2.03 (2.11)	-12.09*** (1.93)
Chi2	14.84	
P-value	0.19	0.00
R-squared		0.23
Number of observations	426	426

Notes: Coefficient estimates are shown with robust standard errors in parentheses. [a] The dependent variable is 1 if the child was excluded or newly included in the second round, and 0 if the child was included in both survey rounds. [b] The dependent variable is height-for-age Z-scores (HAZ) of children and adolescents (aged 5-18). Coefficient estimates are shown with bootstrapped standard errors (400 replications) in parentheses. [c] Maternal education in the HAZ model had to be dropped because of multicollinearity problems. [d] The inverse mills ratio was calculated based on predictions from the attrition probit. * $P<0.1$; ** $P<0.05$; *** $P<0.01$.

5 General Conclusion

5.1 Main Findings

In Kenya, as in many developing countries, dietary choices are shifting from traditional foods towards energy dense and highly processed foods. This nutrition transition does not only provoke a dietary shift but also a transformation in health outcomes. Kenyan official national statistics report an increase in the share of men and women being overweight or obese between 1998 and 2014 by approximately 5 and 12 percentage points, respectively (NCD Risk Factor Collaboration, 2016). At the same time, the share of children under five being stunted in Kenya remained almost unchanged within the last 20 years (IFPRI, 2016). Besides contributing to morbidity and mortality, this double burden of malnutrition places a substantial economic constraint on the country and makes Kenya an extreme example of a country in transition. It is therefore of immense importance to understand different influencing factors to fight malnutrition in all its forms.

The spread of supermarkets was identified as one potential driving force for the nutrition transition in many developing countries. Through modern retails, a broad variety of food products and brands with different degrees of processing are available and promoted in strategic ways. Literature examples are limited to the nexus between supermarket shopping and dietary choices, as well as between supermarket shopping and nutritional outcomes. The few examples that exist are all based on cross-sectional data and show conflicting results. With this dissertation, we have contributed to the existing and respective literature in two respects. First, we have broadened the analysis of linkages between supermarket shopping and nutritional outcomes towards health (see Chapter 2). In detail, we have analyzed effects of supermarket shopping on BMI, overweight/obesity, as well as on fasting blood glucose, pre-diabetes, systolic blood pressure, diastolic blood pressure, pre-hypertension, and the metabolic syndrome. Based on a cross-sectional data set from 2015 and by using an IV approach, we show that supermarket purchase increases adult's BMI and the probability of being overweight/obese. Supermarket purchase is also associated with 0.3 mmol/L higher levels of fasting blood glucose and a higher likelihood of suffering from pre-diabetes and the metabolic syndrome, by 16 percentage points and 7 percentage points, respectively. Effects on blood pressure could not be detected.

Second, with the use of panel data and fixed effects regression models (Chapter 3), we have established robust causality between supermarket use, nutritional outcomes, and dietary choices. The nutritional outcomes we looked at are BMI and being overweight/obese. As dietary choices, we have used the share of energy from highly processed foods and energy consumption of unprocessed staples, fruits/vegetables, meats/fish, dairy/eggs, and vegetable oils. This approach is unique as the linkages have never been analyzed with a panel data set before. Our findings showed that supermarket shopping increased the BMI of individuals by 0.64 kg/m² and the share of energy from highly processed foods by 3.1 percentage points. Further, supermarket shopping lowered the energy consumption of unprocessed staples by 112 kcal/AE/day, of fresh fruits and vegetables by 124 kcal/AE/day, and increased the consumption of meats and fish by 24 kcal/AE/day, of dairy and eggs by 9 kcal/AE/day, and of vegetable oils by 60 kcal/AE/day. Since we did not find significant effects of supermarket shopping on total energy consumption, the increasing effects on BMI were probably driven by changes in the dietary compositions, with medium and highly processed foods gaining in relative importance.

Nutritional knowledge and education are key factors in establishing a healthy nutrition environment. It is widely known that especially maternal nutrition knowledge plays a major role for the nutritional outcomes of children. Many examples from developing countries show that especially for children under-five the mother's nutritional knowledge is an important factor for their nutritional outcomes. Only a few studies identify positive links between maternal nutrition knowledge and child nutrition for older children, and this evidence is limited to developed countries. With our third essay (see Chapter 4) we have contributed to this gap in the literature by using a panel data set from 2012 and 2015 from urban Kenya to analyze the associations between maternal nutrition knowledge and height-for-age Z-scores of children between 5 and 18 years. We find that the aggregated maternal nutrition knowledge score is positively associated with child HAZ (+ 1.25). Further, we have used different types of maternal nutrition knowledge in our analysis in order to understand dissimilar results in children and adolescents nutritional outcomes. We have subdivided the maternal knowledge into three categories: (a) knowledge about food ingredients, (b) knowledge about specific dietary recommendations, and (c) knowledge about the health consequences of not following recommended dietary practices. We find that maternal nutrition knowledge about health consequences of not following dietary recommendations has the largest and strongest positive association with HAZ (+ 0.54).

Overall, and valid for all essays in Chapters 2, 3 and 4, we are adding empirical findings from an African country, where so far only little evidence in the respective research questions is available.

5.2 Policy Implications

In Chapters 2 and 3 we have shown that the rapid spread of supermarkets has direct effects on nutrition and health and contributes to the nutrition transition in Kenya. Since many other factors are also driving these nutritional and dietary outcomes we consider supermarket shopping as an important external factor in the overall discussion about dietary choices, nutrition and health. For policy makers it will be of immense importance to understand these linkages in order to be able to intervene properly. Intervening in this sense does not imply banning supermarkets. We like to avoid the view that supermarkets should be seen as something negative, as they may have clear positive effects for public health and development. Compared to traditional food markets in developing countries, supermarket supply chains are often more efficient, which can make food more accessible for poor population segments and increase food security (Kimenju et al., 2015; Qaim, 2017; Timmer, 2009). The levels of food quality and food safety may also be higher in supermarkets than in traditional markets (Mergenthaler et al., 2009; Minot et al., 2015). Further, studies show that farmers in developing countries could benefit from participating in newly emerging supermarket supply chains (Chege et al., 2015; T Reardon et al., 2012).

However, our results demonstrated that the influence of supermarkets on consumers in small urban centers in Kenya could also be challenging in terms of ‘unhealthier’ food choices and higher levels of BMI and NR-NCDs. Therefore, certain types of regulations and economic incentives may be appropriate in some situations. It will be important for policymakers to strengthen the positive aspects of supermarket growth, while reducing negative implications to the extent possible. A critical aspect will be to create food environments that allow and instigate consumers to make more healthy food choices (Minos et al., 2016). This may require broader awareness building and education towards healthy nutrition, as well as appropriate regulations. Examples from high-income countries show that the access to supermarkets is associated with healthier diets and greater access to fresh products (Drewnowski et al., 2012; Laraia et al., 2004; Morland et al., 2006). In our Kenyan example, and also in other developing countries, outside of the big cities, supermarkets often only sell processed foods, because the offer of fresh fruits and vegetables does not seem to be profitable yet. Requiring supermarkets to offer more fresh fruits

and vegetables, and to position such a fresh produce section in a key place within the store, could be one possible route of tightened regulation. Besides fresh products also other measures to promote healthy diets and nutrition-sensitive food environments, like food products lower in sugar, salt and fat are worth considering. Policy interventions should help to improve people's diets and prevent overweight and obesity without discouraging modernization processes in the food and retail sector.

In Chapter 4 we showed that maternal nutrition knowledge, especially the type of knowledge about health consequences of not following recommended dietary practices, positively influenced child and adolescent nutritional outcomes. Hence, we imply that building broader awareness of the health risks of unsuitable dietary practices among mothers and caretakers plays an important role for improving nutrition and health of children and adolescents. Or seen from another angle, nutritional knowledge about adverse health consequences seems to be more effective in causing dietary behavioral responses than knowledge about food ingredients and dietary recommendations per se. Of course, nutrition education programs will always have to take into account the respective nutritional needs and challenges in a particular setting. But our conclusion, that effective nutrition education and training programs should always link dietary recommendations to precise health consequences holds beyond this specific setting.

5.3 Limitations

A few limitations of the study shall be summarized here. First, we could show significant effects of supermarket shopping on nutritional outcomes in the cross-sectional data and in the panel data set. For the health outcomes, neither panel data nor repeated measurements were available. Repeated collection of comprehensive data for all health outcomes through additional survey rounds or repeated measurements would help to further test the robustness of the estimation results. Further, having additional measurements on different health outcomes would increase the available factors to build other and more robust health indicators like the metabolic syndrome, which is normally based on five instead of three indicators. Second, besides having a clear methodological advantage by using panel data, one also needs to consider the challenges that arise from repeated data collection. The attrition rate that we were facing in our study is rather high. While we tested this bias to the extent possible, balanced panel data sets for longer time periods and with a larger number of observations would be beneficial in this regard. Third, while

we found positive associations between different types of maternal nutrition knowledge and child/adolescent nutritional outcomes, we are aware that the distribution of questions to build the different knowledge score was not equal. We took this into account in the calculation of the aggregated knowledge score. Nevertheless, more questions in some of the categories could have been added to the understanding of the role of different types of nutrition knowledge. In future research, it would be particularly interesting to increase the number and the variety of questions related to dietary recommendations and to the health consequences of not following such recommendations. Fourth, survey data always suffer a certain amount of imprecision. While self-reported (dietary) data face the problems of under- and over estimation, measurement errors in anthropometry are easy to influence the entire outcome of nutritional assessments. Mis-estimations and mis-measurements happen in all social settings and locations, and regardless of the individual body size. We tried to account for these challenges by well-trained enumerators, constant refresher on measurement accuracy, a precise data cleaning and management. Besides these general shortcomings of dietary assessments and anthropometric measurements, we are aware that a 30-day food consumption recall at household level has its limitations in terms of explanatory power for the individual (Deaton and Zaidi, 2002). This relatively long recall period was chosen as some of the more durable food items are only purchased once a month. However, a higher precision of dietary assessment at individual level could be obtained by combining different assessment methods like several non-consecutive 24-hour dietary recalls or methods on bio-maker levels (Shim et al., 2014). Fifth, all our essays were based on the same three towns which are typical for medium-sized urban municipalities in Central Kenya. In comparing the survey characteristics of our study to national statistics we observe that there are similarities especially for the Central Region. However, the amount of towns included in our study is small and our sample is not representative for the country as a whole, which mitigates the external validity of our estimations.

Besides given examples here, one should not forget that dietary choices, nutrition and health are highly interlinked and influenced by many different internal and external factors. Supermarket shopping and maternal nutritional knowledge are only two components in a large set of a comprehensive connection. Of course other factors, like overall health behavior, physical activity, education, media and policy regulations need to be discussed and considered as well in order to fight malnutrition in all its forms.

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General Appendix

Maps of the Study Sites in Central Kenya

Household Survey 2015

Figure A.1. Map of Ol Kalou in Nyandarua County. Created with QGIS **(2015)** based on data provided by OpenStreetMap Contributors **(2015)** and Bing Aerial **(2015)**.

Figure A.2. Map of Njabini in Nyandarua County. Created with QGIS **(2015)** based on data provided by OpenStreetMap Contributors **(2015)** and Bing Aerial **(2015)**.

Figure A.3. Map of Mwea in Kirinyaga County. Created with QGIS **(2015)** based on data provided by OpenStreetMap Contributors **(2015)** and Bing Aerial **(2015)**.

Household Survey 2015

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

UON University of Nairobi

KENYA HOUSEHOLD CONSUMPTION SURVEY 2015

BEFORE STARTING THE INTERVIEW GET YOUR ORIGINAL SURVEY DATA READY AND MATCH WITH THE GIVEN INFORMATION OF THE RESPONDENTS

Explain the households who you are looking for, and that it is important to find exactly the same household that was interviewed in 2012. If you cannot find the original household a replacement household will be necessary, before taking a household as replacement contact **your supervisor** first!

(1.02) HOUSEHOLD ID		
TOWN	ESTATE	NUMBER FROM LISTING

(1.02a) Was this household included in the previous survey?	
YES ► (1.03)	1
NO	2

(1.01) FOR HOW LONG IS HOUSEHOLD RESIDING IN THIS TOWN?	
YEARS	MONTHS

IF < 6 MONTHS, REPLACE HH AND ► (1.22)

Match name of household head with original survey. If household head changed write down new household head, but do not change the order of the household members on FLAP

(1.03) NAME OF HOUSEHOLD HEAD
REPORT 1st, 2nd AND 3rd NAME
FULL NAME

(1.04) ADDRESS
(1.04)a SUBLOCATION:
(1.04)b ESTATE: (NAME)
(1.04)c FEATURES THAT HELP FINDING HOUSEHOLD AGAIN

(1.05) INTERVIEWER	ID
NAME	

(1.06)	
INTERVIEW COMPLETED	1
PARTLY COMPLETED (GIVE REASONS)	2
COMPLETION	

VISIT 1 (ONE DAY)

(1.07) a			(1.07) b		(1.07) c		(1.07) d
DAY	MONTH	YEAR	TIME STARTED		TIME ENDED		TOTAL BREAKS
			HOURS	MINUTES	HOURS	MINUTES	MINUTES

VISIT 2 (ONE DAY)

(1.08) a			(1.08) b		(1.08) c		(1.08) d
DAY	MONTH	YEAR	TIME STARTED		TIME ENDED		TOTAL BREAKS
			HOURS	MINUTES	HOURS	MINUTES	MINUTES

VISIT 3 (ONE DAY)

(1.09) a			(1.09) b		(1.09) c		(1.09) d
DAY	MONTH	YEAR	TIME STARTED		TIME ENDED		TOTAL BREAKS
			HOURS	MINUTES	HOURS	MINUTES	MINUTES

(1.10) NUMBER OF QUESTIONNAIRES USED FOR THIS HOUSEHOLD			
NUMBER		OF	

(1.11) MAIN LANGUAGE OF THE INTERVIEW	
ENGLISH	1
KISWAHILI	2
KIKUYU	3

(1.12) TOWN OF SURVEY	
OL KALOU	1
NJABINI	2
MWEA	3

(1.13) SUPERVISOR	►	SUPERVISOR CHECKED (1.14)	DAY	MONTH	YEAR
SIGNATURE					

(1.15) DATA ENTRANT	ID	►	SUPERVISOR CHECKED (1.16)	DAY	MONTH	YEAR
SIGNATURE						

(1.18) GPS NUMBER	GPS COORDINATES OF DWELLING SAVE THE WAYPOINT IN THE GPS USING HHID	
	(1.19)	S
	(1.20)	E

(1.22) IS THIS HOUSEHOLD A REPLACEMENT?	
YES	1
NO	2 ► (1.25)

(1.24) ID OF REPLACED HOUSEHOLD		
TOWN	ESTATE	NUMBER FROM LISTING

(1.23) WHY WAS HOUSEHOLD REPLACED?			
HOUSE NOT FOUND	1	NO SUITABLE INTERVIEW PARTNER PRESENT	6
HOUSE NOT INHABITED	2	HH MOVED TO TOWN LATER < 6 MONTHS AGO	7
INTERVIEW WAS REFUSED	3	BUSINESS BUILDING	8
SECURITY PROBLEM	4	HH MOVED AWAY FROM DWELLING	9
ALL MEMBERS REFUSED MEASUREMENTS	5		
OTHER (SPECIFY)	96		

LAST YEAR:	
LAST MONTH:	EVENING

RESPONDENT ID 2012:

RESPONDENT ID 2015:

I would now like to ask some information about the people who lived here when we visited in 2012 and about the ones living currently in this household

Copy all names from your info sheet in the exact same order **before** you read out and check together with respondent if the members are still part of the household.

Include new members underneath the "old" ones that you copied from the original survey 2012.

ID CODE	(1.25) Could you please give me the names of all people currently living in this household?	(1.26) How old is [NAME]? IF BABY LESS THAN 1 YEAR ENTER ZERO. ESTIMATE FOR ELDERLY USING THEIR CHILDREN'S AGE OR AN EVENT. FOR CHILDREN <5 ASK FOR EXACT AGE IN YEARS AND MONTHS	(1.27) What is [NAME]'s gender? Male 1 Female 2	(1.27a) THIS QUESTION REFERS TO THE MEMBERS THAT ALREADY PARTICIPATED IN 2012 AND WERE LISTED BY THE ENUMERATOR. Was [NAME] part of the household last year? YES 1 ▶ (1.28) NO 2 CROSS OUT AND ▶ NEXT PERSON	(1.27b) Why is [NAME] no longer living in this household? Moved 1 Set up own household in same dwelling 2 Died 3 ▶ (1.27d)	(1.27c) When did [NAME] move out of this household? ▶ NEXT PERSON	(1.27d) When did [NAME] die? ▶ NEXT PERSON
		YEARS/MONTHS		CODE	CODE	MONTH YEAR	MONTH YEAR
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

RESPONDENT ID 2012:

RESPONDENT ID 2015:

SECTION 1: Household Composition (1/2)

ID CODE	(1.28) How is [NAME] related to the household head?	(1.29) ONLY ASK FOR AGE 5 AND HIGHER — What is the highest level of formal education [NAME] **completed**? IF NEVER BEEN TO SCHOOL ENTER 0 ► (1.31) IF CURRENTLY IN STANDARD 1 ENTER 97	(1.30) Is [NAME] currently enrolled in educational institute (incl vocational training and university)?	(1.31) During the **last year,** how many days was [NAME] **not** present in the household?	(1.32) During the **last month,** how many days was [NAME] **not** present in the household?	(1.33) Only ask for 10 years and older — What is [NAME]'s **main** profession?	(1.36) **ONLY ASK IF MAIN JOB IS NOT A STUDENT OR HOUSEWIFE**
	Head 1 Spouse 2 Co-wife 3 Son/daughter 4 Spouse of son/daughter 5 Grandchild 6 Brother/sister 7 Father/mother 8 Father/mother of spouse 9 Child of relative 10 Child of non-relative 11 Househelp 12 CROSS OUT AND ► NEXT PERSON Other relative 13 Other non-relative 14	Primary / Secondary / Tertiary Std. 1 1 — Form 1 10 — College 1 17 Std. 2 2 — Form 2 11 — College 2 18 Std. 3 3 — Form 3 12 — College 3 19 Std. 4 4 — Form 4 13 — University 1 20 Std. 5 5 — Form 5 14 — University 2 21 Std. 6 6 — Form 6 15 — University 3 22 Std. 7 7 — Vocational 16 — University 4 23 Std. 8 8 — University 5 and above 24 Vocational 9	Yes, 1 Day School Yes, 2 Boarding School No 3	ASK FOR APPROXIMATION INCLUDE TRAVELS, WORK, STUDIES, ETC. IF > 180 DAYS AND NOT HH-HEAD, CROSS OUT THIS PERSON AND ► NEXT PERSON DAYS ABSENT	DAYS ABSENT	USE OCCUPATION CODES UNDERNEATH IF NO PROFESSION CODE 97 ► (1.37) CODE	Did [NAME] contribute to covering household expenses **any time** during the **last 6 months**? Yes 1 No 2
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

OCCUPATION CODES

96 Other(specify)

1 Accountant
2 Agricultural trading (incl timber)
3 Banker
4 Bicycle repair
5 Blacksmith
6 Boda boda operator (bicycle)
7 Boda boda operator (motor)
8 Butcher
9 Carpentry
10 Casual worker-farm
11 Casual worker-non-farm
12 Cleaning Personnel
13 Clerical/secretarial
14 Clothes/shoes business (trading)
15 Cobbler
16 Cook
17 Doctor
18 Door-to-door salesman (eg insurances)
19 Driver
20 Electrician
21 Farmer (working on own farm)
22 Hair dresser / barber
23 Handicraft trader
24 Hawker (incl street and office)
25 Househelp
26 Housewife
27 Livestock trader
28 Making handicraft
29 Manegerial/higher office
30 Masonry
31 Midwife
32 Nurse
33 Painter
34 Photographer/video maker
35 Plumber
36 Posho miller operator
37 Retail shop/kiosk/shopkeeping
38 Student
39 Surveyor
40 Tailor
41 Teacher
42 Tour guide
43 Turn boy/Tout
44 Vehicle mechanic
45 Veterinary doctor
46 Waiter/ bartender
47 Watchman/security
48 Welder

SECTION 1: Household Composition (2/2)

ID CODE	(1.37) ONLY ASK FOR AGE 13 & OLDER What is [NAME]'s present marital status? Never married 1 ► (1.39) Married 2 Divorced/ Separated 3 ► (1.39) Widowed 4 ► (1.39) Other (specify) 96 ► (1.39)	(1.38) Spouse's ID code IF MULTIPLE WIVES ENTER ALL, SEPARATING USING "/" IF SPOUSE IS NOT ON THE FLAP CODE 98 ID CODE	(1.39) IF [NAME] CANNOT POSSIBLY HAVE FATHER/MOTHER WITHIN HH CODE 98 DON'T ASK IF HH ONLY CONSISTS OF A MARRIED COUPLE AND CHILD BELONGS TO ONE OF THEM, BUT CODE THEIR IDs. Who is [NAME]s father/ male care-giver? IF NOT ON THE FLAP CODE 98 ID CODE	(1.40) Who is [NAME]s mother/female caregiver? ID CODE	(1.41) What is [NAME]'s ethnicity? Embu 1 Indian 2 Kalenjin 3 Kamba 4 Kikuyu 5 Kisii 6 Luhya 7 Luo 8 Maasai 9 Meru 10 Somali 11 Half cast 12 Other (specify) 96	(1.42) What is [NAME]'s religon? Catholic 1 Protestant 2 Other christian 3 Muslim 4 Hindu 5 Tradition-alist 6 No religion 7 Other (specify) 96	(1.43) During the **last month**, how many times did [NAME] eat meals **within the household**? DEFINE MEALS NUMBER OF TIMES	(1.44) During the **last month**, how many times did [NAME] eat meals **outside the household**? NUMBER OF TIMES	(1.45) During the **last month**, how much **in total** was spend on **all food** (meals and snacks) as well as **drinks** that were prepared and [NAME] was consuming **outside the household**? KSh
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Respondent Selection

SELECTION OF HOUSEHOLD MEMBERS FOR ANTHROPOMETRIC and BIOMEDICAL MEASUREMENT
1. Check your information on 2012, who were the selected respondents in 2012 and note them down 2. For each case (Male, Female, child1/adolecents) check if they are still part of the household (1.27 a-d) and if they are willing to participate again 3. Explain and probe for consents to interview and to take the measurements of this household member later 4. If interviewing the former person is not possible, cross him/her out, report the reason and find a replacement within the household if possible-check if the replacement was not crossed out before (1.28) or (1.31) 5. For CHILD2 in best case mother is also underneath the SPs. If not make sure mother is available for the interviews to help answering the questions >If no CHILD2 can be found among the household, cross out completely
USE **DECLARATION FORM** ALL ADOLESCENTS AND ADULTS (OLDER THAN **14 YEARS OF AGE) SIGN FOR THEMSELVES** FOR CHILDREN **YOUNGER THAN 14 YEARS** OF AGE AND LET THE **LEGAL REPRESENTATIVE** SIGN
IF CONSENT IS GIVEN, LET THE SELECTED RESPONDENTS (LEGAL REPRESENTATIVES) **SIGN** AND PROCEED.

(1.50)		(1.51)		(1.52)		(1.53)	
ADULT MALES (AGE 19 AND OLDER)		**ADULT FEMALES** (AGE 19 AND OLDER)		**CHILDREN 1/ADOLESC.** (AGE 5-18)		**CHILDREN 2** (AGE 2-4)	
ID CODE	REASON FOR CROSS OUT:	ID CODE	REASON FOR CROSS OUT:	ID CODE	REASON FOR CROSS OUT:	ID CODE	REASON FOR CROSS OUT:

FOR CHILD **BELOW AGE OF 13**, **INTERVIEW CAREGIVER** FOR SECTIONS 13-17 ON BEHALF OF CHILD/ ADOLESCENT SP

FOR CHILDREN <5 IN MANY PARTS THE MOTHER IS NEEDED TO HELP OUT WITH ANSWERING QUESTIONS-CHECK BEFORE, IF SHE IS AVAILABLE, IF NOT CROSS-OUT

REASON FOR CROSS OUT:	
Will not be present in household	1
Child too young Age < 2 y	2
Refused	97
Does not qualify as household member within the scope of this study	97
Mother not present to help out	97
Other (specify)	96

RESPONDENT ID 2012:

RESPONDENT ID 2015:

SECTION 2: Food Consumption Within Household

READ OUT: IF YOU HOSTED A **BIG FUNCTION** DURING THE LAST MONTH (EG WEDDING, GRADUATION) PLEASE **DO NOT** INCLUDE THE ADDITIONAL FOOD CONSUMED DURING THAT EVENT. I WILL ALSO ASK YOU FOR THE VALUE OF FOOD YOU CONSUMED FROM PURCHASES DURING THE LAST MONTH. WITH THIS I DO NOT MEAN HOW MUCH FOOD YOU PURCHASED DURING THE LAST MONTH, BUT HOW MUCH THE FOOD YOUR HOUSEHOLD **ACTUALLY CONSUMED FROM PURCHASES** WAS WORTH.

(2.01)	
During **last month**, did your household consume any own produced food (fruits, vegetables, animal products eg meat, eggs, milk)?	Yes 1 ► PROBE FOR ALL PRODUCTS AND LIST ON FLAP
	No 2

	(2.02)		(2.03)		(2.04)		(2.05)	(2.06)						(2.07)		(2.08)	
	During **last month**, did you or others in your household consume any […] ?		How much of […] in total did your household consume during the **last month**?		How much of the […] that you consumed **last month** came from purchases?		How much did you spend on [THIS AMOUNT OF PURCH. ITEM]?	Where exactly did you purchase [THIS AMOUNT OF ITEM]? PROBE IF ALL PURCHASES CAME FROM ONE SOURCE.						During **last month**, how much […] was consumed that came from own production?		During **last month**, how much […] was consumed that came from gifts or ofther sources (e.g. in-kind payment, food aid program) ?	
	READ OUT: PLEASE **INCLUDE** FOOD THAT WAS EATEN TOGETHER BY ALL HOUSEHOLD MEMBERS BUT ALSO FOOD THAT WAS EATEN BY INDIVIDUAL HOUSEHOLD MEMBERS ALONE. PLEASE **INCLUDE** FOOD PREPARED AT HOME BUT EATEN OUTSIDE (EG LUNCHBOXES). DO **NOT INCLUDE** MEALS THAT WERE BOTH PREPARED AND EATEN OUTSIDE THE HOME (EG RESTAURANT VISITS).	Yes 1 / No ► NEXT ITEM 2	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	KSh	(2.06)a LARGE SUPERMARKET QUANTITY	(2.06)a UNIT (CODES AT THE RIGHT)	(2.06)b SMALL SUPERMARKET QUANTITY	(2.06)b UNIT (CODES AT THE RIGHT)	(2.06)c TRADITIONAL RETAIL QUANTITY	(2.06)c UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)
	CEREALS																
1	RICE WHITE																
2	RICE BROWN																
3	MAIZE GRAIN																
4	GREEN MAIZE																
5	MAIZE FLOUR																
6	MAIZE FLOUR WITH ADDED VITAMINS, MINERALS OR AMARANTH																
7	WHEAT FLOUR BROWN																
8	WHEAT FLOUR WHITE																
9	MILLET																
10	SORGHUM																
11	PORRIDGE MIX																
12	PORRIDGE MIX WITH ADDED VITAMINS, MINERALS, OR AMARANTH																
13	CORNFLAKES (EG WEETABIX, MAIZE AND WHEAT FLAKES)																
14	CHOCOLATE CORNFLAKES																
15	OATS																
16	BREAD WHITE																
17	BREAD BROWN																
18	WHEAT BUNS/SCONES WHITE																
19	WHEAT BUNS/SCONES BROWN																
20	PASTA (EG SPAGHETTI, MACARONI)																
21	OTHER CEREALS (SPECIFY)																
	ROOTS AND TUBERS																
22	POTATOES (IRISH)																

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILLILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
25 KG BAG	B25
50 KG BAG	B50
90 KG BAG	B90
DEBE (18kg)	DB
TABLE SPOON	TAS
TEA SPOON	TS
COOKING SPOON	CS
PIECE/NUMBER	PI
GOROGORO	GO
1/4 KG TIN	T0.25
1/2 KG TIN	T0.5
1 KG TIN	T1
CUP 15	C15
OTHER (Specify)	96

		(2.02)	(2.03)		(2.04)		(2.05)	(2.06)						(2.07)		(2.08)	
		During **last month**, did you or others in your household consume any […] ?	How much of […] in total did your household consume during the **last month**?		How much of the […] that you consumed **last month** came from purchases?		How much did you spend on [THIS AMOUNT OF PURCH. ITEM]?	Where exactly did you purchase [THIS AMOUNT OF ITEM]? PROBE IF ALL PURCHASES CAME FROM ONE SOURCE.						During **last month**, how much […] was consumed that came from own production?		During **last month**, how much […] was consumed that came from gifts or ofther sources (eg in-kind payment, food aid program) ?	
		READ OUT: PLEASE **INCLUDE** FOOD THAT WAS EATEN TOGETHER BY ALL HOUSEHOLD MEMBERS BUT ALSO FOOD THAT WAS EATEN BY INDIVIDUAL HOUSEHOLD MEMBERS ALONE. PLEASE **INCLUDE** FOOD PREPARED AT HOME BUT EATEN OUTSIDE (EG LUNCHBOXES). DO **NOT INCLUDE** MEALS THAT WERE BOTH PREPARED AND EATEN OUTSIDE THE HOME (EG RESTAURANT VISITS).							(2.06)a LARGE SUPERMARKET		(2.06)b SMALL SUPERMARKET		(2.06)c TRADITIONAL RETAIL					
			Yes 1														
			No ▶ NEXT ITEM 2														
			QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	KSh	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)
23		SWEET POTATOES															
24		ARROW ROOTS															
25		CASSAVA TUBER, FLOUR															
26		YAMS															
27		COOKING BANANA															
28		OTHER ROOTS AND TUBERS (SPECIFY)															
		PULSES AND NUTS															
29		BEANS DRY															
30		BEANS FRESH															
31		BLACK BEANS (NJAHI)															
32		GREEN GRAMS															
33		PEAS (INCL COWPEA AND PIGEONPEA)															
34		LENTILS															
35		RAW NUTS (EG GROUNDNUT, CASHEW NUT) NON SALTED															
36		OTHER PULSES (SPECIFY)															
		VEGETABLES															
37		ONION															
38		GARLIC															
39		CABBAGES															
40		CARROTS															
41		TOMATOES															
42		SPINACH															
43		KALE-SUKUMA WIKI															
44		COWPEA LEAVES															
45		PUMPKIN LEAVES/ KAHURURA															
46		MANAGU/ OSUGA															
47		AMARANTH LEAVES															

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
25 KG BAG	B25
50 KG BAG	B50
90 KG BAG	B90
DEBE (18kg)	DB
TABLE SPOON	TAS
TEA SPOON	TS
COOKING SPOON	CS
PIECE/NUMBER	PI
GOROGORO	GO
1/4 KG TIN	T0.25
1/2 KG TIN	T0.5
1 KG TIN	T1
CUP 15	C15
OTHER (Specify)	96

	(2.02)		(2.03)		(2.04)		(2.05)	(2.06)						(2.07)		(2.08)	
	During **last month**, did you or others in your household consume any […] ? **READ OUT**: PLEASE **INCLUDE** FOOD THAT WAS EATEN TOGETHER BY ALL HOUSEHOLD MEMBERS BUT ALSO FOOD THAT WAS EATEN BY INDIVIDUAL HOUSEHOLD MEMBERS ALONE. PLEASE **INCLUDE** FOOD PREPARED AT HOME BUT EATEN OUTSIDE (EG LUNCHBOXES). DO **NOT INCLUDE** MEALS THAT WERE BOTH PREPARED AND EATEN OUTSIDE THE HOME (EG RESTAURANT VISITS).	Yes 1 / No ▶ NEXT ITEM 2	How much of […] in total did your household consume during the **last month**?		How much of the […] that you consumed **last month** came from purchases?		How much did you spend on [THIS AMOUNT OF PURCH. ITEM]?	Where exactly did you purchase [THIS AMOUNT OF ITEM]? PROBE IF ALL PURCHASES CAME FROM ONE SOURCE.						During **last month**, how much […] was consumed that came from own production?		During **last month**, how much […] was consumed that came from gifts or ofther sources (eg in-kind payment, food aid program) ?	
								(2.06)a LARGE SUPERMARKET		**(2.06)b** SMALL SUPERMARKET		**(2.06)c** TRADITIONAL RETAIL					
			QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	KSh	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)
48	GINGER																
49	CUCUMBER																
50	CAPSICUMS (PILIPILI HOHO)																
51	FRENCH BEANS																
52	COURGETTE																
53	PUMPKINS																
54	CORIANDER LEAVES (DANIA)																
169	STINGING NETTLE																
170	CELERY																
171	BEET ROOT																
172	EGGPLANT																
55	OTHER VEGETABLES (SPECIFY)																
	MEAT																
56	BEEF																
57	PORK																
58	MUTTON/GOAT MEAT																
59	FROZEN CHICKEN																
60	NON-FROZEN CHICKEN KIENYEJI																
61	OTHER NON-FROZEN CHICKEN																
62	OFFAL'S (EG LIVER, KIDNEY)-MATUMBO																
63	SAUSAGES (INCL SMOKIES; MINI BITES)																
64	FROZEN SAUSAGES																
65	BACON, HAM, SALAMI, BRAWN																
66	RABBIT																
67	SOYA MEAT																
68	OTHER MEAT (SPECIFY)																
	FISH																
69	FRESH FISH (NON TAKEAWAY)																
70	FROZEN FISH (NON TAKEAWAY)																
71	OMENA																
72	OTHER FISH (SPECIFY)																
	DAIRY PRODUCTS AND EGGS																
73	MILK WHOLE																
74	MILK LOW FAT/SKIMMED																
75	MILK FLAVOURED																

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
25 KG BAG	B25
50 KG BAG	B50
90 KG BAG	B90
DEBE (18kg)	DB
TABLE SPOON	TAS
TEA SPOON	TS
COOKING SPOON	CS
PIECE/NUMBER	PI
GOROGORO	GO
1/4 KG TIN	T0.25
1/2 KG TIN	T0.5
1 KG TIN	T1
CUP 15	C15
OTHER (Specify)	96

	(2.02)		(2.03)		(2.04)		(2.05)	(2.06)						(2.07)		(2.08)	
	During **last month**, did you or others in your household consume any […] ?		How much of […] in total did your household consume during the **last month**?		How much of the […] that you consumed **last month** came from purchases?		How much did you spend on [THIS AMOUNT OF PURCH. ITEM]?	Where exactly did you purchase [THIS AMOUNT OF ITEM]? PROBE IF ALL PURCHASES CAME FROM ONE SOURCE.						During **last month**, how much […] was consumed that came from own production?		During **last month**, how much […] was consumed that came from gifts or ofther sources (eg in-kind payment, food aid program) ?	
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76	MILK DRIED (POWDER)																
77	BABY MILK - TINNED																
78	MILK SOUR - MALA																
79	NATURAL YOGHURT																
80	FLAVOURED YOGHURT																
81	BUTTER																
82	EGGS																
83	OTHER DAIRY (INCL SOYA MILK, GHEE, SPECIFY)																
	FRUITS																
84	SWEET BANANA (SMALL)																
85	OTHER BANANA -RIPE																
86	ORANGES																
87	TANGERINE																
88	PAW PAW S																
89	AVOCADO																
90	MANGOES																
91	PINEAPPLES																
92	PASSION FRUITS/ (MELO)																
93	PEARS																
94	TAMARILLO/ TREE TOMATO																
95	APPLES																
96	LEMONS																
97	MELONS																
173	GUAVA																
174	STRRAWBERRY																
175	GRAPES																
177	MARLBERRY																
98	OTHER FRUITS (SPECIFY)																
	SUGAR																
99	SUGAR																
100	SUGAR WITH ADDED VITAMINS																
101	SUGAR CANE																
102	GLUCOSE POWDER																
103	OTHER SUGAR (INCL JAGGERY, SPECIFY)																

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
25 KG BAG	B25
50 KG BAG	B50
90 KG BAG	B90
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1/4 KG TIN	T0.25
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								(2.06)a LARGE SUPERMARKET		(2.06)b SMALL SUPERMARKET		(2.06)c TRADITIONAL RETAIL					
		Yes 1 / No ► NEXT ITEM 2	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	KSh	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)	QUANTITY	UNIT (CODES AT THE RIGHT)
	JAM, HONEY AND SWEETS																
104	JAM/MARMELADE																
105	HONEY																
106	PEANUT BUTTER																
107	CHOCOLATE BARS AND CHOCOLATE DROPS																
108	CAKES, COOKIES, BISCUITS																
109	ICE CREAM																
110	SWEETS																
111	OTHER SWEETS (SPECIFY)																
	NON-ALCOHOLIC BEVERAGES																
	FRUIT JUICES - ASK: "WHAT KIND OF FRUIT JUICES DID YOUR HOUSEHOLD CONSUME LAST MONTH?" PROBE FOR ANY OTHER.																
112	FRUIT JUICE WITHOUT ADDED SUGAR																
113	FRUIT JUICE WITH ADDED SUGAR																
114	FRUIT FLAVOURED DRINK (EG QUENCHER, PICANA, HIGHLANDS)																
115	DRINKING CHOCOLATE POWDER (INCL MILO, CHOCO PRIMO)																
116	SOYA DRINK POWDER																
117	COFFEE POWDER																
118	TEA LEAVES OR BAGS																
119	BOTTLED WATER																
120	HEALTH DRINK (EG LUCOZADE, RIBENA)																
121	ENERGY DRINK (EG RED BULLS, SHARK)																
122	COCA COLA, FANTA OR OTHER SODAS WITH SUGAR																
123	OTHER NON-ALCOHOLIC BEVERAGES (SPECIFY)																
	ALCOHOLIC BEVERAGES - PROBE FIRST IF ANY ALCOHOLIC BEVERAGES WERE CONSUMED IN HOUSEHOLD DURING LAST MONTH																
124	SPIRITS, LIQUOR AND WINE																
125	BEER (EG TUSKER, WHITE CAP)																
126	TRADITIONAL BREW (EG MURATINA, BUZAA, CHANG'AA)																

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
25 KG BAG	B25
50 KG BAG	B50
90 KG BAG	B90
DEBE (18kg)	DB
TABLE SPOON	TAS
TEA SPOON	TS
COOKING SPOON	CS
PIECE/NUMBER	PI
GOROGORO	GO
1/4 KG TIN	T0.25
1/2 KG TIN	T0.5
1 KG TIN	T1
CUP 15	C15
OTHER (Specify)	96

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								(2.06)a		(2.06)b		(2.06)c					
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127	OTHER ALCOHOLIC BEVERAGES (SPECIFY)																
	SPICES & MISCELLANEOUS																
128	SALT																
128a	SALT IODIZED																
129	KETCHUP, TOMATO SAUCE																
130	CHILI SAUCE																
131	STEW SPICE MIX, SOUP POWDER, ROICO,																
132	OTHER SPICES (SPECIFY)																
	COOKING OIL AND FATS - ASK: "WHAT COOKING FAT/ OIL DID YOU USE LAST MONTH?" PROBE FOR ANIMAL FAT AND ANY OTHER.																
133	MARGARINE BLUE BAND																
134	MARGARINE BLUE BAND LOW FAT																
135	MARGARINE YELLOW BAND																
136	MARGARINE BIDDY																
137	MARGARINE PRIME																
138	ANIMAL FAT																
139	VEGETABLE FAT																
140	VEGETABLE FAT, CHOL. FREE																
141	VEGETABLE OIL																
142	CORN OIL																
143	SUNFLOWER OIL																
144	PALM OIL																
145	PALM OIL, CHOL. FREE																
146	OLIVE OIL																
176	SOYA OIL																
147	OTHER COOKING OIL AND FAT (SPECIFY)																
	TINNED PRODUCTS/ PRODUCTS IN GLASS - PROBE FIRST IF ANY TINNED PRODUCTS/ PRODUCTS IN GLASS WERE CONSUMED DURING LAST MONTH																
148	VEGETABLES (EG BEANS, BABYCORN, PEAS) TINNED OR IN GLASS																
149	FRUIT TINNED OR IN GLASS																
150	SOUPS TINNED OR IN GLASS																
151	FISH TINNED OR IN GLASS																

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
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	(2.02)		(2.03)		(2.04)		(2.05)	(2.06)						(2.07)		(2.08)	
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152	OTHER PRODUCTS TINNED OR IN GLASS (SPECIFY)																
	OTHER (PARTIALLY) PREPARED FOOD																
153	CRISPS																
154	PUFFED SALTED CORN CHIPS																
155	SALTED NUTS (INCL SIMSIM)																
156	POPCORN																
157	INSTANT NOODLES (EG INDOMIE)																
158	OTHER PREPARED FOOD (SPECIFY)																
	TAKEAWAY FOOD - PROBE FIRST IF HOUSEHOLD CONSUMED ANY FOOD INSIDE THE HOUSE THAT WAS PREPARED OUTSIDE DURING LAST MONTH, INCL EG PRE-COOKED BEANS.																
159	BOILED GITHERI																
168	MUKIMO																
160	BOILED PULSES (EG BEANS, BLACK BEANS, GREEN GRAMS)																
161	PREPARED VEGETABLES (EG SUKUMA, CABBAGE)																
162	PREPARED MEAT (EG NYAMA CHOMA, FRIED SAUSAGES)																
163	DEEP FRIED FISH																
164	CHIPS																
165	CHAPATI																
166	MANDAZI																
167	SAMOSA																
168	OTHER TAKEAWAYS (SPECIFY)																

UNIT CODES	
KILOGRAMS	KG
GRAMS	GR
MILILITER	ML
LITER	L
5 KG BAG	B5
10 KG BAG	B10
25 KG BAG	B25
50 KG BAG	B50
90 KG BAG	B90
DEBE (18kg)	DB
TABLE SPOON	TAS
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COOKING SPOON	CS
PIECE/NUMBER	PI
GOROGORO	GO
1/4 KG TIN	T0.25
1/2 KG TIN	T0.5
1 KG TIN	T1
CUP 15	C15
OTHER (Specify)	96

CATERING FOR NON-HOUSEHOLD MEMBERS - REMIND HOUSEHOLD TO EXCLUDE BIG FUNCTIONS

(2.09)	During **last month**, did you cater for someone other than your household members for a **period of two weeks in total or more**? (eg household help, relative)	Yes 1 / No 2 ► (2.12)	(2.12)	During **last month,** how many times did you cater for **other non-household members** (eg having friends over for dinner)?	IF "0" ► NEXT SECTION
(2.10)	During **last month,** for how many non-household members did you cater for a **period of two weeks in total or more**?		(2.13)	During **last month,** for how many other non-household members did you usually cater **each time**?	
(2.11)	When you reported the **food consumed within your household during the last month,** did you include the food that you used for catering for [THESE NON-HOUSEHOLD MEMBERS]?	Yes 1 / No 2	(2.14)	When you reported the **food consumed within your household during the last month,** did you include the food that you used for catering for [THESE NON-HOUSEHOLD MEMBERS]?	Yes 1 / No 2

RESPONDENT ID 2012:

RESPONDENT ID 2015:

SECTION 3: Shopping Behaviour and Attitudes (1/3)

INTRODUCTION: DEFINE RETAIL OUTLETS

(3.01) During the **last month**, how many times did you buy **food and drinks** in [...] ?

READ OUT

IF NO FOOD BOUGHT IN THIS OUTLET, ENTER 0

(3.01)a	LARGE SUPERMARKET	____ times	
(3.01)b	SMALL SUPERMARKET	____ times	
(3.01)c	KIOSK/ SHOP	____ times	
(3.01)d	OTHER TRADITIONAL RETAIL	____ times	LAST MONTH

(3.02) Since you shop in [...], what are the most important reasons for you to shop there?

FOR EACH OUTLET ONLY IF (3.01) IS NOT ZERO

ALLOW UP TO THREE RESPONSES PER OUTLET

		1st	2nd	3rd
(3.02)a	LARGE SUPERMARKET			
(3.02)b	SMALL SUPERMARKET			
(3.02)c	KIOSK/ SHOP			

Lower prices 1	Proximity to work 9	Possibility to talk to the shop owner or staff 18
More **variety** of food products (e.g. flavour, brands) 2	Availability of large packaging sizes 10	Habit - I always used to shop there 19
Availability of more **kinds** of **food products** 3	Availability of small packaging sizes 11	Selfservice 20
Possibility to read labels 4	Social status/ prestige/ lifestyle 12	Personal service (by staff or owner) 21
It has everything that I need under one roof 5	Availability of more kinds of **non-food products** 13	Meeting people 22
Shopping athmosphere/ spacious 6	Higher perceived quality 14	I just need a small number of items 23
I happened to be in the neighbourhood/outlet was along my travel route 7	Higher perceived food safety 15	I know the shop owner or staff 24
Proximity to home 8	Get credit 16	Long opening hours 25
	Get discount 17	Other (specify) 96

(3.03) If you try **new food products**, how do you generally learn about them?

ALLOW UP TO THREE RESPONSES

1st ____ 2nd ____ 3rd ____

Rarely try new food-products 1	Other promotion 6	Friends 11
See it in large supermarkets 2	Special offer in large supermarket 7	Radio advertisement 12
See it in other stores 3	Special offer in other store 8	Medical adviser 13
TV advertisement 4	Relatives 9	Newspaper advertisement/ poster 14
Promotion in large supermarket 5	Neighbours 10	Other (specify) 96

SECTION 3: Shopping Behaviour and Attitudes (2/3)

	When you **actually buy a product**: How much do/does [...] influence your buying choice?	READ OUT FOR EACH FACTOR, TICK THE ONE THAT APPLIES			
		VERY MUCH	CONSIDER-ABLY	A LITTLE BIT	NOT AT ALL/ NEVER THOUGHT ABOUT IT
(3.04)a	PRICE	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)b	TASTE	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)c	ABILITY TO KEEP THE STOMACH FULL FOR A LONG PERIOD	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)d	HABITS	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)e	NUTRITIONAL VALUE OF A FOOD ITEM	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)f	PRODUCTS CONTRIBUTION TO A BALANCED DIET OF ALL FOOD PRODUCTS	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)g	FRESHNESS (EG MEAT,FRUITS,VEGETABLES)	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)h	ABILITY TO KEEP IN STORAGE (LONGEVITY)	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)i	THE FACT THAT THE FOOD IS EASY TO PREPARE	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)k	FOOD SAFETY	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)l	BRAND/ MANUFACTURER	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)m	THE FACT THAT THE FOOD IS TRADITIONAL (EG ARROW ROOTS, SWEET POTATOES)	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)n	THE FACT THAT THE FOOD IS MODERN (EG WEETABIX, NOODLES, CRISPS, TINNED FRUITS AND VEGETABLES)	☐ 1	☐ 2	☐ 3	☐ 4
(3.04)o	WHO SELLS THE FOOD	☐ 1	☐ 2	☐ 3	☐ 4

(3.05) In your opinion, what do you think are (in Njabini: would be) the main **advantages** of having a **large supermarket** in this town, if any?

ALLOW UP TO THREE RESPONSES — 1st ☐ 2nd ☐ 3rd ☐

There are no advantages 1	Long opening hours 9	Provides opportunities to supply own produce to them 17
Lower prices of food items 2	Attracts people from neighbouring locations 10	Having everything under one roof 18
More variety of food products (eg flavour, brand) 3	Possibility to read labels 11	Symbolises more modern lifestyle 19
Availability of more kinds of **food items** 4	Attracts other businesses 12	It symbolises that the town is prospering 20
Shopping atmosphere/ spacious 5	Provides employment opportunities 13	Availability of large packaging sizes 21
Availability of more kinds of **non-food items** 6	Higher perceived food quality 14	Self - service 22
More stable food suply 7	Higher perceived food safety 15	Products move faster/ are more fresh 23
More stable prices of food items 8	Possibility to compare prices 16	Other (specify) 96

(3.06) In your opinion, what do you think are (in Njabini: would be) the main **disadvantages** of having a large supermarket in this town, if any?

ALLOW UP TO THREE RESPONSES — 1st ☐ 2nd ☐ 3rd ☐

There are no disadvantages 1	Lower perceived food quality 5	Attracts people from neighbouring locations 10
Pushes small stores out of business 2	Lower perceived food safety 6	People buy less of my farm produce 11
Pushes farmers out of business 3	Symbolises more modern lifestyle 7	Traditional food disapears 12
Increases prices of food items 4	Encourages eating of more unhealthy food 8	Other (specify) 96
	Necessary to queue for a long time 9	

(3.07) In your opinion, do you (in Njabini: would you) see more advantages or disadvantages of having a **large supermarket** in this town?

READ OUT. TICK THE ONE THAT APPLIES

- MORE ADVANTAGES ☐ 1
- SAME ADVANTAGES AS DISADVANTAGES ☐ 2
- MORE DISADVANTAGES ☐ 3

ONLY IF IN TOWN OL KALOU OR MWEA. OTHERWISE ► (3.14)

(3.08) When did you start to buy food products in [LARGE SUPERMARKET] **in this town,** if you did?

☐☐ MONTH ☐☐☐☐ YEAR

SECTION 3: SHOPPING BEHAVIOUR AND ATTITUDES (3/3)

USE OF FOOD LABELS - READ OUT: "A FOOD LABEL IS EVERY INFORMATION WRITTEN ON THE PACKAGE, EXCEPT THE PRICE"

(3.14) **For the foods & drinks that you buy**: To what extent does the information written on the package (other than price) influence your choice to **buy or keep buying** a product?

READ OUT & TICK THE ONE THAT APPLIES

VERY MUCH	CONSIDER-ABLY	A LITTLE BIT	NOT AT ALL/ NEVER THOUGHT ABOUT IT	DON'T KNOW INFORMATION
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
► (3.16)	► (3.16)	► (3.16)		

(3.15) Why does the information written on the package (other than price) **not** influence your choice to **buy or keep buying** a product?

ALLOW UP TO THREE RESPONSES

1st ☐ 2nd ☐ 3rd ☐ ► (4.04)

Does not contain the information I am looking for 1	I do not trust the information 3	I already know and am used to the product 5	Don't know 99
Hard to understand information 2	I'm not interested in information 4		Other (specify) 96

(3.16) What are the kind of information written on the packages (other than the price) that influence your buying decision?

ALLOW UP TO THREE RESPONSES

1st ☐ 2nd ☐ 3rd ☐

Expiry date 1	Added sugar 7	Other mineral 13	List of ingredients 19
Serving size 2	Fibre 8	Halaal label 14	Brand name 20
Calories/ Energy 3	Protein 9	KEBS/Diamond mark of quality label 15	Salt / sodium 21
Total fat 4	Vitamins 10	Place of manufacture 16	Date of manufacture 22
Saturated fat 5	Calcium 11	Instructions of preparing food 17	Other (specify) 96
Total carbohydrates 6	Iron 12	% of daily recommendation 18	

SECTION 4: Food Preparation

RESPONDENT ID 2012: ☐

RESPONDENT ID 2015: ☐

(4.04) How long does it **usually** take to prepare meals for all the household members (to eat inside home and carry to work/ school) during a day?

DO NOT COUNT TIME THAT YOU ARE NOT PAYING ATTENTON DUE TO MEALS COOKING ALONG.

☐ HOURS ☐ MINUTES

SECTION 5: Food Accessibility (1/1)

RESPONDENT ID 2012: ____

RESPONDENT ID 2105: ____

	READ OUT: NOW, I AM GOING TO ASK YOU A FEW QUESTIONS ABOUT FOOD ACCESSIBILITY	LARGE SUPER-MARKET	SMALL SUPERMARKET	KIOSK	PLACE FOR FRESH FRUITS + VEGETABLES	RESTAURANT
(5.08)	How long does it take you/ would it take you to travel from here (<u>one way</u>) to **nearest** […]? READ OUT: GIVE TIME IN MINUTES AND **INCLUDE** TIME WAITING (EG FOR A BUS)	**(5.08)a** ___ min	**(5.08)b** ___ min	**(5.08)c** ___ min	**(5.08)d** ___ min	**(5.08)e** ___ min
(5.09)	How do you usually get to/ would you travel to **nearest** […]? (<u>one way</u>) Foot 1 ► (5.11) Motorcycle 4 Bicycle 2 ► (5.11) Boda boda 5 Car 3 Matatu 6 Other (specify) 96	**(5.09)a** ___	**(5.09)b** ___	**(5.09)c** ___	**(5.09)d** ___	**(5.09)e** ___
(5.10)	How much does it cost you/ would it cost you to get to **nearest** […] by [THIS MEANS OF TRANSPORT]? (<u>one way</u>)	**(5.10)a** ___ KSh	**(5.10)b** ___ KSh	**(5.10)c** ___ KSh	**(5.10)d** ___ KSh	**(5.10)e** ___ KSh
(5.11)	Is **most of the food** for your household that is bought in [...] **usually** done on the way to work of some household member or on the way from work back home? IF NO FOOD IS BOUGHT IN […] CROSS OUT AND ► NEXT OUTLET	**(5.11)a** FOR EACH CASE TICK THE ONE THAT APPLIES 1 ___ Yes 2 ___ No ► **NEXT OUTLET**	**(5.11)b** 1 ___ Yes 2 ___ No ► **NEXT OUTLET**	**(5.11)c** 1 ___ Yes 2 ___ No ► **NEXT OUTLET**	**(5.11)d** 1 ___ Yes 2 ___ No ► **NEXT OUTLET**	**(5.11)e** 1 ___ Yes 2 ___ No ► **<u>NEXT SECTION</u>**
	HELP FOR INTERVIEWER: WHICH WAY? FROM HOME TO WORK ► **a)** FROM WORK TO HOME ► **b)**	___	___	___	___	___
(5.12)	How long **would it take** this household member to travel: a) from home straight to work? b) from work straight home?	**(5.12)a** ___ min	**(5.12)b** ___ min	**(5.12)c** ___ min	**(5.12)d** ___ min	**(5.12)e** ___ min
(5.13)	How long does it take this household member to travel (<u>one way</u>): a) from home to […] and then to work? b) from work to […] and then home?	**(5.13)a** GIVE TIME IN MINUTES AND **INCLUDE** TIME WAITING (EG FOR A BUS). **EXCLUDE** TIME SPENT SHOPPING. ___ min	**(5.13)b** ___ min	**(5.13)c** ___ min	**(5.13)d** ___ min	**(5.13)e** ___ min
(5.14)	How does this houshold member usually travel to […] on the way a) to work b) from work? Foot 1 Motorcycle 4 Bicycle 2 Boda boda 5 Car 3 Matatu 6 Other (specify) 96	**(5.14)a** WAY TO […] ___ WAY FROM […] TO a)/ b) ___	**(5.14)b** WAY TO […] ___ WAY FROM […] TO a)/ b) ___	**(5.14)c** WAY TO […] ___ WAY FROM […] TO a)/ b) ___	**(5.14)d** WAY TO […] ___ WAY FROM […] TO a)/ b) ___	**(5.14)e** WAY TO […] ___ WAY FROM […] TO a)/ b) ___

SECTION 6: Non-Food Expenditure (1/2)

RESPONDENT ID 2012:

RESPONDENT ID 2015:

		EXPENDITURE DURING LAST MONTH **READ OUT:** PLEASE **EXCLUDE** BUSINESS EXPENDITURES. IN OTHER (SPECIFY) EXCLUDE VERY INFREQUENT HIGH VALUE PURCHASES (EG PURCHASING A TV SET) ENTER 99 IF RESPONDENT DOESN'T KNOW	(6.01) Did your household purchase or pay for any [ITEM]/[SERVICE] during the **last month**? Yes 1 No 2 ► (6.03)	(6.02) How much did your household spend on [ITEM]/[SERVICE] during the **last month**? VALUE IN KSh	(6.03) How much of [ITEM]/[SERVICE] did your household receive without payment during the **last month** (eg gifts, subsidies)? DO NOT INCLUDE STOCKS IF NONE CODE "0" INCL OWN PRODUCTION VALUE IN KSh
Housing and cooking fuel		**READ OUT: INCLUDE ONLY WHAT IS NOT ALREADY INCLUDED IN RENT**			
	1	MAINTENANCE AND REPAIRS			
	2	GARBAGE (SOLID WASTE) COLLECTION			
	3	ELECTRICITY			
	4	GAS			
	5	KEROSENE/ FUEL FOR COOKING/ LIGHT			
	6	FIREWOOD/ CHARCOAL			
	7	WATER (EXCL. BOTTLED WATER)			
	8	WATER FILTER AND OTHER TREATMENT			
	9	BATTERIES, LIGHTBULBS, LIGHTERS			
	10	HOUSEHOLD HELP (EG GARDNER, PERSON DOING LAUNDRY, SECURITY GUARD)			
	11	OTHER HOUSING EXPENDITURE **(EXCLUDE RENT)**			
Hygiene	12	SOAP FOR WASHING HANDS AND BODY			
	13	CLEANING EQUIPMENT (INCL LAUNDRY DETERGENT)			
	14	TOOTHPASTE AND TOOTHBRUSHES			
	15	BEAUTY PRODUCTS/ COSMETICS/ PERFUMES			
	16	TOILET PAPER AND OTHER TISSUES			
	17	BABY DIAPERS			
	18	INSECTICIDES/ MOSQUITO COILS			
	19	CANDLES/ MATCHES/ INCENSE			
	20	HAIR CUTS AND DRESSING			
	21	OTHER HYGIENE EXPENDITURES			
TRANSPORT	22	FUEL/ LUBRICATION PERSONAL VEHICLE			
	23	REPAIRS PERSONAL VEHICLE (EG CAR)			
	24	BUS, MATATU, BODA BODA, TAXI			
	25	PARKING FEES			
	26	OTHER TRANSPORTATION EXPENDITURE			
COMMUNICATION	27	AIRTIME FOR **MOBILE PHONES** (INCL MPESA)			
	28	BILL FOR LANDLINE PHONES			
	29	AIRTIME OR BILL **FOR INTERNET**			
	30	POSTAL EXPENSES (POSTBOX AND SENDING LETTERS/ PARCEL)			
	31	DAILY OR WEEKLY NEWSPAPER			
	32	OTHER COMMUNICATION EXPENDITURE			
TOBACCO	33	TOBACCO (INCL SNUFF AND MIRAA(KHAT))			

SECTION 6: Non-Food Expenditure (2/2)

			(6.01)	(6.02)	(6.03)
		LAST YEAR	Did your household purchase or pay for any [ITEM]/[SERVICE] during the **last year**?	How much did your household spend on [ITEM]/[SERVICE] during the **last year**?	How much of [ITEM]/[SERVICE] did your household receive without payment during the **last year** (eg gifts, subsidies)?
		READ OUT: PLEASE EXCLUDE BUSINESS EXPENDITURES.			DO NOT INCLUDE STOCKS
		ENTER 99 IF RESPONDENT DOESN'T KNOW	Yes 1 / No 2	VALUE IN KSh	IF NONE CODE "0" / INCL OWN PRODUCTION / VALUE IN KSh
Education	34	SCHOOL FEES			
	35	SCHOOL TEXTBOOKS			
	36	STATIONARY (EG PENCILS, NOTEBOOKS)			
	37	SCHOOL UNIFORMS			
	38	OTHER EDUCATION EXPENSES			
Health	39	MEDICATION (PURCHASED PRIVATELY)			
	40	NUTRIENT SUPPLEMENTS (EG IRON, VITAMIN A PILLS, NUTRITIOUS STONES)			
	41	FEES FOR DOCTORS/ CLINICAL OFFICER (INCL REGISTRATION FEES)			
	42	FEES FOR MIDWIVES/ DELIVERY			
	43	FEES FOR HOSPITAL STAYS (EXCL DELIVERIES)			
	44	FEES FOR TRADITIONAL HEALERS			
	45	THERAPEUTIC APPLIANCES (EG GLASSES, CRUTCHES)			
	46	OTHER HEALTH EXPENSES			
Clothing, textiles		**INCLUDE CLOTHING, SHOES, SHEETS, FABRIC, REPAIRS**			
	47	WOMEN'S CLOTHING			
	48	CHILDREN'S CLOTHING (NOT INCL CHILDREN BORN LAST YEAR)			
	49	MEN'S CLOTHING			
	50	OTHER TEXTILES (INCL DRYCLEANING, NOT INCL CHILDREN BORN LAST YEAR)			
Entertainment	51	NATIONAL PARK (ENTRANCE & GAME DRIVE)			
	52	CINEMA			
	53	CONCERTS			
	54	SPORT GAMES			
	55	ENTRANCE FOR BARS AND DISCOS			
	56	CDS AND VIDEOS			
	57	PAY TV			
	58	OTHER ENTERTAINMENT			
Other	59	MAGAZINES AND BOOKS (NO SCHOOLBOOKS)			
	60	EXPENSES ON CHILDREN BORN LAST YEAR (FIRST SUPPLY, EG TEXTILES, CRIB)			
	61	KITCHEN UTENSILS			
	62	LOAN REPAYMENTS			
	63	CONTRIBUTIONS (EG CHURCH, GROUPS)			
	64	INSURANCE (EG CAR, LIFE, HEALTH)			
	65	REMITTANCES TRANSFERED TO OTHER HOUSEHOLDS			
	66	ATTENDING OR HOSTING SPECIAL OCCASIONS (EG WEDDING, GRADUATION)			

(6.04)	Taken together, how much did your household approximately spend on **last month's food consumption and non-food expenditure**?	KSh

SECTION 7:Livelihood (1/1)

RESPONDENT ID 2012: ____

RESPONDENT ID 2015: ____

(7.01) During the **last year,** did **your household** rely on […] as a source of livelihood?

READ OUT AND TICK ALL THE ONES THAT APPLY

REMEMBER TO REFER TO THE ENTIRE HOUSHOLD AND NOT ONLY THE RESPONDENT

PUBLIC SECTOR EMPLOYMENT	1	STATE TRANSFERS (EG SUBSIDIES, SCHOLARSHIP, FOOD AID)	9
PRIVATE SECTOR EMPLOYMENT	2	USING SAVINGS	10
SELF EMPLOYMENT	3	RECEIVING INTEREST RATES	11
RECEIVING PENSIONS	4	SELLING OF OWN AGRICULTURAL PRODUCTION	12
RECEIVING REMITTANCES (REGULAR MONETARY SUPPORT FROM FAMILY OR FRIENDS)	5	CONSUMPTION OF OWN AGRICULTURAL PRODUCTION	13
RECEIVING GIFTS (MONETARY & IN-KIND)	6	FARM CASUAL LABOR	14
RENT (FROM RENTING OUT ASSETS, LAND, AND BUILDINGS)	7	NON-FARM CASUAL LABOR	15
USING MONEY FROM LOANS OR CREDIT	8	OTHER (SPECIFY)	96

(7.02) During the **last year,** what were the three **most important** livelihood sources for your household?

ALLOW UP TO THREE RESPONSES

1st ____ 2nd ____ 3rd ____

PUBLIC SECTOR EMPLOYMENT	1	RENT (FROM RENTING OUT ASSETS, LAND, AND BUILDINGS)	7	SELLING OF OWN AGRICULTURAL PRODUCTION	12
PRIVATE SECTOR EMPLOYMENT	2	USING MONEY FROM LOANS OR CREDITS	8	CONSUMPTION OF SELF PRODUCTION	13
SELF EMPLOYMENT	3	STATE TRANSFERS	9	FARM CASUAL LABOR	14
RECEIVING PENSIONS	4	USING SAVINGS	10	NON-FARM CASUAL LABOR	15
RECEIVING REMITTANCES	5	INTEREST RATES	11	OTHER (SPECIFY)	96
RECEIVING GIFTS	6				

(7.03) During the **last year**, what was the contribution of [MOST IMPORTANT LIVELIHOOD SOURCE] to household consumption and expenditure?

READ OUT AND TICK THE ONE IN EACH COLUMN THAT APPLIES

MORE THAN HALF ▶		MORE THAN THREE QUARTERS	1
		LESS THAN THREE QUARTERS	2
HALF	3	MORE THAN ONE QUARTER	4
LESS THAN HALF ▶		LESS THAN ONE QUARTER	5

(7.04) **CHANGE OF RECALL PERIOD**

During the last year, what was the **average monthly** income of your household?

READ OUT AND TICK THE ONE THAT APPLIES

INCLUDE ALL SOURCES FROM ALL HOUSEHOLD MEMBERS, INCLUDE ALSO CASUAL LABOR & REMITTANCES

0-5000 KSh	1	25001-35000 KSh	4
5001-15000 KSh	2	35001-50000 KSh	5
15001-25000 KSh	3	above 50000 KSh	6

SECTION 8: Health (1/3)

RESPONDENT ID 2012:

RESPONDENT ID 2015:

ID CODE	(8.01) What **chronic** illnesses/ conditions has [NAME] been **diagnosed** with and is still suffering from, if any? READ OUT **CHRONIC** DISEASES ON THE RIGHT. IF NO ILLNESS FILL IN 97, IF DON'T KNOW, FILL IN 99 AND ► NEXT PERSON	(8.02) For how long has [NAME] been diagnosed with this [CHRONIC ILLNESS/ CONDITION] ?	(8.03) Who told [NAME] that he/she was suffering from this [CHRONIC ILLNESS/CONDITION]? Medical Doctor/ Clinical Officer 1; Medical worker in hospital 2; Medical worker at dispensary 3; Medical worker at non-health facility 4; Pharmacist 5; Traditional healer 6; Community Health Worker 7; Self diagnosis/ other household members 8; Other (Specify) 96; Don't know 99	(8.031) What did [NAME] get as treatment when he/she was suffering from this [CHRONIC ILLNESS/CONDITION]? No treatment 1; Aspirin 2; Other medicines, tablets or pills 3; Diet 4; Exercise 5; Other (Specify) 96; Don't know 99	(8.04) Since the diagnosis of this [CHRONIC ILLNESS/CONDITION], what have been the total direct costs associated with diagnosis and treatment? **READ OUT: INCLUDE** TRANSPORTATION, DIAGNOSIS, MEDICATION, MEDICAL CARE. DO **NOT INCLUDE** INCOME LOSS AND OTHER OPPORTUNITY COSTS
	CODE	MONTHS	CODE	CODE	KSh
1	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
2	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
3	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
4	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
5	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
6	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
7	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
8	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
9	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
10	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
11	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
12	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
13	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
14	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd
15	1st	1st	1st	1st	1st
	2nd	2nd	2nd	2nd	2nd

RECORD UP TO TWO ILLNESSES PER MEMBER

IF MORE THAN TWO ILLNESSES RECORD THE TWO MOST SEVERE

CHRONIC ILLNESSES	
DIABETES	1
HYPERTENSION	2
CARDIOVASCULAR/ HEART DISEASE	3
KWASHIORKOR	4
CANCER (Specify)	5
HIGH CHOLESTEROL	6
ANAEMIA	7
RICKETTS	8
IF NOT BY BIRTH: BLINDNESS/ LOSS OF (NIGHT)VISION	9
GOITER	10
GOUT (Arthritis)	11
BAD TEETH	12

NON-CHRONIC ILLNESSES	
FEVER, MALARIA	1
DIARRHEA	2
STOMACH ACHE	3
VOMITING	4
FLU/ COLD	5
HEADACHE	6
SKIN PROBLEM	7
BAD TEETH (ACHE)	8
EYE PROBLEM	9
EAR/NOSE/THROAT	10
PAIN WHEN PASSING URIN	11
TUBERCULOSIS	12
KWASHIORKOR	13
TYPHOID	14
PNEUMONIA	15
FAINTING	16
INTESTINAL WORMS	17
OTHER (SPECIFY)	96

SECTION 8: Health (2/3)

ID CODE	(8.06) During the **last month**, has [NAME] suffered from **any other illnesses/ conditions**? READ OUT **NON-CHRONIC ILLNESSES** ON THE RIGHT. IF NO ILLNESS FILL IN 97, IF DON'T KNOW, FILL IN 99 AND ► NEXT PERSON	(8.07) From whom did [NAME] seek medical advice for this [ILLNESS/ CONDITION], **if any**?	(8.08) Does your household have any **mosquito nets?** TICK THE ONE THAT APPLIES	(8.09) Does any member (under 10 years of age) of your household ever got **measels injections?** TICK THE ONE THAT APPLIES	RECORD UP TO TWO ILLNESSES PER MEMBER. IF MORE THAN TWO ILLNESSES RECORD THE TWO MOST SEVERE
	CODE	CODE	TICK	TICK	
1	1st	1st			
	2nd	2nd			
2	1st	1st			
	2nd	2nd			
3	1st	1st			
	2nd	2nd			
4	1st	1st			
	2nd	2nd			
5	1st	1st			
	2nd	2nd			
6	1st	1st			
	2nd	2nd			
7	1st	1st			
	2nd	2nd			
8	1st	1st			
	2nd	2nd			
9	1st	1st			
	2nd	2nd			
10	1st	1st			
	2nd	2nd			
11	1st	1st			
	2nd	2nd			
12	1st	1st			
	2nd	2nd			
13	1st	1st			
	2nd	2nd			
14	1st	1st			
	2nd	2nd			
15	1st	1st			
	2nd	2nd			

Medical Doctor/ Clinical Officer 1
Medical worker in hospital 2
Medical worker at dispensary 3
Medical worker at non-health facility 4
Pharmacist 5
Traditional healer 6
Community Health Worker 7
Advice from non-medical persons (eg friend, neighbour) 8
Did not seek advice 9
Other (Specify) 96
Don't know 99

(8.08) YES (continue) 1; NO ► (8.09) 2; Don't know ► (8.09) 99
If **YES**, did [NAME] sleep under a mosquito net **last night**?
TICK ALL MEMBERS THAT SLEPT UNDER A NET LAST NIGHT

(8.09) YES (continue) 1; NO ► (8.10) 2; Don't know ► (8.10) 99
If **YES,** which household members (under 10 years of age) got **measels injection**?
TICK ALL MEMBERS (<10 YEARS) THAT GOT INJECTION

CHRONIC ILLNESSES

DIABETES	1
HYPERTENSION	2
CARDIOVASCULAR/ HEART DISEASE	3
KWASHIORKOR	4
CANCER (Specify)	5
HIGH CHOLESTEROL	6
ANAEMIA	7
RICKETTS	8
IF NOT BY BIRTH: BLINDNESS/ LOSS OF (NIGHT)VISION	9
GOITER	10
GOUT (Arthritis)	11
BAD TEETH	12

NON-CHRONIC ILLNESSES

FEVER, MALARIA	1
DIARRHEA	2
STOMACH ACHE	3
VOMITING	4
FLU/ COLD	5
HEADACHE	6
SKIN PROBLEM	7
BAD TEETH (ACHE)	8
EYE PROBLEM	9
EAR/NOSE/THROAT	10
PAIN WHEN PASSING URIN	11
TUBERCULOSIS	12
KWASHIORKOR	13
TYPHOID	14
PNEUMONIA	15
FAINTING	16
INTESTINAL WORMS	17
OTHER (SPECIFY)	96

SECTION 8: Health (3/3)

*This part of the health section is only to be asked to households that have chidren **under the age of 5 years** , check first and probe if you are not sure!*
*If **NO** Children under 5 years ► next Section "Health Knowledge" (9.01)*

(8.10)	Did [NAME/children in this household <5 years] suffer from **fever last week**? TICK THE ONE THAT AAPLIES	YES ☐ 1 NO ☐ 2 NOT SURE ☐ 99
(8.11)	Did [NAME/children in this household <5 years] suffer from **diarrhea last week**? TICK THE ONE THAT AAPLIES	YES ☐ 1 NO ☐ 2 NOT SURE ☐ 99

*This part of the health section is only to be asked to households that have chidren **under the age of 1 year** , check first and probe if you are not sure! If **NO** Children under 1 year ► next Section "Health Knowledge" (9.01)*

(8.12)	How many months old are the children under 1 year in your household?	RECORD AGE IN MONTHS FOR UP TO 3 CHILDREN child 1 ____ months old child 2 ____ months old child 3 ____ months old
(8.13)	Is/are [NAMEs of child/children] still being **brestfed**?	RECORD, YES=1, NO=2, NOT SURE=99 child 1 ____ child 2 ____ child 3 ____ If none of the children is still beeing brestfed ► (8.15)
(8.14)	Was [NAMEs of the child/children] **brestfed yesterday** during day or at night?	RECORD, YES=1, NO=2, NOT SURE=99 child 1 ____ child 2 ____ child 3 ____
(8.15)	Was any other **special meal** prepared for [NAMEs of child/children] **yesterday**?	READ OUT: With special meal I mean a meal which was not consumed among other family members and was cooked to feed the child only. RECORD, YES=1, NO=2, NOT SURE=99 child 1 ____ child 2 ____ child 3 ____
(8.16)	Did [NAMEs of child/children] receive **solid, semi-solid or soft food yesterday**?	RECORD, YES=1, NO=2, NOT SURE=99 child 1 ____ child 2 ____ child 3 ____
(8.17)	Starting at what age was [NAMEs of child/children] given **other food** or liquids apart from breast milk?	*Please verify by asking other household members and by using the local calendar* RECORD AGE IN MONTHS OR IF NOT SURE=99, or IF CHILD DOES NOT TAKE FOOD YET =77 child 1 ____ child 2 ____ child 3 ____

SECTION 9: Health Knowledge (1/4)

RESPONDENT ID 2012:

RESPONDENT ID 2015:

READ OUT: NOW I WOULD LIKE TO ASK YOU SOME QUESTIONS THAT WILL HELP US UNDERSTAND THE KNOWLEDGE ABOUT NUTRITION AND HEALTH OF THIS HOUSEHOLD. IF YOU ARE **UNSURE** ABOUT SOME QUESTIONS, PLEASE ALWAYS SAY SO AND DO NOT GUESS A RESPONSE.

(9.01)	How would you rate the **overall healthiness** of the diet consumed in your household during the **last month**?	Not sure 99	VERY GOOD 1	GOOD 2	OK: NOT GOOD NOT POOR 3	A LITTLE POOR 4	VERY POOR 5	
	READ OUT AND TICK THE ONE THAT APPLIES							
(9.02)	How would you rate your household's total **fat** consumption during **last month** as compared to a healthy amount?	Not sure 99	TOO MUCH 1	GOOD AMOUNT 2	OK: NOT GOOD NOT INSUFFI-CIENT 3	A LITTLE INSUF-FICIENT 4	SEVERELY INSUFFICIENT 5	
	READ OUT AND TICK THE ONE THAT APPLIES	INCL ALL SOURCES: COOKING OIL/FAT & FAT FROM FOOD ITEMS EG MEAT						
(9.03)	How would you rate your household's **total sugar** consumption during **last month** as compared to a healthy amount?	Not sure 99	TOO MUCH 1	GOOD AMOUNT 2	OK: NOT GOOD NOT INSUFFI-CIENT 3	A LITTLE INSUF-FICIENT 4	SEVERELY INSUFFICIENT 5	
	READ OUT AND TICK THE ONE THAT APPLIES	INCL ALL SOURCES: EG SUGAR ADDED TO TEA, SUGAR IN CAKES & SODAS						

				HIGH	MEDIUM	LOW	Not Sure
(9.04)	Do you think these food-products are high, medium or low in added **sugar**?	**(9.04)a**	NATURAL YOGHURT	1	2	3	99
		(9.04)b	FLAVOURED YOGHURT	1	2	3	99
	READ OUT	**(9.04)c**	FRESH JUICE	1	2	3	99
	TICK ONE BOX PER FOOD ITEM	**(9.04)d**	WHITE BREAD	1	2	3	99
		(9.04)e	TOMATO KETCHUP	1	2	3	99
(9.05)	Do you think these food-products are high, medium or low in **fat**?	**(9.05)a**	CHIPS	1	2	3	99
		(9.05)b	MARGARINE (EG BLUE BAND)	1	2	3	99
		(9.05)c	CRISPS	1	2	3	99
	READ OUT	**(9.05)d**	FRIED BEEF SAUSAGE	1	2	3	99
	TICK ONE BOX PER FOOD ITEM	**(9.05)e**	HONEY	1	2	3	99
		(9.05)f	RAW NUTS (NOT BOILED NOR ROASTED)	1	2	3	99
		(9.05)g	WHITE BREAD	1	2	3	99
		(9.05)h	CAKE	1	2	3	99
(9.06)	Do you think these food-products are high, medium or low in **salt**?	**(9.06)a**	SAUSAGES	1	2	3	99
		(9.06)b	BROWN BREAD	1	2	3	99
	READ OUT	**(9.06)c**	POPCORN	1	2	3	99
	TICK ONE BOX PER FOOD ITEM	**(9.06)d**	TOMATO KETCHUP	1	2	3	99
		(9.06)e	INSTANT NOODLES (EG INDOMIE)	1	2	3	99

(9.08)	How many servings of **fruits and vegetables together** do you think experts are advising people to eat **every day**? (For example, one serving could be an apple or a handful of Sukuma)	number of servings

SECTION 9: Health Knowledge (2/4)

(9.14) What do you think is the meaning of (kilo)**calories** in the context of nutrition?
TICK THE ONE THAT APPLIES

Unit of energy ☐ 1
Other (specify) ☐ 96
Not sure ☐ 99 ► **(9.18)**

(9.15) How many (kilo)**calories** should a 40 year old male teacher consume in a day?

☐ Number of kilocalories Not sure ☐ 99

READ OUT: THE NEXT QUESTIONS ARE ABOUT THE RELATIONSHIP BETWEEN NUTRITION AND HEALTH

(9.18) Are you aware of any health problems that are associated with **eating none or too little of fresh fruits and vegetables**?
TICK THE ONE THAT APPLIES

Yes ☐ 1 Not sure ☐ 99
No ☐ 2 ► **(9.20)**

(9.19) Which diseases/symptoms do you think are associated with **eating none or too little of fresh fruits and vegetables**?

ALLOW UP TO THREE RESPONSES. RANK ACCORDING TO LIKELIHOOD.
1st ☐ 2nd ☐ 3rd ☐

Loss of vision 1 | Weakness/ weak immune system 4 | Bad teeth 6 | Other (specify) 96
Aneamia 2 | Kwashiorkor 7
Migraine 3 | Bad skin 5 | Bad hair 8

(9.20) Are you aware of any health problems or diseases that are associated with **excess weight?**
TICK THE ONE THAT APPLIES

Yes ☐ 1 Not sure ☐ 99
No ☐ 2 ► **(9.22)**
DO NOT DEFINE EXCESS WEIGHT HERE.

(9.21) Which diseases do you think are associated with excess weight?

ALLOW UP TO THREE RESPONSES. RANK ACCORDING TO LIKELIHOOD.
1st ☐ 2nd ☐ 3rd ☐

Hypertension 1 | Diabetes 3 | High colesterol 5 | Other (Specify) 96
Cardiovascular dieseases 2 | Cancer 4 | Lack of stamina 6

(9.22) What do you think is the recommended period of **exclusively breastfeeding infants**? DEFINE EXCLUSIVE BREASTFEEDING

IF UNSURE, FILL IN 99
☐ Number of months

(9.23) Which health problems or diseases do you think are associated with **not exclusively breastfeeding** infants for [THIS PERIOD], if any?

ALLOW UP TO 3 RESPONSES. RANK ACCORDING TO LIKELIHOOD.
1st ☐ 2nd ☐ 3rd ☐

Death 1 | Low weight for age 4 | Delayed achievement of development milestones (eg smiling, grabbing) 6 | Weak immune system 7
Low weight for height 2 | Stomach Ache 5 | No health problems 8
Low height for age 3 | Other (specify) 96

(9.26) How would you rate your **knowledge** about a **healthy nutrition**?
READ OUT AND TICK THE ONE THAT APPLIES

Not sure	VERY GOOD	GOOD	OK: NOT GOOD NOT POOR	A LITTLE POOR	VERY POOR
☐ 99	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

(9.27) How would you rate your knowledge about **relationships between nutrition and health**?
READ OUT AND TICK THE ONE THAT APPLIES

Not sure	VERY GOOD	GOOD	OK: NOT GOOD NOT POOR	A LITTLE POOR	VERY POOR
☐ 99	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

SECTION 9: Health Knowledge (3/4)

READ OUT: THE NEXT QUESTIONS ARE ABOUT SOURCES OF NUTRITION AND HEALTH INFORMATION

(9.271) During the past 30 days, have you noticed or received **information about healthy eating** or healthy diets?

Yes ☐ 1 No ☐ 2 ► **(9.273)** Not sure ☐ 99

(9.271) Where did you find, see or get this information on healthy eating/diets?

TICK ALL THE ONES THAT APPLY

Radio English	1	Doctor	6	Internet	11	Nutritionist	16
Radio Kiswahili	2	Nutrition education program	7	Relatives/ friend	12	Church	17
Radio vanacular	3	Newspaper English	8	School	13	Community organisation	18
TV	4	Newspaper Kiswahili	9	Books/ Magazines	14	Work	19
Food labels	5	Health Centre	10	Community Health Worker	15	Advertisement	20
NGO	21	Other (specify)	96				

(9.273) During the past 30 days, have you noticed or received information about **dangers of non-healthy eating** behavior?

Yes ☐ 1 No ☐ 2► **(9.29)** Not sure ☐ 99

(9.28) Where do you **usually** get health/nutrition information from?

ALLOW UP TO THREE RESPONSES

1st ☐ 2nd ☐ 3rd ☐

Radio English 1	Doctor 6	Internet 11	Nutritionist 16
Radio Kiswahili 2	Nutrition education 7	Relatives/ friend 12	Church 17
Radio vanacular 3	Newspaper English 8	School 13	Community organisation 18
TV 4	Newspaper Kiswahili 9	Books/ Magazines 14	Work 19
Food labels 5	Health Centre 10	Community Health Worker 15	Other (specify) 96

(9.29) What do you think about the following statement?
"There are so many health/nutrition information available, it is hard to decide what to believe"

READ OUT AND TICK THE ONE THAT APPLIES

STRONGLY AGREE ☐ 1 SOMEWHAT AGREE ☐ 2 SOMEWHAT DISAGREE ☐ 3 STRONGLY DISAGREE ☐ 4 Not sure ☐ 99

(9.30) What are some of the barriers you face in consuming a healthy diet, if any?

ALLOW UP TO THREE RESPONSES

1st ☐ 2nd ☐ 3rd ☐

I already eat a healthy diet 1	Poor availability of healthy foods 4	Taste - unhealthy food tastes better 7	Time constraints 8
Affordability: costs too high 2	Lack of knowledge/ information 5		Inconvenience 9
Lack of cooking skills 3	Habits 6		Other (specify) 96

(9.31) During the past 30 days, have you noticed or received information about health benefits through **physical activity**?

TICK THE ONE THAT APPLIES

Yes ☐ 1 No ☐ 2 Not sure ☐ 99

(9.32) During the past 30 days, have you noticed or received information about **dangers of smoking cigarettes** or that encourages quitting?

TICK THE ONE THAT APPLIES

Yes ☐ 1 No ☐ 2 Not sure ☐ 99

(9.33) During the past 30 days, how often has anyone smoked cigarettes or cigars **inside your house**?

READ OUT AND TICK THE ONE THAT APPLIES

ON ALMOST EVERY DAYS (21-30 days) ☐ 1 OFTEN (11-20 days) ☐ 2 SOMETIMES (3-10 days) ☐ 3 RARELY (1-2 days) ☐ 4 NEVER (0 days) ☐ 5

SECTION 9: Health Knowledge (4/4)

READ OUT: THE NEXT QUESTIONS ARE ON YOUR HYGIENE BEHAVIOR

(9.34) Does your household have **soap** (or washing powder/ liquid) at present? TICK THE ONE THAT APPLIES — Yes ☐ 1 ► (9.36) — No ☐ 2 — Not sure ☐ 99

(9.35) If you **don't have** soap do you use something else? TICK THE ONE THAT APPLIES — Yes (specify) ☐ 1 ..... — No ☐ 2

(9.36)a Are you aware of **causes for diarrhea**? TICK THE ONE THAT APPLIES — If **YES** (LET SPECIFY AND TICK THE ONES THAT APPLY UNDER b)) ☐ 1 — No ☐ 2 ► (9.38) — Not sure ☐ 99 ► (9.38)

DO NOT READ ALOUD THE LIST, PROBE FOR FURTHER RESPONSES

(9.36)b More than one answer possible. TICK ALL THE ONES THAT APPLY

Contaminated food ☐ 1		Flies ☐ 4	
Contaminated water ☐ 2		Eating greens ☐ 5	
Contaminated hands ☐ 3		Other (specify) ☐ 96	.....

(9.38)a Can you name any things that help prevent you and other family members from getting **diarrhea**? If **YES** (LET SPECIFY AND TICK THE ONES THAT APPLY UNDER b)) ☐ 1 — No ☐ 2 ► (9.40) — Not sure ☐ 99 ► (9.40)

DO NOT READ ALOUD THE LIST, PROBE FOR FURTHER RESPONSES

(9.38)b More than one answer possible. TICK ALL THE ONES THAT APPLY

Washing hands ☐ 1		Exclusive breast feeding ☐ 4	
Use latrine or bury feces ☐ 2		Protect food and water supplies with cover ☐ 5	
Boil or filter drinking water ☐ 3		Other (specify) ☐ 96	.....

(9.40) Are you aware of diet realted **causes for aneamia**? (**DO NOT READ OUT**: *The answer should be: Iron deficiency causes aneamia)*

Yes (if respondent knows the answer) ☐ 1
No (if the respondent doesn't know/is wrong or unsure) ☐ 2
TICK THE ONE THAT APPLIES

HELP FOR ENUMERATOR — Foods rich in iron

BEEF (RED MEAT)
BROCCOLI
CEREALS
CHICKEN
DRY FRUITS
EGGS
GREEN LEAVY VEGETABLES
LIVER
NUTS
PULSES

(9.41) Please name 3 **foods** that either **help to avoid aneamia or** that are **rich in iron**

RECORD THE NAMED FOODS

Yes ☐ 1 able to name 3 foods
No ☐ 2 unable to name 3 foods

1 .....
2 .....
3 .....

(9.42) Are you aware of diet related causes for **night blindness**? (**DO NOT READ OUT**: *The answer should be: Vitamin A deficiency causes night blindness*)

Yes (if respondent knows the answer) ☐ 1
No (if the respondent doesn't know/is wrong or unsure) ☐ 2
TICK THE ONE THAT APPLIES

HELP FOR ENUMERATORS — Foods rich in Vitamin A

CARROTS
DAIRY PRODUCTS
DRIED FRUITS
EGGS
FISH
GREEN LEAVY VEGETABLES
MARGARINE
MELON
PALMOIL
PAPAYA
PUMPKIN
RED MEAT
SWEET POTATO (ORANGE-FLESH)
SWEET RED PEPPER

(9.43) Please name 3 **foods that help to prevent night blindness** (that are rich in Vitamin A)

RECORD FOODS

Yes ☐ 1 able to name 3 foods
No ☐ 2 unable to name 3 foods

1 .....
2 .....
3 .....

SECTION 10: Housing

RESPONDENT ID 2012: ____

RESPONDENT ID 2015: ____

(10.01)	What is the tenure status of this house/appartment? TICK THE ONE THAT APPLIES	Rented 1 ► (10.03) Owned 3 Given without rent 2 Don't know 99
(10.02)	How much would you get **per month** if you rented out this house/appartment in it's current state?	KSh ► (10.04) PER MONTH
(10.03)	How much rent do you pay **per month** for this house/appartment? HELP RESPONDENT TO ESTIMATE MONTHLY VALUE	KSh PER MONTH
(10.04)	How many rooms do your household members use (incl househelp)? EXCLUDING KITCHEN, BATHROOM AND CORRIDORS	Rooms
(10.05)	During **last month**, did you have electricity **working** in your dwelling? TICK THE ONE THAT APPLIES	Yes 1 No 2
(10.06)	Is the toilet facility located within the appartment/ house?	Yes 1 No 2
(10.07)	What is the main toilet facility for this household? TICK THE ONE THAT APPLIES	Flush toilet 1 Covered pit latrine 3 Uncovered pit latrine 2 Bucket 4 Other (specify) 96
(10.08)	Is this toilet facility for the use of: READ OUT AND TICK THE ONE THAT APPLIES	HOUSEHOLD MEMBERS ONLY 1 3 HOUSEHOLDS 3 2 HOUSEHOLDS 2 4 HOUSEHOLDS OR MORE 4
(10.09)	What is the household's **main source of water** for [DRINKING/HOUSEHOLD USE] during […]? (EXCLUDE USE FOR FARMING ACTIVITIES)	(10.09)a DRINKING WATER DRY S. ____ RAIN S. ____ (10.09)b (10.09)c HOUSEHOLD USE (EXCL. DRINKING) DRY SEASON ____ RAIN SEASON ____ (10.09)d Piped into dwelling 1; Piped into plot/yard 2; Unprotected dug well/springs 3; Tubewell/borehole with pump 4; Protected dug well 5; Protected spring 6; Rain water collection 7; Public tab 8; River/ponds/streams 9; Tankers-truck/vendor 10; Bottled water 11; Other (specify) 96
(10.10)	Do you usually treat your water before **drinking** during […]? (Point of use) READ OUT YES 1 NO 2 ► (10.091) NO - IT IS ALREADY TREATED 3 ► (10.091)	(10.10)a ____ DRY S. (10.10)b ____ RAIN S.
(10.11)	How do you usually treat your **drinking water** during […]?	(10.11)a DRY S. ____ (10.11)b RAIN S. ____ Boil 1; Chlorine/ bleach (incl waterguard) 2; Let it stand and settle 3; Filter 4; Don't treat it 5; Other (specify) 96
(10.091)	**Where** is the **main source of water** located, that your household relies on? READ OUT AND TICK THE ONE THAT APPLIES	IN OWN DWELLING 1 ► (10.093) IN OWN YARD/PLOT 2 ELSEWHERE (specify) 96
(10.092)	**How long** does it take to go to your main source of water, get water, and come back?	RECORD ANSWER IN MINUTES Minutes ____ Don't know 99
(10.093)	What type of **fuel** does your household mainly use for cooking?	TICK ALL THE ONES THAT APPLY Electricity 1; LPG 2; Biogas 3; Kerosene 4; Coal, Lignite 5; Charcoal 6; Wood 7; Straw, Shrubs, Grass 8; Animal Dung 9; No food cooked in household 10; Other (Specify) 96
(10.094)	Is the **cooking** usually done in the house, in a separate building, or outdoors?	In the house 1 In a seperate bulding 2 ► (10.12) Outdoors 3 ► (10.12) Other 96 ► (10.12)
(10.095)	Do you have a **separate room** which is used as a kitchen?	YES NO

(10.12)	INTERVIEWER ONLY ASK IF UNABLE TO OBSERVE How is the **floor** of this house/appartment covered? IF SEVERAL TYPES, RECORD MATERIAL OF **MAJORITY** OF FLOORS - TICK ONLY 1 ANSWER	Cement ☐ 1 Tiles ☐ 2 Wood ☐ 3	Earth ☐ 4 Other (specify) ☐ 96
(10.13)	INTERVIEWER ONLY ASK IF UNABLE TO OBSERVE What is the **roof** of this house/appartment made of? IF SEVERAL TYPES, RECORD MATERIAL OF **MAJORITY** OF ROOF - TICK ONLY 1 ANSWER	Tin ☐ 1 Tiles ☐ 2 Concrete ☐ 3 Asbestos sheets ☐ 4 Corrugated iron sheets ☐ 5	Improved iron sheets ☐ 6 Grass ☐ 7 Makuti ☐ 8 Other (specify) ☐ 96
(10.14)	INTERVIEWER DON'T ASK BUT OBSERVE What **type of house/appartment** does your household live in? TICK THE ONE THAT APPLIES	Flat ☐ 1 Maisonnett ☐ 2 House/Bungalow ☐ 3	Shanty ☐ 4 Manyatta/Traditional Hut ☐ 5 Other (specify) ☐ 96
(10.15)	INTERVIEWER DON'T ASK BUT OBSERVE What are the outer **walls** of your house/appartment made of? IF SEVERAL TYPES, RECORD MATERIAL OF **MAJORITY** OF WALLS - TICK ONLY 1 ANSWER	Stone ☐ 1 Brick ☐ 2 Mud & Wood ☐ 3 Mud & Cement ☐ 4 Wood only ☐ 5	Corrugated iron sheet ☐ 6 Grass/Straw ☐ 7 Tin ☐ 8 Stone & Wood ☐ 9 Other (specify) ☐ 96

SECTION 11: Assets

RESPONDENT ID 2012: ☐

RESPONDENT ID 2015: ☐

INTRODUCTION: DO NOT COUNT PERMANENTLY BROKEN ITEMS. COUNT ITEMS OF ALL HOUSEHOLD MEMBERS.

	(11.01) How many pieces of [ITEM] does your household **own**, if any? DO NOT COUNT ITEMS BORROWED. IF NONE, FILL IN ZERO		(11.02) Since when does household own [ITEM]? IF MORE THAN ONE, AKS FOR THE ONE OWNED THE LONGEST	(11.03) How much would you get, if you sold **all** [ITEMs] today? IF MORE THAN ONE, GIVE TOTAL VALUE
	READ OUT	PIECES	YEAR	VALUE IN KSh
1	RADIO			
2	TELEPHONE (MOBILE)			
3	WRIST WATCH			
4	IRON			
5	MOSQUITO NET			
6	BED			
7	TV			
8	DVD/VCR PLAYER			
9	MEKO COOKER			
10	ELECTRONIC KETTLE			
11	MICROWAVE			
12	2 PLATES GAS COOKER			
13	ELECTRIC/ GAS STOVE WITH			
14	REFRIGERATOR			
15	LAUNDRY MACHINE			
16	LAPTOP OR COMPUTER			
17	WEIGHING SCALE FOR PERSONS			
18	GENERATOR			
19	SOLAR PANEL			
20	BICYCLE			
21	MOTOR CYCLE			
22	CAR			

(11.07)	Does any member of this household have a bank account? CODE	☐	YES 1 NO 2 NOT SURE 99

DEFINE PERIOD OF LAST 3 YEARS:

RESPONDENT ID 2012:

RESPONDENT ID 2015:

SECTION 12: Mortality

READ OUT: AS YOU KNOW; WE HAVE ASKED YOU QUESTIONS ABOUT HEALTH AND DISEASES IN THE PREVIOUS SECTIONS. WE ARE ALSO INTERESTED TO KNOW IF YOUR HOUSEHOLD HAS LOST MEMBERS THROUGH DEATH IN THE PAST FIVE YEARS DUE TO THE DISEASES WE PREVIOUSLY TALKED ABOUT. THIS IS WHY I WILL ASK YOU SOME QUESTIONS ABOUT DECEASED HOUSEHOLD MEMBERS AND CLOSE RELATIVES (PARENTS, GRANDPARENTS, CHILDREN AND SIBLINGS). PLEASE ANSWER AS ACCURATELY AS YOU CAN.

(12.01)	(12.02)	(12.03)	(12.04)	(12.05)	(12.06)	(12.07)
During the **last 3 years**, did your household lose any household members or close relatives through death?	During the **last 3 years**, how many household members or close relatives has your household lost through death?	How was [...] related to the **current household head**?	Was [...] living in your **house-hold**?	In which year did [...] die?	How old was [...] when he/she died?	What was the cause of [...]'s death?
		Spouse 1				Old age 1
		Co-wife 2				Accident 2
		Son/daughter 3				HIV/AIDS 3
		Spouse of son/daughter 4			IF LESS THAN AGE 1 WRITE ZERO	Heart Problem/ failure 4
		Grandchild 5				Cancer (specify) 5
		Brother/sister 6				Kidney disease 6
		Father/mother 7			IF AGE UNKNOWN ESTIMATE	Diahorrea incl other gatro-intestinal diseases 7
Yes 1		Father/mother of spouse 8				Malaria 8
No 2		Aunt/ Oncle 9				Diabetes 9
► NEXT SECTION		Child of relative 10				Stroke 10
		Child of non-relative 11				Hypertension 11
CODE	PEOPLE	Other relative (specify) 12	Yes 1			Pneumonia 12
		Other non-relative (specify) 13	No 2	YEAR	YEARS	TB 13
						Other (specify) 96

RESPONDENT ID ON BEHALF OF CHILD 1: | |
IF CHILD IS BELOW 13:
RESPONDENT ID ON BEHALF OF CHILD 2: | |

SECTION 13: Weight and Health Related Behaviour and Food Eaten Away From Home (1/3)

READ OUT: NOW, I WILL ASK YOU ABOUT YOUR INDIVIDUAL SPECIFIC CONSUMPTION, NOT THAT OF OTHER HOUSEHOLD MEMBERS.

SAMPLE SELECTION OF SPs	(13.01) REPORT MEMBER ID FROM FLAP FOR PERSONS SELECTED FOR WEIGHT MEASUREMENT	(13.02) Have you ever taken part in any nutrition and health related education training?	(13.03) Where did you take part in nutrition and health related education training?	(13.04) During the **last six months**, have you been trying to **change** your weight?	(13.05) What have you been trying to do to your weight?	(13.06) What have been the most important strategies for you to **lose** weight?	(13.07) Have you been successful in **losing** weight?	(13.08) What have been the most important strategies for you to **gain** weight?	(13.09) Have you been successful in **gaining** weight?	(13.10) Why have you been trying to change your weight?	(13.11) Do you intend to **change** your weight within the **next month**?	(13.12) Are you trying to gain or to lose weight?	(13.13) Are you **actively trying** to **maintain** your weight?
						ALLOW UP TO 2 RESPONSES		ALLOW UP TO TWO RESPONSES					
						Increase physical activity 1							
						Drink more water 2 / Eat less cake/chocol. 4							
					READ OUT	Eat less 3							
			Workplace 1			Eat more protein 5		Reduce physical activity 1		Medical advice 1			
			NGO 2			Eat less carbohydrates 6		Eat more 2		Family advice 2			
			Church 3			Reduce fat (eg chips, oil use) 7		Eat later in the day 3		Friends advice 3			
			Medical center 4	Yes 1 / No 2		Reduce snacking 8		Eat more carbohydrates 4		Partners advice 4			
			School 5 ▶ (13.11)			Eat more fruits and vegetab. 9		Eat more protein 5		Own health concern 5			
		Yes 1	Television 6		GAIN 1	Take pills 10	Yes 1	Eat more fat 6		Own beauty ideal 6		Gain 1	
		No ▶ (13.04) 2	Radio 7	Don't know 99	▶ (13.08)	Eat earlier in the day 11	▶ (13.10)	Eat more fruits and veg. 7			Yes 1	▶ (13.16)	
				▶ (13.11)		Take other medicine 12	No 2	Take pills 8	Yes 1	Was told partner does not take good care 7	▶ (13.13)	Lose 2	Yes 1
	ID CODE		Other (specify) 96		LOSE 2	Other (specify) 96	▶ (13.10)	Increase snacking 9			No 2	▶ (13.16)	
								Take other medicin 10	No 2				No 2
								Other (specify) 96					
male adult						1st 2nd		1st 2nd					
female adult						1st 2nd		1st 2nd					
1 child/ adoles.						1st 2nd		1st 2nd					
2 child						1st 2nd		1st 2nd					

SAMPLE SELECTION OF SPs	(13.16)a Are you confident that if you wanted to **lose** weight, you could?	(13.16)b Are you confident that if you wanted to **gain** weight, you could?	(13.17)a During the last month, how often did the following statements apply to you? "I eat even though I am already full"	(13.17)b "I deliberately avoid certain foods or eat small portion sizes in order not to gain weight"	(13.17)c "If I am tense, stress or bored I start eating even though I am not hungry"	(13.17)d "I can't bring myself to leaving food on the plate even if I'm full"	(13.171) Would you change your eating behavior if you were diagnosed by **unhealthy underweight?**	(13.172) Would you change your eating behavior if you were diagnosed by **unhealthy overweight?**	(13.173) Do you think your **eating and/or drinking behavior** affects your health?	(13.174) What **behavior** do you think has greatest **positiv/negative impact** on your **health**?
	Yes 1 / Maybe 2 / No 3	Don't know 99	READ OUT: ALL THE TIME (21 - 30 times) 1	OFTEN (11-20 times) 2	SOMETIMES (3-10 times) 3	RARELY (once or twice) 4 / NEVER 5	Yes 1 / Maybe 2 / No 3	Yes 1 / Maybe 2 / No 3	Yes 1 / Maybe 2 / No 3	Eating/ Drinking 1; Physical activity 2; Livelihood 3; Medication 4; Smoking 5; Dangerous activity 6; Environment (social) 6; Environment (physical) 7; Other (Specify) 96
										Record up to 3 answers
										POSITIVE: 1st 2nd 3rd; NEGATIVE: 1st 2nd 3rd
male adult										
female adult										
1 child/ adoles.										
2 child										

SECTION 13: Weight and Health Related Behaviour and Food Eaten Away From Home (2/3)

	SAMPLE SELECTION OF SPs	(13.18) During the **last month**, how many main meals did you eat during a **typical day**? DO NOT INCLUDE SNACKS. DEFINE MEALS AND SNACKS. Number of meals	(13.19) **IF LESS THAN 3 in (13.18)** During the **last month**, which meals did you usually skip? ALLOW UP TO TWO RESPONSES. Breakfast 1, Lunch 2, Dinner 3	(13.20) Amongst breakfast, lunch and dinner, which meal did you most commonly eat the most food during the **last month**? Breakfast 1, Lunch 2, Diner 3	(13.21) What did you most commonly have for breakfast during **last month**? ALLOW UP TO FOUR COMPONENTS. Usually skip breakfast 97; Drink such as tea, coffee, porridge 1; Small portion of carbohydrates such as 2 bread slices, 1 pancake, handful arrow roots or oats or cereals 2; Large portion of carbohydrates 3; Small portion of proteins such as 1 egg, handful of beans, half-cup yog. 4; Large portion of proteins 5; Small portion of fruits eg 1 piece of banana, 1 apple 6; Large portion of fruits 7; Other (specify) 96	(13.22) How many times did you carry a lunch-box/ snacks to work/ school during the **last month**? IF NEVER ENTER ZERO AND ► (13.24). Did not work/ did not go to school 97 ► (13.24). Number of times	(13.23) What did you most commonly carry in your lunchbox/ as snacks to work/ school during the **last month**? ALLOW UP TO THREE RESPONSES. Coke or other sodas 1; Cake, biscuit, sweets, Mandazi 2; Crisps, chips 3; Samosa 4; Fruit 5; Prepared meal from previous day 6; Other (specify) 96	(13.24) How long before sleeping did you most commonly take your last main meal during the **last month**? Number of minutes	(13.25) Amongst breakfast, lunch and dinner, which meals did you most commonly eat outside home during the **last month**? Breakfast 1, Lunch 2, Dinner 3, Rarely ate outside home 4	**ONLY REFER TO FOOD BOTH PREPARED AND EATEN OUTSIDE HOME** (13.26) How many **main meals** did you eat outside home that were also prepared outside home **last month**? IF NONE ENTER ZERO AND ► (13.29). Nb of meals	(13.27) Which kind of **main meals** did you eat outside home that were prapared outside home **last month**? ALLOW UP TO 2 RESPONSES PLUS USUAL ACCOMPANIMENT. Roasted maize 1; Sausages 2; Meat stew 3; Roasted meat 4; Stewed pulses 5; Deep fried fish 6; Stewed vegetables 7; Fried eggs 8; Mandazi 9; Samosa 10; **Usually plus:** Chips 11; Ugali 12; Rice 13; Chapati 14; Mukimo 15; Bread 16; Other (specify) 96
	male adult		1st / 2nd		1st / plus 2nd / plus 3rd / plus 4th		1st / plus 2nd / plus 3rd				1st / 2nd / plus1st / plus2nd
	female adult		1st / 2nd		1st / plus 2nd / plus 3rd / plus 4th		1st / plus 2nd / plus 3rd				1st / 2nd / plus1st / plus2nd
1	child/ adoles.		1st / 2nd		1st / plus 2nd / plus 3rd / plus 4th		1st / plus 2nd / plus 3rd				1st / 2nd / plus1st / plus2nd
2	child		1st / 2nd		1st / plus 2nd / plus 3rd / plus 4th		1st / plus 2nd / plus 3rd				1st / 2nd / plus1st / plus2nd

SECTION 13: Weight and Health Related Behaviour and Food Eaten Away From Home (3/3)

ONLY REFER TO FOOD AND DRINKS BOTH PREPARED AND TAKEN OUTSIDE HOME

READ OUT: The next questions are about your individual health behavior

SAMPLE SELECTION OF SPs	(13.28) Where did you most commonly eat **main meals** outside home **last month**?	(13.29) How many **snacks** did you eat outside home that were also prepared outside home during the **last month**?	(13.30) Which kind of **snacks** did you eat outside home that were prepared outside home **last month**? (ALLOW UP TO THREE RESPONSES)	(13.31) Where did you most commonly eat **snacks** outside home **last month**?	(13.35) **In total**, how much did you spend on **all food and drinks** prepared and consumed outside home **last month**?	(13.36) Which are the **most important** factors you consider when buying food and drinks away from home? (ALLOW UP TO THREE RESPONSES)	(13.37a,b) When do you usually go to bed/when do you usually get up? Usually meaning on at least 21 days of the last month (RECORD IN AM/PM)	(13.37c) How many hours do you sleep on a regular basis? (DO TAKE AVERAGE FROM WEEK & WEEKEND DAYS)	(13.37d) How many hours did you sleep yesterday?	(13.38) Did you feeel **heavily stressed** by work or family duties on some days in the last month?	(13.39) During the last month, did you suffer from any of the following? (READ OUT, ALLOW UP TO 3 RESPONSES)
			Roasted maize, boiled maize 1			Price 1	a) Getting up AM	b) Going to bed PM	c) hours of sleep HOURS	READ OUT:	Frequent urination 1
	School/ work restaur./ canteen 1		Brown bread, brown chapati, pulses, raw nuts, seeds 2	School/ work restaur./ canteen 1		Taste 2			d) sleep yesterday HOURS	ALL THE TIME (21 - 30 days) 1	Excessive thirst 2
	Butchery rest. 2		Meat stew, eggs, sausage, fish 3	Butchery rest. 2		Habits 3				OFTEN (11-20 days) 2	Increased hunger 3
	Hawker 3		Candy, cake, dessert 4	Hawker 3		Social status/ lifestyle 4				SOMETIMES (3-10 days) 3	Weight loss 4
	Kiosk/ Shop 4		White bread, mandazi, samosa, meat pie, sandwich 5	Kiosk/ Shop 4		Nutritional value/ healthiness 5				RARELY (1-2 days) 4	Tiredness 5
	Other restaurant 5	IF NONE ENTER ZERO AND ► (13.35)	Roasted meat 6	Other restaurant 5		Food safety 6				NEVER 5	Lack of interest/ concentration 6
	Friends/ Neighbours 6		Salty snack, eg. crisps, chips 7	Friends/ Neighbours 6		Balanced diet 7					A tingling sensation or numbness in the hands or feet 7
			Milk or yoghurt 8			Freshness 8					Blurred vision 8
			Vegetables, fruits 9								Frequent infections 9
			Tea 10								Slow-healing wounds 10
	Other (specify) 96	Nb. of snacks	Other (specify) 96	Other (specify) 96	Ksh	Other (Specify) 96				CODE	NONE 77
male adult			1st 2nd 3rd			1st 2nd 3rd					1st 2nd 3rd
female adult			1st 2nd 3rd			1st 2nd 3rd					1st 2nd 3rd
1 child/ adoles.			1st 2nd 3rd			1st 2nd 3rd					1st 2nd 3rd
2 child			1st 2nd 3rd			1st 2nd 3rd					1st 2nd 3rd

(13.40) During the last month, did you suffer from any of the following? (READ OUT, ALLOW UP TO 3 RESPONSES)

		Center chest pain 1		the body (travelling pain) 7						
		Spread pain through arms, neck or back 2		Lightheadedness 8						
		Indigestion 3		Sweating 9						
		Feeling full or bloated 4		Nausea 10						
		Bringing up fluid or food into the gullet 5		Breathlessness 11						
		Heart attack 6		Heart failure 12						
				NONE 77						
	male adult	1st	2nd	3rd						
	female adult	1st	2nd	3rd						
1	child/ adoles.	1st	2nd	3rd						
2	child	1st	2nd	3rd	For children under 5 Years of age ► (15.01)					

SECTION 14: Physical Activity at Work

CHILDREN < 5 YEARS OF AGE SKIP SECTION 14 ► SECTION 15

READ OUT: NOW, I AM ASKING ABOUT WORK RELATED PHYSICAL ACTIVITY. FOR THE RESPONSES, PLEASE CONSIDER THE PERIOD OF **THE LAST 6 MONTHS**. PLEASE CONSIDER ALL OCCUPATIONAL ACTIVITIES.

SAMPLE SELECTION OF SPs	(14.01) REPORT MEMBER ID FROM FLAP FOR PERSONS SELECTED FOR WEIGHT MEASUREMENT ID CODE	HELP FOR INTERVIEWER During the last six months, what kind of work activities did you do in a **typical week**? PROBE TO SEE WHAT TO INCLUDE	(14.02) During the last six months, how many days did you **usually** work in a **typical week**? INCLUDE ALL OCCUPATIONAL ACTIVITIES	(14.03) During the last six months, how many hours did you **usually** work in a **typical working day**? INCLUDE ALL OCCUPATIONAL ACTIVITIES	(14.04) READ OUT STORY A How often do you think **A**'s occupational activities require **lots of** physical effort in a **typical week**? ALL OF THE TIME 1 MOST OF THE TIME 2 SOME OF THE TIME 3 NONE/ ALMOST NONE OF THE TIME 4	(14.05) READ OUT STORY B How often do you think **B**'s occupational activities require **lots of** physical effort in a **typical week**? ALL OF THE TIME 1 MOST OF THE TIME 2 SOME OF THE TIME 3 NONE/ ALMOST NONE OF THE TIME 4	(14.06) READ OUT STORY C How often do you think **C**'s occupational activities require **lots of** physical effort in a **typical week**? ALL OF THE TIME 1 MOST OF THE TIME 2 SOME OF THE TIME 3 NONE/ ALMOST NONE OF THE TIME 4	(14.07) How often do your occupational activities require **lots of** physical effort in a **typical week**? INCLUDE ALL OCCUPATION. ACTIVITIES ALL OF THE TIME 1 MOST OF THE TIME 2 SOME OF THE TIME 3 NONE/ ALMOST NONE OF THE TIME 4	(14.08) Does your job require you to lift, pull, or push above 5 kgs (eg more than 5l jerrycan of water) **regularly**? Yes 1 No 2	(14.09) Does your job require you to lift, pull, or push weights more than 0.5 kg but less than 5 kgs **regularly**? Yes 1 No 2	(14.10) Does your job require you to climb stairs, inclines, or hills **regularly**? Yes 1 No 2	(14.11) Does your job require you to stoop, kneel, bend over or crouch **regularly**? Yes 1 No 2	(14.12) Does your job require you to reach for supplies, materials, or balance items etc. **regularly**? Yes 1 No 2	(14.13) Does your job require you to walk around **regularly** ? Yes 1 No 2
male adult															
female adult															
	ONLY ASK FOR AGE 10 AND ABOVE.				FOR <13: ONLY ASK CAREGIVER IF NOT ASKED ABOVE ALREADY										
1 child/ adoles.															

STORY A

Person A is a primary school teacher. Person A is teaching English and Math lessons.

A is usually teaching 7 hours a day, 5 days a week. Person A does teaching mainly standing but sometimes sitting down.

1 day a week for 7 hours that day, Person A is operating the kiosk of his/her spouse.

RESPONDENT ID ON BEHALF OF CHILD **IF CHILD IS BELOW 13**:

STORY B

Person B is a casual construction worker

B usually works 7 hours a day, 6 days a week.

Most of the times, B is responsible for providing coworkers with a sand cement mix. This involves transporting the ingredients to the mixing point, manually mixing sand, cement and water and transporting the mix to the coworkers with a wheelbarrow.

STORY C

Person C works in a butchery.

C usually works 7 hours a day, 6 days a week.

C usually receives a full cow carcas three times a week that he has to cut into large pieces and hang. This takes him 30 minutes per cow.

When serving customers, C sometimes has to unhang the pieces. Most of the time C can cut the meat for the customers from the hanging pieces directly.

C also is responsible for weighing and wrapping the meat and cutting into small pieces if the customer wishes.

SECTION 15: Physical and leisure related activity

FEMALE SP RESPONDENT ID: ____

(15.01) How do you usually get to/ from school/ work? (IF MAIN JOB IS HOUSEWIFE ► (15.05)b
TICK THE ONE THAT APPLIES.

Foot 1 | Car 2 | Bicycle 3 | Matatu 4 | 96
Boda boda 5 | Motor-cycle 6 | Don't work/ don't attend school 97 | ↑Other (specify)

ONLY IF (15.01) IS FOOT OR BICYCLE

(15.02) How many times did you go to/ from school/work like this during the **last month**? (1 WAY = 1 TIME) ____ Times

(15.03) About how many minutes did this take you each time? ____ Min
IF HIGH FLUCTUATION, REPORT AVERAGE

(15.04) How many times did you choose to do this **for the purpose of** engaging in physical activity, if any? ____ Times

	READ OUT ACTIVITIES ONLY CAPTURE ACTIVITIES DURING LEISURE TIME, i.e. THAT ARE NOT RELATED TO OCCUPATIONAL ACTIVITIES	During **last month**, did you do [...] in your leisure time? TICK THE ONE THAT APPLIES	During **last month**, how many times did you do [...]?	During **last month**, for how many minutes did you do [...]?
(15.05)a	HOUSEHOLD CHORES, EG CLEANING (OTHER THAN FOR HOUSEHELP AS MAIN OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)b	GARDENING AND LIVESTOCK CARE (OTHER THAN FOR FARMING OR FARMHELP AS OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		min
	NOT TO SCHOOL/ WORK:			
(15.05)c	WALKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)d	BIKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)e	WALKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)f	BIKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)g	PHYSICAL EXERCISE EDUCATION **(ONLY FOR INDIVIDUALS ATTENDING SCHOOL)**	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)h	JOGGING/RUNNING	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)i	USING JUMPING ROPE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)k	AEROBICS (EG SITUPS, STRETCHING)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)l	WEIGHT LIFTING	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)m	FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)n	VOLLEYBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)o	BASKETBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)p	DANCING (EG WHEN GOING OUT)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)q	OTHER PHYSICAL GAMES OR PLAYS	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)r	WATCHING TELEVISION/MOVIES/FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)s	SURFING INTERNET	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)t	SITTING TOGETHER WITH FAMILY AND FRIENDS AS YOU DRINK BEER	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)u	SITTING TOGETHER WITH FAMILY OR FRIENDS WITHOUT DRINKING BEER	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)v	READING (EG NEWPAPER/MAGAZINES)	Yes 1 / No 2 ► NEXT ACTIVITY		min

(15.06) Are you satisfied with the **kinds of physical activities** you are currenty doing during leisure time and **the extent to which you do them**?
Yes 1 ► (15.09) / No 2
(15.07) Why are you not satisfied?
It's too much ↑1 / It's too little 2 / Would like to shift to/ add other physical activities 3 / Other (Specify) 96

(15.08) Why don't you engage in the **kinds of physical activities** that you would like or **to the extent** that you would like to do them?
ALLOW UP TO THREE RESPONSES: 1st ____ 2nd ____ 3rd ____

Physical disability (chronic) 1
Illness/ injury (non-chronic) 2
Injury (chronic) 3
Lack of time 4
Negative society attitude 5
Lack of facilities/grounds 6
Insecurity 7
Bad weather 8
Gym is too costly 9
There is no need 10
Laziness/ lack of motivation or discipline 11
Other (specify) 96

(15.081) What could be a reason for you **to do more physical activities**?
ALLOW UP TO THREE RESPONSES: 1st ____ 2nd ____ 3rd ____

Sports programs by community 1
Possibility of going to the gym 2
Good weather 3
Health advice by doctors or expert 4
Family or friends joining 5
Free sports equipment in the cummunities 6
More time 7
Beauty reasons (lose weight/gain muscels) 8
Relieves pain 9
Other (Specify) 96

(15.09) Taking into acount the physical activity you do during **work and leisure**, how would you rate your **current** amount of physical activity **as compared to a healthy amount of physical activity**? READ OUT

TOO MUCH	GOOD	OK: NOT GOOD NOT INSUFFIC.	A LITTLE IN-SUFFICIENT	SEVERELY IN-SUFFICIENT	Not sure
1	2	3	4	5	99

(15.10) Taking into account the physical activity you do during **work and leisure,** how would you rate your **current** amount of physical activity **as compared to the amount of one year ago**? READ OUT

MUCH MORE	A LITTLE MORE	THE SAME	A LITTLE LESS	MUCH LESS	Not sure
1	2	3	4	5	99

SECTION 15: Physical and leisure related activity

MALE SP
RESPONDENT ID:

(15.01) How do you usually get to/ from school/ work? (IF MAIN JOB IS HOUSEWIFE ► (15.05)b

TICK THE ONE THAT APPLIES.

Foot 1 | Car 2 | Bicycle 3 | Matatu 4 | 96
Boda boda 5 | Motor-cycle 6 | Don't work/ don't attend school 97 | ↑Other (specify)

ONLY IF (15.01) IS FOOT OR BICYCLE

(15.02) How many times did you go to/ from school/work like this during the **last month**? **(1 WAY = 1 TIME)** ____ Times

(15.03) About how many minutes did this take you each time? ____ Min
IF HIGH FLUCTUATION, REPORT AVERAGE

(15.04) How many times did you choose to do this **for the purpose of** engaging in physical activity, if any? ____ Times

	READ OUT ACTIVITIES ONLY CAPTURE ACTIVITIES DURING LEISURE TIME, i.e. THAT ARE NOT RELATED TO OCCUPATIONAL ACTIVITIES	During **last month**, did you do [...] in your leisure time? TICK THE ONE THAT APPLIES	During **last month**, how many times did you do [...]?	During **last month**, for how many minutes did you do [...]?
(15.05)a	HOUSEHOLD CHORES, EG CLEANING (OTHER THAN FOR HOUSEHELP AS MAIN OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)b	GARDENING AND LIVESTOCK CARE (OTHER THAN FOR FARMING OR FARMHELP AS OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		min
	NOT TO SCHOOL/ WORK:			
(15.05)c	WALKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)d	BIKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)e	WALKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)f	BIKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)g	PHYSICAL EXERCISE EDUCATION **(ONLY FOR INDIVIDUALS ATTENDING SCHOOL)**	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)h	JOGGING/RUNNING	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)i	USING JUMPING ROPE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)k	AEROBICS (EG SITUPS, STRETCHING)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)l	WEIGHT LIFTING	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)m	FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)n	VOLLEYBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)o	BASKETBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)p	DANCING (EG WHEN GOING OUT)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)q	OTHER PHYSICAL GAMES OR PLAYS	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)r	WATCHING TELEVISION/MOVIES/FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)s	SURFING INTERNET	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)t	SITTING TOGETHER WITH FAMILY AND FRIENDS AS YOU DRINK BEER	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)u	SITTING TOGETHER WITH FAMILY OR FRIENDS WITHOUT DRINKING BEER	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)v	READING (EG NEWPAPER/MAGAZINES)	Yes 1 / No 2 ► NEXT ACTIVITY		min

(15.06) Are you satisfied with the **kinds of physical activities** you are currenty doing during leisure time and **the extent to which you do them**?
Yes 1 / No 2 ► (15.09)

(15.07) Why are you not satisfied?
It's too much ↑1 | It's too little 2 | Would like to shift to/ add other physical activities 3 | Other (Specify) 96

(15.08) Why don't you engage in the **kinds of physical activities** that you would like or **to the extent** that you would like to do them?
ALLOW UP TO THREE RESPONSES: 1st ____ 2nd ____ 3rd ____

Physical disability (chronic) 1 | Illness/ iniury (non-chronic) 2 | Injury (chronic) 3 | Lack of time 4 | Negative society attitude 5 | Lack of facilities/arounds 6 | Insecurity 7 | Bad weather 8 | Gym is too costly 9 | There is no need 10 | Laziness/ lack of motivation or discipline 11 | Other (specify) 96

(15.081) What could be a reason for you **to do more physical activities**?
ALLOW UP TO THREE RESPONSES: 1st ____ 2nd ____ 3rd ____

Sports programs by community 1 | Possibility of going to the gym 2 | Good weather 3 | Health advice by doctore or expert 4 | Family or friends joining 5 | Free sports equipment in the cummunities 6 | More time 7 | Beauty reasons (lose weight/gain muscels) 8 | Relieves pain 9 | Other (Specify) 96

(15.09) Taking into acount the physical activity you do during **work and leisure**, how would you rate your **current** amount of physical activity **as compared to a healthy amount of physical activity**? READ OUT

TOO MUCH	GOOD	OK: NOT GOOD NOT INSUFFIC.	A LITTLE IN-SUFFICIENT	SEVERELY IN-SUFFICIENT	Not sure
1	2	3	4	5	99

(15.10) Taking into account the physical activity you do during **work and leisure,** how would you rate your **current** amount of physical activity **as compared to the amount of one year ago**? READ OUT

MUCH MORE	A LITTLE MORE	THE SAME	A LITTLE LESS	MUCH LESS	Not sure
1	2	3	4	5	99

SECTION 15: Physical and leisure related activity

CHILD1 /ADOLESC SP CAREGIVER RESPONDENT ID:

(15.01) How do you usually get to/ from school/ work? (IF MAIN JOB IS HOUSEWIFE ► (15.05)b

TICK THE ONE THAT APPLIES.

Foot 1 | Car 2 | Bicycle 3 | Matatu 4 | 96 | Boda boda 5 | Motor-cycle 6 | Don't work/ don't attend school 97 | ↑Other (specify)

ONLY IF (15.01) IS FOOT OR BICYCLE

(15.02) How many times did you go to/ from school/work like this during the **last month**? **(1 WAY = 1 TIME)** ____ Times

(15.03) About how many minutes did this take you each time? ____ Min

IF HIGH FLUCTUATION, REPORT AVERAGE

(15.04) How many times did you choose to do this **for the purpose of** engaging in physical activity, if any? ____ Times

	READ OUT ACTIVITIES ONLY CAPTURE ACTIVITIES DURING LEISURE TIME, i.e. THAT ARE NOT RELATED TO OCCUPATIONAL ACTIVITIES	During **last month**, did you do [...] in your leisure time? TICK THE ONE THAT APPLIES	During **last month**, how many times did you do [...]?	During **last month**, for how many minutes did you do [...]?
(15.05)a	HOUSEHOLD CHORES, EG CLEANING (OTHER THAN FOR HOUSEHELP AS MAIN OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)b	GARDENING AND LIVESTOCK CARE (OTHER THAN FOR FARMING OR FARMHELP AS OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		min
	NOT TO SCHOOL/ WORK:			
(15.05)c	WALKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)d	BIKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)e	WALKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(0.01)f	BIKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)g	PHYSICAL EXERCISE EDUCATION **(ONLY FOR INDIVIDUALS ATTENDING SCHOOL)**	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)h	JOGGING/RUNNING	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)i	USING JUMPING ROPE	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)k	AEROBICS (EG SITUPS, STRETCHING)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)l	WEIGHT LIFTING	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)m	FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)n	VOLLEYBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)o	BASKETBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)p	DANCING (EG WHEN GOING OUT)	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)q	OTHER PHYSICAL GAMES OR PLAYS	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)r	WATCHING TELEVISION/MOVIES/FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)s	SURFING INTERNET	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)t	**ONLY IF AGE>12**:SITTING TOGETHER WITH FAMILY AND FRIENDS AS YOU DRINK BEER	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)u	SITTING TOGETHER WITH FAMILY OR FRIENDS WITHOUT DRINKING BEER	Yes 1 / No 2 ► NEXT ACTIVITY		min
(15.05)v	READING (EG NEWPAPER/MAGAZINES)	Yes 1 / No 2 ► NEXT ACTIVITY		min

(15.06) Are you satisfied with the **kinds of physical activities** you are curreny doing during leisure time and **the extent to which you do them**?

Yes 1 ► (15.09) / No 2

(15.07) Why are you not satisfied?

It's too much ↑1 | It's too little 2 | Would like to shift to/ add other physical activities 3 | Other (Specify) 96

(15.08) Why don't you engage in the **kinds of physical activities** that you would like or **to the extent** that you would like to do them?

ALLOW UP TO THREE RESPONSES — 1st ____ 2nd ____ 3rd ____

Physical disability (chronic) 1 | Illness/ injury (non-chronic) 2 | Injury (chronic) 3 | Lack of time 4 | Negative society attitude 5 | Lack of facilities/grounds 6 | Insecurity 7 | Bad weather 8 | Gym is too costly 9 | There is no need 10 | Laziness/ lack of motivation or discipline 11 | Other (specify) 96

(15.081) What could be a reason for you **to do more physical activities**?

ALLOW UP TO THREE RESPONSES — 1st ____ 2nd ____ 3rd ____

Sports programs by community 1 | Possibility of going to the gym 2 | Good weather 3 | Health advice by doctore or expert 4 | Family or friends joining 5 | Free sports equipment in the cummunities 6 | More time 7 | Beauty reasons (lose weight/gain muscels) 8 | Relieves pain 9 | Other (Specify) 96

(15.09) Taking into acount the physical activity you do during **work and leisure**, how would you rate your **current** amount of physical activity **as compared to a healthy amount of physical activity**? READ OUT

TOO MUCH 1 | GOOD 2 | OK: NOT GOOD NOT INSUFFIC. 3 | A LITTLE IN-SUFFICIENT 4 | SEVERELY IN-SUFFICIENT 5 | Not sure 99

(15.10) Taking into account the physical activity you do during **work and leisure**, how would you rate your **current** amount of physical activity **as compared to the amount of one year ago**? READ OUT

MUCH MORE 1 | A LIITLE MORE 2 | THE SAME 3 | A LITTLE LESS 4 | MUCH LESS 5 | Not sure 99

SECTION 15: Physical and leisure related activity

CHILD 2 SP CAREGIVER RESPONDENT ID:

(15.01) How do you usually get to/ from kindergarden? (IF NOT GOING OUTSIDE HOUSE ► (15.05)b

TICK THE ONE THAT APPLIES.

Foot 1 | Car 2 | Bicycle 3 | Matatu 4 | 96 | Boda boda 5 | Motor-cycle 6 | Don't work/ don't attend school 97 | ↑Other (specify)

ONLY IF (15.01) IS FOOT OR BICYCLE

(15.02) How many times did you go to/ from school/work like this during the **last month**? **(1 WAY = 1 TIME)** ____ Times

(15.03) About how many minutes did this take you each time? ____ Min

IF HIGH FLUCTUATION, REPORT AVERAGE

(15.04) How many times did you choose to do this **for the purpose of** engaging in physical activity, if any? ____ Times

	READ OUT ACTIVITIES ONLY CAPTURE ACTIVITIES DURING LEISURE TIME, i.e. THAT ARE NOT RELATED TO OCCUPATIONAL ACTIVITIES	During **last month**, did you do [...] in your leisure time? TICK THE ONE THAT APPLIES	During **last month**, how many times did you do [...]?	During **last month**, for how many minutes did you do [...]?
(15.05)a	HOUSEHOLD CHORES, EG CLEANING (OTHER THAN FOR HOUSEHELP AS MAIN OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)b	GARDENING AND LIVESTOCK CARE (OTHER THAN FOR FARMING OR FARMHELP AS OCCUPATION)	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
	NOT TO SCHOOL/ WORK:			
(15.05)c	WALKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(0.01)d	BIKING FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(0.01)e	WALKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(0.01)f	BIKING NOT FOR EXERCISE	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)g	PHYSICAL EXERCISE EDUCATION **(ONLY FOR INDIVIDUALS ATTENDING SCHOOL)**	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)h	JOGGING/RUNNING	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)i	USING JUMPING ROPE	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)k	AEROBICS (EG SITUPS, STRETCHING)	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)l	WEIGHT LIFTING	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)m	FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)n	VOLLEYBALL	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)o	BASKETBALL	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)p	DANCING (EG WHEN GOING OUT)	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)q	OTHER PHYSICAL GAMES OR PLAYS	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)r	WATCHING TELEVISION/MOVIES/FOOTBALL	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)s	SURFING INTERNET	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)t	SITTING TOGETHER WITH FAMILY AND FRIENDS AS YOU DRINK BEER	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)u	SITTING TOGETHER WITH FAMILY OR FRIENDS WITHOUT DRINKING BEER	Yes 1 / No 2 ► NEXT ACTIVITY		____ min
(15.05)v	READING (EG NEWPAPER/MAGAZINES)	Yes 1 / No 2 ► NEXT ACTIVITY		____ min

(15.06) Are you satisfied with the **kinds of physical activities** you are currenty doing during leisure time and **the extent to which you do them**?

Yes 1 ► (15.09) / No 2

(15.07) Why are you not satisfied?

It's too much ↑1 | It's too little 2 | Would like to shift to/ add other physical activities 3 | Other (Specify) 96

(15.08) Why don't you engage in the **kinds of physical activities** that you would like or **to the extent** that you would like to do them?

ALLOW UP TO THREE RESPONSES — 1st ____ 2nd ____ 3rd ____

Physical disability (chronic) 1; Illness/ iniury (non-chronic) 2; Injury (chronic) 3; Lack of time 4; Negative society attitude 5; Lack of facilities/grounds 6; Insecurity 7; Bad weather 8; Gym is too costly 9; There is no need 10; Laziness/ lack of motivation or discipline 11; Other (specify) 96

(15.081) What could be a reason for you **to do more physical activities**?

ALLOW UP TO THREE RESPONSES — 1st ____ 2nd ____ 3rd ____

Sports programs by community 1; Possibility of going to the gym 2; Good weather 3; Health advice by doctore or expert 4; Family or friends joining 5; Free sports equipment in the cummunities 6; More time 7; Beauty reasons (lose weight/gain muscels) 8; Relieves pain 9; Other (Specify) 96

(15.09) Taking into acount the physical activity you do during **work and leisure**, how would you rate your **current** amount of physical activity **as compared to a healthy amount of physical activity**? READ OUT

TOO MUCH 1 | GOOD 2 | OK: NOT GOOD NOT INSUFFIC. 3 | A LITTLE INSUFFICIENT 4 | SEVERELY INSUFFICIENT 5 | Not sure 99

(15.10) Taking into account the physical activity you do during **work and leisure,** how would you rate your **current** amount of physical activity **as compared to the amount of one year ago**? READ OUT

MUCH MORE 1 | A LITTLE MORE 2 | THE SAME 3 | A LITTLE LESS 4 | MUCH LESS 5 | Not sure 99

SECTION 15/2: Physical and leisure realted activity

(15.11) How would you rate your **current overall healthiness**?
READ OUT

	VERY GOOD		GOOD		OK, NOT GOOD NOT POOR		A LITTLE POOR		VERY POOR		Not sure	
FEMALE SP ID		1		2		3		4		5		99
MALE SP ID:		1		2		3		4		5		99
CHILD/ADOLESC: ID		1		2		3		4		5		99
CHILD 2 ID		1		2		3		4		5		99

(15.12) How would you rate your healthiness **as compared to one year ago**?
READ OUT

	MUCH BETTER		A LITTLE BETTER		THE SAME		A LITTLE WORSE		MUCH WORSE		Not sure	
FEMALE SP ID		1		2		3		4		5		99
MALE SP ID:		1		2		3		4		5		99
CHILD/ADOLESC: ID		1		2		3		4		5		99
CHILD 2 ID		1		2		3		4		5		99

SECTION 16: Beauty Ideals

IF CHILD 1/ADOL. SP AGE 13 AND ABOVE

	READ OUT: NOW, I WILL ASK QUESTIONS ABOUT YOUR PERCEPTION OF DIFFERENT BODY IMAGES. PLEASE CONSIDER THE PICTURES OF FEMALE AND MALE ADULTS. IF DONT KNOW CODE 99. IF NONE CODE "NONE"	FEMALE SP RESPON-DENT ID:	MALE SP RESPON-DENT ID:	ADOLESCENT SP RESPON-DENT ID:
(16.01)	Which one of the bodies resembles your **current** stature?			
(16.02)	Which one of the bodies would you say resembles your body stature **one year ago**?			
(16.03)	Which one of the bodies do you think resembles your **ideal** body stature?			
(16.04)	What would be your **ideal** weight?	kg	kg	kg
	FOR ALL QUESTIONS BELOW: IF YES, PROBE: "WHICH ONE(S)?". IF NO, CODE "NONE", IF not sure, CODE "99"			
(16.05)	Would you say that any of the **female** bodies is healthiest?			
(16.06)	Would you say that any of the **male** bodies is healthiest?			
	DEFINE EXCESS WEIGHT: WEIGHING MORE THAN BEST FOR HEALTH			
(16.11)	Would you classify any **female** body as having **excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST BODY.			
(16.12)	Would you classify any **male** body as having **excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST BODY.			
	DEFINE STRONG EXCESS WEIGHT: WEIGHING MUCH MORE THAN BEST FOR HEALTH			
(16.13)	Would you classify any **female** body as having **strong excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST BODY.			
(16.14)	Would you classify any **male** body as having **strong excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNEST TO BIGGEST BODY.			
(16.15)	Would you say that any **female** body has a high risk of developing diabetis? ALLOW UP TO 3 RESPONSES. RANK ACCORDING TO LIKELIHOOD.	1st 2nd 3rd	1st 2nd 3rd	
(16.16)	Would you say that any **male** body has a high risk of developing diabetis? ALLOW UP TO 3 RESPONSES. RANK ACCORDING TO LIKELIHOOD.	1st 2nd 3rd	1st 2nd 3rd	
(16.17)	Would you say that any **female** body has a high risk of developing a heart disease? ALLOW UP TO 3 RESPONSES. RANK ACCORDING TO LIKELIHOOD.	1st 2nd 3rd	1st 2nd 3rd	
(16.18)	Would you say that any **male** body has a high risk of developing a heart disease? ALLOW UP TO 3 RESPONSES. RANK ACCORDING TO LIKELIHOOD.	1st 2nd 3rd	1st 2nd 3rd	

FOR CHILD 2 SP AND IF CHILD 1/ ADOLESESCENT SP AGE 5-12 ASK THE FOLLOWING QUESTIONS TO MOTHER OF THAT SP

READ OUT: PLEASE CONSIDER THIS PICTURE OF CHILDREN.
DEFINE EXCESS/ STRONG EXCESS/ TOO LITTLE WEIGHT PRIOR TO CORRESPONDING QUESTIONS

MOTHER OF CHILD 1 RESPONDENT ID: 2012 2015
MOTHER OF CHILD 2 RESPONDENT ID:

		CHILD 1	CHILD 2
(16.23)	Which one of the bodies would you say resembles an ideal body stature for **boys**?		
(16.24)	Which one of the bodies would you say resembles an ideal body stature for **girls**?		
	FOR ALL FOLLOWING QUESTIONS: IF YES, PROBE "WHICH ONE". IF NO, CODE "NONE", IF not sure, CODE "99"		
(16.25)	Would classify any **boy** as having **excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST.		
(16.26)	Would classify any **girl** as having **excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST.		
(16.27)	Would classify any **boy** as having **strong excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST.		
(16.28)	Would classify any **girl** as having **strong excess weight**? PROBE FOR FIRST ONE LOOKING FROM SKINNIEST TO BIGGEST.		

SECTION 17/1: Weight Related Risk Factors

SAMPLE SELECTION OF SPs	(17.01) REPORT MEMBER ID FROM FLAP FOR PERSONS SELECTED FOR WEIGHT MEASUREMENT	(17.011) FOR CHILD2 and IF CHILD1/ADOLESCENTS IS YOUNGER THAN 13; LET MOTHER OF THE SP RESPOND	(17.05) ONLY ASK MOTHER OF INFANT (0-2) Are you currently breastfeeding an infant?	(17.06) During the **last 2 weeks**, have you suffered from an acute illness/ condition that resulted in weight loss?	(17.07) When is your birthday? COPY YEAR FROM FLAP AND MATCH AGAIN WITH THE GIVEN INFOR FROM 2012		(17.08) ONLY ASK IF AGE 13 OR OLDER Do you drink alcohol?	(17.09) During **last month**, how much alcoholic beverages did you drink?	(17.10) During **last month,** on how many days did you drink alcoholic beverages?	(17.11) Did you ever regularly **smoke** cigarettes?	(17.12) During **last month**, how many cigarettes did you smoke?	(17.121) If you are currently smoking or if you smoked in the past, what could be **reason for you to quit**?
												Health issues 1
												Doctoral/expert advice 2
												Advice by family/friends 3
												Financial situation 4
												Family/partner demand 5
							Yes 1			Yes 1		Info campaigns 6
			Yes 1	Yes 1	MONTH (2 DIGITS)	YEAR (4 DIGITS)	No 2			No 2		Don't want to stop 7
	ID CODE	ID CODE MOTHER	No 2	No 2			► (17.11)	LITRES	DAYS	► (17.14)	NUMBER OF CIGAR.	Other (Specify) 96
male adult												
female adult												
1 child/ adoles.												
2 child/ adoles.												

	(17.14) How many month were you breastfed exclusively? DEFNIE EXCLUSIVELY BREASTFED, AS NOT GIVING ANY OTHER LIQUIDS OR SEMI, SOLID OR SEMI-SOLID FOODS BESIDE BREASTFEEDING	(17.15) Did you get pre-natal care before you were born?	(17.16) What do you think is your **current** weight?	(17.18) Does or did either one of your mother/ father/ grandparents or siblings suffer from **diabetes** type 2?	(17.19) Did either one of your mother/ father/ grandparents or siblings suffer from a **heart attack** before the age of 60?	(17.22) During last 12 months, how many **times** have you seen a GP/doctor or visit a clinic for your own purpose?	(17.23) What was the reason?	(17.24) What did the doctor/clinic charge you for the service if it was not for free?
							Pain/ felt unwell 1	
							Check-up 2	
							Regular visit 3	
							Emergency (injury) 4	Include cost for
				Yes (specify) 1	Yes (specify) 1	Often (more than 6) 1	Pre-natal care 5	medicine and service
				No 2	No 2	Sometimes (3-5) 2	Need for prescription 6	If it was for free
	ASK MOTHER IF POSSIBLE			Don't know 99	Don't know 99	Rarely (1-2) 3	Vaccination 7	CODE '0'
	MONTHS	Yes 1 No 2	WEIGHT IN KG	(specify)	(specify)	Never I► (END) 4	Other (Specify) 96	Ksh
male adult								
female adult								
	CONFIRM WITH IMMUNIZATION CARD IF POSSIBLE							
1 child/ adoles.								
2 child/ adoles.								

Make sure to set appointments for the measurements, which will be conducted by a local nurse-remind the respondents to stay fastening the morning before for the measurements as it will change the results

SECTION 17/2: Anthropometry and Bio-medical Measurements

Date of Measurements	DAY	MONTH	YEAR	NURSE ID/ NAME		

THIS SECTION IS TO BE FILLED BY NURSE; PLEASE START WITH EXPLAINING THE MEASUREMENTS AND GETTING CONSENT AGAIN FROM EVERY PARTICIPANT (SP)

SAMPLE SELECTION OF SPs	(17.25) REPORT MEMBER ID FROM F LAP FOR PERSONS SELECTED FOR WEIGHT MEASUREMENT		(17.26) FOR CHILD 2 and IF CHILD1/ADOLESC. IS YOUNGER THAN 13 LET MOTHER OF THE SP RESPOND	(17.27) ASK THE RESPONDENTS AGAIN OF THEIR CONSENTS FOR THE MEASUREMENTS THAT THEY GAVE IN BEGINNING OF THE INTERVIEW CODE '1' IF THEY GAVE CONSENT AND STILL WILLING TO TAKE THE MEASUREMENTS CODE '2' IF THEY ARE NOT WILLING TO GIVE CONSENTS TO THE MEASURMENTS-THANK THE RESPONDENT AND TAKE THE MEASUREMENT ONLY FROM THE ONES GIVING CONSENT	(17.28) ONLY ASK FEMALE AGE 13 -50 Are you pregnant? Yes 1 No 2 ► (17.25) Don't know 99 ► (17.25)	(17.29) How old is the pregnancy?	(17.30) Did you eat or drink anything today beside water?	(17.31) When was the last time you ate or drink anything beside water?		(17.32) Have you ever been told by a doctor that you have diabetes, other than during pregnancy?	(17.33) Do you use any of the following? READ OUT	(17.34) Have you ever been told by a doctor that you have heart disease, such as heart attack, angina, abnormal heart rhythm or high blood pressure?	(17.35) Do you use any of the following? READ OUT
						Yes (Specify) 1 No 2	Yesterday 1 Today 2	USE 24h	Yes 1 No 2	Insulin injections 1 Metformin 2 Glucophage 3 Glibenclamide 4 Glipizide 5 None 6 Other (Specify) 96	Yes 1 No 2	Enalapril 1 Atenolol 2 Nifedipine 3 Telmisartan 4 Ipisartan 5 None 6 Other (Specify) 96
	ID	NAME	ID CODE MOTHER		► (17.25)	MONTHS (2 DIGITS)	CODE	DAY	HOUR	CODE	CODE	CODE	CODE
male adult													
female adult													
1 child/ adoles.													
2 child/ adoles.													

	(17.36) NOW I WOULD LIKE TO DO SOME MEASUREMENTS I WILL EXPLAIN EACH PROCEDURE TO YOU WRITE 97 IF RESPONDENT REFUSES			CALIBRATION WEIGHT	(17.37) DO NOT ASK, OBSERVE. What kind of cloth did [NAME] wear during measurements?	(17.38) Nr. of BP device	LET [NAME] SIT DOWN AT LEAST FOR FEW MINUTES-TAKE UPPER ARM TO DO BLOOD PRESSURE MEASUREMENTS		(17.39) Nr. of BL. GLUCOSE device	EXPLAIN AGAIN THAT THIS BLOOD SAMPLE IS ONLY FOR THE PURPOSE OF MEASURING BLOOD GLUCOSE AND IS NOT ABLE TO TEST FOR ANYTHING ELSE-THE SAMPLE WILL BE DISTROYED IMMEDIATELY AFTER	After the measurements thank the respondents for their time and help! EXPLAIN TO THE RESPONDENTS! Their personal measurement results (anthropometry and bio-medical) will be provided to them as they like-in case of any questions they are free to call the responsible person in field. Kathrin Demmler (0704879894) or Alfred Moni (0711627237)
				KG						
	(17.36)a HEIGHT IN CM	(17.36)b WEIGHT IN KG	(17.36)c CM HIP CIRCUM-FERENCE	(17.36)d CM WAIST CIRCUM-FERENCE	Light clothing 1 Light clothing + medical appliance (e.g. cast) 2 Other (specify) 96	REDO IF NECESSARY (WAIT AT LEAST 3MIN IN BETWEEN) (17.38)a BP systolic mmg Hg	(17.38)b BP diastolic mmg Hg	(17.38)c Pulse beats/min	Blood glucose fastening mg/dl		
male adult											
female adult											
						ONLY CHILDREN >15 YEARS			ONLY CHILDREN >10 YEARS		
1 child/ adoles.											
2 child/ adoles.											

Section 18: End of the Questionnaire

Could you please give us your cellphone number and/or at least two other family members/relatives/friends of your household such that we can contact you if we need more information?

NAME	PHONE NUMBER

For the purpose of providing you with your measuremnet results could you please give us also the cellphone numbers of the respondents (or the responding mothers) from the measurement section members/relatives/friends of your household such that we can contact you if we need more information?

NAME	PHONE NUMBER
SP **MALE** ADULT	
SP **FEMALE** ADULT	
SP **CHILD 1/ADOLESC** (OR MOTHER)	
MOTHER OF SP **CHILD 2**	

For enumerator's comments/notes

APPOINTMENT FOR MEASUREMENTS SET FOR [...]

	TIME	DAY	COMMENTS
SP **MALE** ADULT			
SP **FEMALE** ADULT			
SP **CHILD 1/ADOLESC**			
SP **CHILD 2**			

Declaration of Consent

1. I confirm that I have received information about the study and I understood the purpose of the study and procedure of measurements that will be taken in the survey : "**Supermarket purchase, the nutrition transition, and the burden of non-communicable diseases: an analytical observation in urban Kenya**".

2. I had enough opportunity to ask questions about the study and all my questions have been answered.

3. I agree that my body size, blood pressure, and blood sugar will be measured and that all my personal data will be coded with a number and not displayed with my name. I agree that my results are stored and publicized in the same manner, according to the Lower Saxony and federal data privacy act.

I feel completely informed and agree to the participation in the study "**Supermarket purchase, the nutrition transition, and the burden of non-communicable diseases: an analytical observation in urban Kenya**".

TOWN:……..DATE:……/……/2015

Name of the participant	Signature of participant /caregiver	code
Name of the participant	Signature of participant /caregiver	code
Name of the participant	Signature of participant /caregiver	code
Name of the participant	Signature of participant /caregiver	code
Name of responsible interviewer	Signature	code