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Food Policies and their Implications on Overweight and Obesity Trends in Selected Countries in the Near East and North Africa Region

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LIST OF ACRONYMS

BMI	Body mass index
CI	Confidence interval
DHS	Demographic and Health Survey
EFTA	European Free Trade Agreement
EMAA	European Mediterranean Association Agreement
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FBS	Food Balance Sheet
FTA	Free trade agreement
GATT	General Agreement on Tariffs and Trade
GCC	Gulf Cooperation Council
GDP	Gross domestic product
GHO	Global Health Observatory
HICs	High-income countries
HIECS	Household Income, Expenditure and Consumption Survey
IFPRI	International Food Policy Research Institute
LICs	Low-income countries
LMICs	Low- and middle-income countries
LSMS	Living Standard Measurement Survey
LSMS-ISA	Living Standard Measurement Study–Integrated Surveys on Agriculture
MICs	Middle-income countries
NCD	Non-communicable disease
NCD-RisC	Non-communicable Disease Risk Factor Collaboration
NENA	Near East and North Africa
ODIN	Open Data Inventory
USDA	United States Department of Agriculture
WDI	World Development Indicators
WHO	World Health Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

Regional and global trends in body weight show that the Near East and North Africa (NENA) region countries, especially the Gulf Cooperation Council (GCC) member countries, have the highest average body mass index and highest rates of overweight and obesity in the world. There exist several explanations that expound the high rates of overweight and obesity in most NENA countries, including the nutrition transition, urbanization, changes in lifestyle, and consequent reduction of physical activities. This study examines the implication of food policies, mainly trade and government food subsidies, on evolving nutritional transitions and associated body weight outcomes. We examine the evolution of trade (food) policies, food systems, and body weight outcomes across selected countries in the NENA region – Egypt, Jordan, and Iraq. In particular, we investigate the implications of important trade (food) policies in shaping diets and food systems as well as their implications on public health outcomes, mainly the rising levels of overweight and obesity in the NENA region. We provide a simple conceptual framework through which trade policies (tariff rates) and domestic government food policies (subsidies) may affect food systems and nutritional outcomes. An important and innovative feature of this study is that it compiles several macro- and micro-level datasets that allow both macro and micro-level analyses of the evolution of trade (food) policies and associated obesity trends. This approach helps to at least partly overcome the data scarcity that complicates rigorous policy research in the NENA region.

Overweight and obesity rates have almost doubled between 1975 and 2016, with varying rates and trends across regions. For instance, whereas body weight in the NENA region was comparable with that found in high-income countries in the early years, after the 1990s regional overweight and obesity rates became much higher than those in high-income countries. Specifically, while most high-income countries are experiencing a relative slowing of increases in overweight rates, the trend for the NENA region continues to increase at higher rates. The evolution of overweight rates for the GCC countries are even more concerning. These trends are likely to contribute to the already high burden of non-communicable diseases in the NENA region.

Contrary to the conventional view that overweight and obesity rates are urban problems, our findings show that rural body weight has been rising over the past few decades, sometimes at higher rates than in urban areas. In the absence of effective national and regional interventions and efforts to curb these trends, these rates are expected to increase in the coming decades. However, to date, the evolving efforts targeting the epidemic overweight and obesity rates in the NENA region have focused on urban residents. Our findings reinforce the need for new and integrated initiatives to lessen the ever-increasing overweight and obesity rates in urban and rural areas.

We also find that for most countries in the NENA region, overall food supply quadrupled in the period between 1960 and 2013. Despite some cross-country and temporal differences, countries' food import dependence and thus the importance of trade has been increasing over time, partly because population growth has increased demand for food. On average, food import dependence in the NENA region increased from about 40 percent in the 1970s to 60 percent in the 2010s. The overall role of trade (food imports) is much higher in the GCC region, countries known for having the highest obesity rates. Overall, the results reinforce the detrimental role of trade and imports in the food systems of the NENA countries.

Using alternative descriptive and predictive models, we show significant relationships between trade (food) policy indicators and food availability indicators, and, ultimately, important relationships between trade policies and body weight outcomes. We assess alternative trade and food policies, including tariff rates on primary (food) products and food-specific tariff rates (e.g., cereals). We find that countries with lower tariff rates have higher overweight and obesity rates. In particular,

countries that increase tariff rates on “unhealthy” foods (e.g., sugar and confectionery foods, fats and oils) are more likely to witness reductions in overweight and obesity rates. We also consider and examine generic government-related subsidies that can influence diets and nutritional outcomes. We find that higher rates of subsidies (as a share of government expenditure) are significantly associated with higher overweight and obesity rates. We theoretically and empirically identify some important channels through which alternative food policies may shape nutritional outcomes. Most importantly, the price of food items appears to be an important mechanism, and we empirically find that prices of “unhealthy” diets are inversely associated with body weight outcomes.

Overall, our analyses highlight that trade policies and government food subsidies should consider their nutritional implications on society. In addition, complementary domestic policies should address unintended (adverse) dietary and public health impacts of trade policies and government subsidies. Our results also call for nutrition-sensitive domestic policies that can increase the availability and affordability of nutritious foods at community and household levels. These instruments could include investments in agriculture to promote production of healthy and nutritious foods and policies that discourage imports of “unhealthy” foods. Given that food policies have other major objectives, including poverty reduction and food security targets, our analysis is partial, focusing on how food policies can affect overweight and obesity rates. A general equilibrium and economy-wide cost-benefit analysis of the overall implication of food policies remains an important future research avenue.

1 INTRODUCTION

The Near East and North Africa (NENA) countries are known for high levels of overweight and obesity. These patterns are observed for both children and adults.[1] Despite some variations across countries, on average 60 to 70 percent of adults in the NENA region are overweight, with obesity rates amounting to about half of this. For instance, according to the 2015 Demographic and Health Survey (DHS), 75 percent of adult Egyptian women are overweight and 48 percent are obese. These rates are almost twice the world average rates of overweight and obesity. Most predictions suggest that these rates are expected to further increase in the next few decades (Ng et al. 2014; Kilpi et al. 2014).[2] This upward trend is particularly the case in the NENA region as well as in other low- and middle-income countries (LMIC), while this trend has been slowing in high-income countries (Ng et al. 2014). High rates of overweight and obesity are strongly linked with high prevalence of non-communicable diseases (NCDs), such as cancer, heart disease, and stroke. Consistent with this, NCDs remain the major causes of death in many of the NENA countries, accounting for about 60 percent of annual deaths (Musaiger 2011; Kilpi et al. 2014). NCDs are creating a significant economic burden for these countries and their public health services.

There are several explanations for the high rates of overweight and obesity in most NENA countries, including lifestyle changes that reduced people's physical activities and a nutrition transition that shifted dietary patterns and increased the intake of energy-dense but low-nutrient foods. The nutrition transition seen in many parts of the world is commonly associated with unhealthy weight gains and related cardiovascular diseases (Popkin 1999; Harpham et al. 2003; Monda et al. 2007). Furthermore, many NENA countries have gone through some form of demographic transition involving significant levels of urbanization, a process that involves a transition in lifestyle as people shift to more sedentary livelihoods with limited physical activity and potential for unhealthy weight gains (Popkin 1999; Harpham et al. 2003; Monda et al. 2007; Abay and Amare 2018).

Despite lack of rigorous empirical evidence, international food trade and domestic government food policies may also contribute to existing nutritional transitions and associated body weight outcomes. Globalization and associated international trade can instrumentally shape food systems and influence diets and dietary patterns in ways that can increase overweight and obesity rates. For example, international and national trade policies can affect the production and availability of food by shaping food supply patterns. Various trade policies, including trade liberalization, in Central America and the Pacific region are shown to increase food imports and food availability (Thow and Hawkes 2009; Thow, Heywood et al. 2011). Besides increasing food imports, some types of trade policies can also encourage domestic production and marketing of processed food products or associated foreign direct investments. Similarly, government food subsidies may also shape dietary patterns, and hence contribute to nutritional transitions. For instance, Egypt's food subsidy program is associated with increased overweight and obesity (Asfaw 2007; Ecker et al. 2016).

Trade policies and government food subsidies represent important policymaking instruments and features in the NENA region. Most countries in the region satisfy a substantial share of their food demand through imports.[3] More specifically, the countries satisfy about 59 percent of their cereal needs and more than 90 percent of sugar and vegetable oils needs through imports (FAO

[1] Our definition of the NENA region includes 17 member countries of the Arab League: .Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the United Arab Emirates, and Yemen.

[2] Globally, the rate of obesity doubled between the 1970s and 2016.

[3] For instance, on average Jordan satisfies about 70 percent of total food demand through imports. This is much higher in the Gulf Cooperation Council (GCC) member countries, which import most of their food requirements.

2019). Some of these countries are also known for long-standing consumer food subsidy programs (Asfaw 2007; Ecker et al. 2016) targeting mostly recurrent food items, including wheat, rice, maize, sugar, and cooking oil. These programs are large enough that they cost these governments a substantial share of their annual budgets. Moreover, these policies have important implications in reducing the relative price of these food items, which may encourage people to (over)consume subsidized energy-dense food items, while discouraging consumption of relatively expensive nutrient-rich foods.

Trade policies and food subsidies in the NENA region could interact with the region's nutritional transition and associated high prevalence of overweight and obesity. Countries in the NENA region are known for other types of food policies and subsidies, including fuel and input subsidies, yet trade and government food subsidies are expected to be more consequential and relevant to the region's overall food system. However, rigorous empirical investigations of the relationship between trade (food) policies and body weight and related health outcomes in the NENA region have yet to come. Understanding the implications of trade (food) policies on food systems and obesity rates and related health outcomes is crucial to inform food policies and public health initiatives that can address the burden of diet-related chronic diseases in the region.

This report examines the relationships between various food (trade) policies and the prevalence of overweight (or obesity) in the NENA region. We pay particular attention to the links and implications of important trade (food) policies in shaping food systems as well as their implications on ultimate public health outcomes, mainly the rising regional levels of overweight and obesity. We employ both descriptive and predictive approaches to investigate this relationship. We conduct both macro and micro-level analyses of the evolution of trade (food) policies and associated obesity trends. For our macro-level analysis, we employ country-level data from the World Development Indicators (WDI) and FAOSTAT (FAO 2019; World Bank 2019), which provide information on food trade and food production as well as on policies characterizing these interactions worldwide. These data provide time-series information that covers several decades and most countries of the world, including the NENA region, where we particularly emphasize our analysis.

We then descriptively and predictively explore potential relationships between macro-level food (trade) policies and body weight outcomes (overweight and obesity rates). We further advance these macro-level insights using micro-level (country-specific) individual surveys and case studies. The micro-level individual data focus on three NENA countries: Egypt, Jordan, and Iraq. The selection of countries is based on the severity of their overweight and obesity epidemics and the availability of suitable micro-level data. We employ country-specific Demographic and Health Surveys (DHS); Household Income, Expenditure, and Consumption Surveys (HIECS); and Living Standard Measurement Surveys (LSMS) for the three chosen countries.

Through our macro-level analysis, we document the rising trends of overweight and obesity over time along with the chronological evolution of food (trade) policies in the NENA countries. We highlight some distinct regional features and trends of overweight and obesity rates. Globally, overweight rates have doubled between the 1970s and 2016. However, the rates and trends of overweight vary across regions. The NENA region countries, particularly the Gulf Cooperation Council (GCC) member countries, have the highest rate of overweight throughout the whole period, except at the beginning of our sample period (1970s) when most countries had comparable rates of overweight. Although the increasing trend in overweight slows after the early 2000s for many high-income countries, it continues to increase for the NENA region countries. This trend deserves greater attention.

We also show the evolution of food production, imports, and availability, along with associated dynamics, in contributing to these outcomes in the NENA countries. For most countries in the

NENA region, overall food supply quadrupled in the period 1960 to 2013. Despite some cross-country and temporal differences, countries' food import dependency (and hence the importance of trade) has been increasing over time. On average, food import dependence (the share of food demand satisfied by imports) in the NENA region increased from about 40 percent in the 1970s to 60 percent in the 2010s. The overall role of trade (food imports) is much higher in the GCC region, whose countries are known for low production potential but high obesity rates. Overall, the results reinforce the detrimental role of trade and imports in the food systems of NENA countries.

Using our descriptive and predictive models, we show significant associations between alternative trade (food) policy indicators and food availability indicators, and, ultimately, between trade policies and body weight outcomes. We employ alternative trade and food policies, including tariff rates on primary (food) products. Countries with low tariff rates have higher overweight and obesity rates. We particularly find that tariff rates on "unhealthy" foods (e.g., sugar and confectionery foods; fats and oils) are negatively associated with body weight outcomes, implying that those countries increasing tariff rates on unhealthy foods are more likely to witness a reduction in overweight and obesity rates. We also examine generic government related subsidies that can influence diets and nutritional outcomes. We find that higher rates of subsidies (as a share of government expenditure) are significantly associated with higher overweight and obesity rates.

Our micro-analysis further investigates the above macro-relationships at the individual level. We take a deeper look at micro-level evidence on potential associations between trade (food) policies and body weight outcomes. The micro-level data and analysis allow further decomposition and disaggregation of relationships and trends. For instance, consistent with a recent finding (NCD-RisC 2019), overweight and obesity rates are not urban-specific problems, as these trends have also been increasing in rural areas. In fact, some NENA countries are experiencing higher increases in overweight and obesity rates in rural areas than in urban areas; a pattern against the common view that urbanization is a major driver of the global rise in body weight. The implications of this pattern can inform public policies aiming at reducing epidemics of obesity. The micro-level analysis further allows disentangling of potential mechanisms through which specific trade (food) policies may affect individuals' nutritional and health outcomes. For this purpose, we identify potential channels through which alternative trade (food) policies can affect nutritional and body weight outcomes. We then examine potential linkages between these channels and intermediate outcomes that may ultimately affect nutritional and body weight outcomes.

Overall, our micro- and macro-level analyses document that overweight and obesity trends in the NENA region have been increasing and now are at alarming levels. Without proper interventions and public policies, these trends will continue to present major public health challenges to the economic and social development of these countries. Our findings suggest that trade (food) policies have important implications in shaping the nutrition transition and dietary patterns in the NENA region, which in turn may explain the prevalence and distribution of overweight and obesity across countries and communities. On the other hand, trade and food policies may also serve important roles in addressing overweight and obesity rates. These findings suggest that trade policies and government food subsidies should be reconsidered and redesigned to consider their nutritional implications on societies. Furthermore, complementary domestic policies will be needed to address unintended adverse dietary and public health impacts of trade policies and government subsidies, including nutrition-sensitive policies that can increase the availability and affordability of nutritious foods at community and household levels.

2 TRADE (FOOD) POLICIES AND NUTRITIONAL IMPLICATIONS

Trade policies have the potential to shape global food systems and influence domestic food environments through their effects on food production, processing, and distribution through several direct and indirect channels:

- Trade policies, including easing trade barriers and reducing tariff rates, can increase food imports, which in turn can affect the domestic food environment by increasing the availability and affordability of various foods.
- Efforts to ease trade barriers may encourage the flow of foreign direct investment, including investment in food processing industries and supermarket chains, which can increase domestic and global production of processed food. For instance, trade liberalization policies are commonly associated with the flourishing of food processing industries (Hawkes 2006).
- Trade policies can influence the relative prices of foods, which can affect consumers' food choices, dietary preferences, and consumption patterns (Shankar 2017). For instance, an increase in tariff rates on unhealthy foods can increase the relative prices of these foods relative to healthy foods, which in turn may discourage the consumption of energy-dense foods.
- Besides the above-mentioned direct channels, trade policies can indirectly influence domestic food environments by affecting the income and purchasing power of individuals as well as their distribution across communities. For instance, a country's increasing trade volume may trigger economic growth that can increase individuals' demand for food (Shankar 2017).

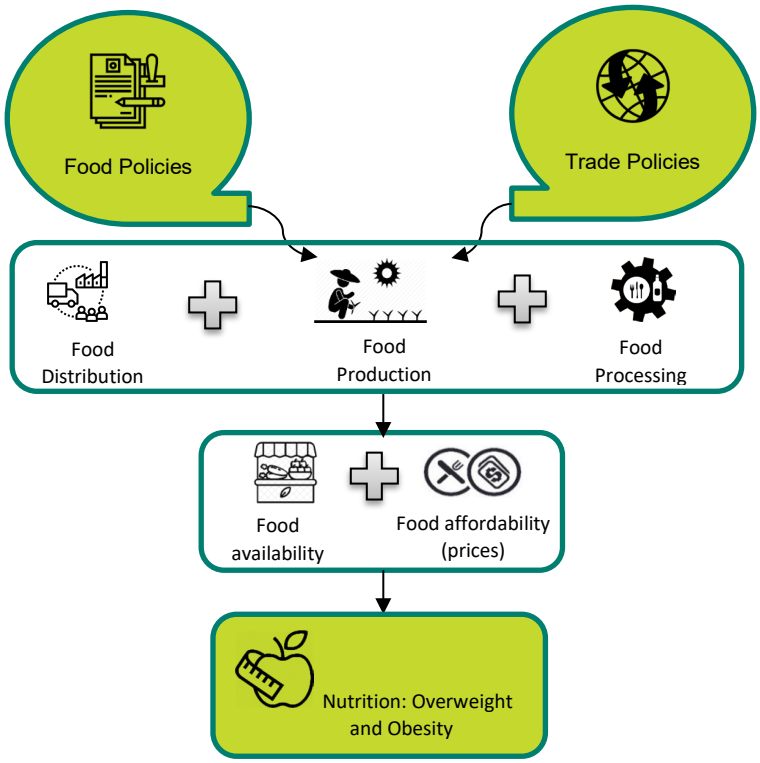
Similarly, governments' agricultural input and food subsidies can also influence domestic food systems, including food availability and affordability. Many low- and middle-income countries (LMICs) have policies that involve agricultural input subsidies and market-related supports for farmers. Many such policies are in the form of provisions of modern inputs, such as fertilizers, irrigation technologies, and extension services, as well as price guarantees and related market support. Most of these policies focus on specific staple cereals, which can shape the dietary patterns of smallholders. These agricultural policies can affect food environments in two important ways. First, agricultural input subsidies in most LMICs and in NENA region countries alike, encourage the production of a few staple cereals, which can increase the productivity of these specific crops and their availability in local food markets. These subsidies can induce overproduction of specific types of cereals with potential implications on the composition of domestic food systems and food environments. Second, apart from increasing the production and availability of subsidized food items, agricultural input subsidies and market-related support can make specific foods cheaper for consumers and food-processing industries, further affecting consumers' preferences as well as the quality of foods in the market (Hawkes et al. 2012).

Direct food subsidies are also common policy instruments in the NENA region and many other LMICs. Most food subsidy programs in the NENA region target specific staple food items and sometimes specific types of consumers (see Table 4.1 for details). Some NENA countries have consumer subsidy programs targeting mostly staple food items, including wheat, sugar, and cooking oil. These food subsidy programs are large and cost governments a substantial share of their budgets. For instance, the cost of the Egypt's food subsidy program amounts to about 2 percent of national GDP and between 5 and 6 percent of annual government expenditure (Abdalla and Al-Shawarby 2018). Similarly, food subsidies in Iraq amount to about 2 percent of that country's GDP (Sdralevich et al. 2014).

The major objectives of these food subsidy programs in the NENA region include reducing undernutrition in children and adults by ensuring the affordability of staple foods and stabilizing the price of common, recurrent food items. The emphasis on relatively poorer households is justified by the fact that these households spend a larger share of their income on purchases of recurrent food items, implying that subsidizing these items can reduce undernutrition and increase calorie intake (Breisinger et al. 2013). If targeted effectively, these types of food subsidies can significantly improve food security and reduce poverty (Breisinger et al. 2013).

Theoretically, food subsidy programs can affect consumers' diets through income and substitution effects (Timmer et al. 1983). First, subsidizing some food items increases consumers' real income and purchasing power, which can increase demand for subsidized and nonsubsidized food items. Second, subsidies on some food items increase the relative price of nonsubsidized foods, encouraging the substitution of unsubsidized food items with those covered by these subsidy programs. If food subsidy programs are not nutrition-sensitive, this substitution may have important implications on the diet composition and the health outcomes of individuals. Though it is theoretically intuitive, the question of whether these types of food policies improve undernutrition and calorie intake remains contested (Jensen and Miller 2011; Ecker et al. 2016). In particular, even though the impact of these food subsidies on reducing undernutrition remains questionable and potentially marginal (Kochar 2005; Jensen and Miller 2011; Ecker et al. 2016), subsidies are associated with overnutrition and, hence, overweight and obesity (Asfaw 2006; 2007; Ecker et al. 2016). Furthermore, most of these programs, whether in the NENA region or in other LMICs, are heavily criticized for their inefficiencies and targeting problems (Alderman and von Braun 1984; Löfgren and El-Said 2001; Kochar 2005; World Bank 2010; Kishore and Chakrabarti 2015).

Figure 2.1 Conceptual framework



Source: Authors.

Figure 2.1 provides a simple framework and conceptual linkages between alternative trade (food) policies and nutritional outcomes.[4] It shows that trade (food) policies can shape global and domestic food systems by influencing food production, distribution, and processing. The physical

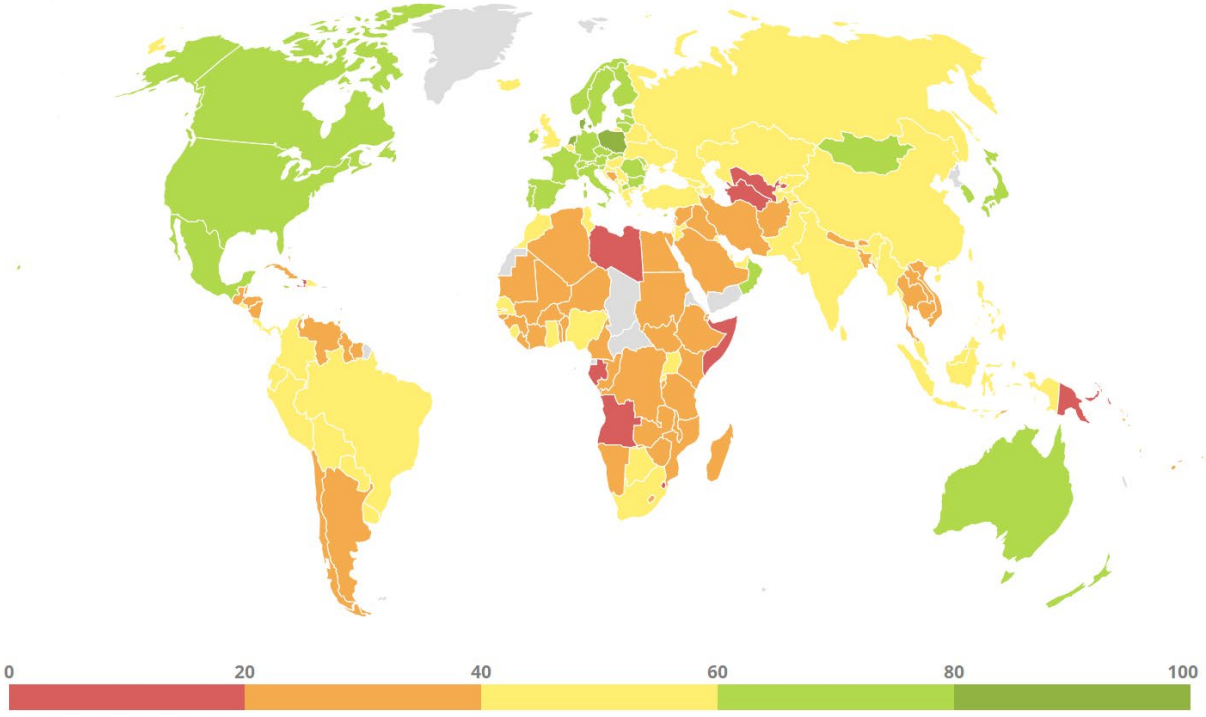
[4] This is a simplified, not comprehensive conceptual framework; we aim to focus on the most important channels.

supply and production of food, in turn, affects physical access (availability) and economic access (affordability) to food. Food availability and affordability influence individuals' diets and dietary patterns and are strongly linked with nutritional outcomes (undernutrition and overnutrition).

3 DATA AND DATA SOURCES

The NENA region is under-researched compared to other parts of the world. Data on the region remain scant and sometimes incomplete and patchy. Despite some progress led by international organizations, donors, universities, and governments, data scarcity remains a major challenge facing researchers in the region (Rizk, Salem, and Felsberger 2019; Breisinger et al. 2012). This is particularly the case for publicly available household- and individual-level data on nutrition, consumption, and related health outcomes. Information from the Open Data Watch Initiative, using a widely cited methodology that evaluates data availability and quality based on several indicators across many sectors, confirms these data limitations in the NENA region. Figure 3.1 shows a map with the Open Data Inventory (ODIN) weighted score (0–100), highlighting the stark differences between many countries in the NENA region and the rest of the world (ODIN 2019). Accordingly, countries such as Egypt, Saudi Arabia, Lebanon, Algeria, Iraq, Sudan, and Libya rank among the lowest in the world in terms of data availability, accessibility, and accuracy.[5] The issue of data availability in some cases is not attributable to the existence of data but rather to accessibility. The Open Data Barometer estimates that only 1.5 percent of the data collected in Arab countries is made available (ODDC 2015), citing technical data storage errors (not machine-readable) and legal barriers as contributing to this problem.

Figure 3.1 Open Data Inventory score, globally



Source: Open Data Inventory Initiative (ODIN 2019)

In particular, datasets that can provide detailed information on trade (food) policies and health outcomes of individuals are scant. To address this limitation, we combine various macro-level and

[5] Appendix Table A1 provides disaggregated scores and ranking across sectors. This table shows that the issue of data scarcity is most notable for household datasets surveying health topics and household income and expenditure. For example, the latest DHS data available for Morocco is from 2004, for Yemen from 2013, and for Egypt from 2014. Most of the GCC countries have no publicly available household datasets.

micro-level data sources. We employ three major sources of macro data: (1) the World Bank World Development Indicators (WDI), (2) the World Health Organization (WHO) Global Health Observatory (GHO) (NCD-RisC 2017; WHO 2019), and (3) the Food and Agriculture Organization of the United Nations (FAO) FAOSTAT. The WDI database is a major source of data for macroeconomic analysis. It serves an important source of information for economic indicators of countries, including gross domestic product (GDP), economic growth, trade balance, and government expenditure. The GHO database compiles and standardizes population-based body weight measurements from national and international sources; they are collated by the Non-communicable Disease Risk Factor Collaboration (NCD-RisC), originally from ministries of health and other national health and statistical agencies. These data have been well received and widely used in recent studies showing global trends and dynamics in body weight outcomes (NCD-RisC 2017; 2019).

The FAOSTAT data, particularly the Food Balance Sheet (FBS) database, provide comprehensive account of countries' food supply, production, and imports.[6] Despite some limitations, these data remain important sources of information and analysis for macro and meso-level studies on food systems. The FBS database compiles country level statistics related to food production, imports, and availability. These data come from government agencies and international reliable sources. After some adjustments to ensure data consistency, the FBS database provides a time series of important indicators of food supply and demand for each country.

Our macro-level analysis combines the WDI, GHO, and FAOSTAT macro-level data. This helps merge important information on trade (food) policies, food supply, and body weight outcomes. The WDI data provide information on important trade policies, including tariff rates, trade volumes, and government subsidies. The FAOSTAT database includes important information on food production, imports, and availability. Combining these macro-level data enables macro-level analysis of the relationship between alternative trade (food) policies and nutritional outcomes.

We complement our macro-level data and analysis using micro-level data from various programs and country-specific sources. We employ three major sources of individual data that provide anthropometric information as well as other outcomes that may be influenced by trade (food) policies. The first micro-level data come from the Demographic and Health Survey (DHS) program, which includes some NENA countries. The DHS program has been an important source of data for analyzing the nutritional and health outcomes of adults and children across the globe. The DHS data are publicly available data and widely used for studying nutritional outcomes of children and adults (DHS 2018). These data are collected using relatively comparable methods across countries and time. These data provide detailed anthropometric information for children and adult women.

The second data source is the country-specific Household Income, Expenditures, and Consumption Surveys (HIECS). These data, collected by national statistical offices with the support of international organizations, are large-scale nationally representative household surveys collecting rich information on households' income, consumption, and other expenditures. These data provide detail accounts of food consumption and associated expenditures. Sometimes, these data also collect anthropometric measurements, mostly for children and women. For some of the countries not covered by the DHS program and HIECS, we employ individual level data from the Living Standard Measurement Surveys (LSMS) of the World Bank.

However, both the DHS and HIECS data have some limitations. The former contain relatively rich information on body weight and related nutritional outcomes, but provide limited information

[6] More details on the food balance sheet database can be found at "Supply Utilization Accounts and Food Balance Sheets," FAO, http://www.fao.org/economic/the-statistics-division-ess/methodology/methodology-systems/supply-utilization-accounts-and-food-balance-sheets-background-information-for-your-better-understanding/en/.

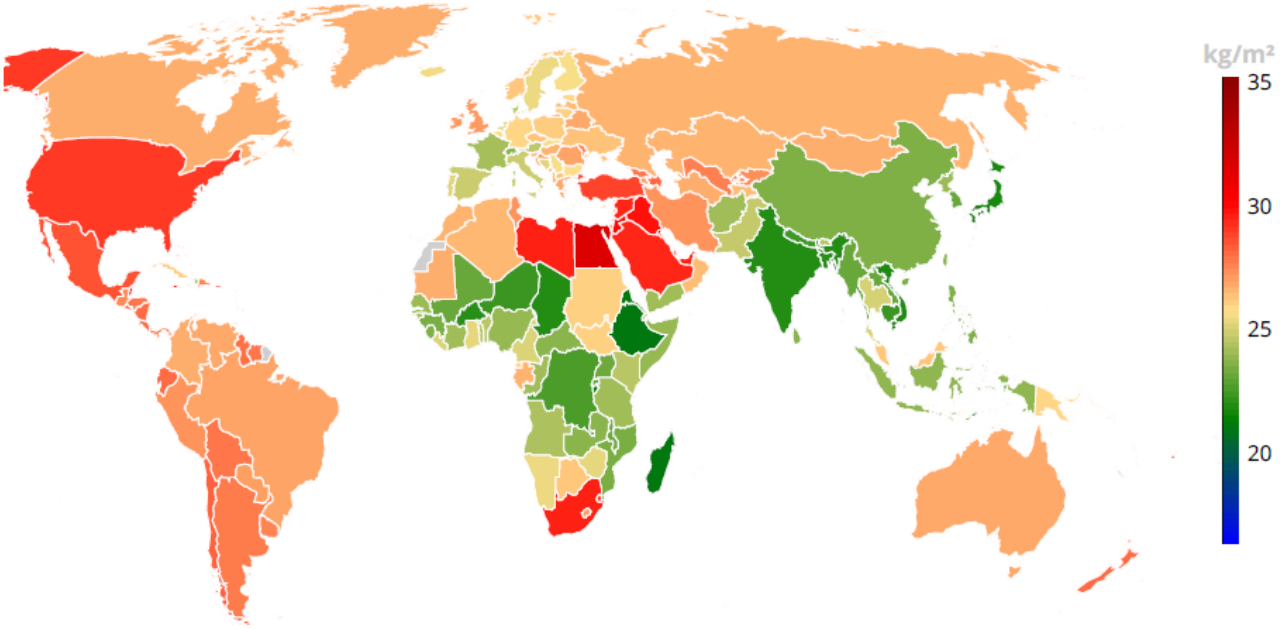
related to trade (food) policies. The latter complement some of the drawbacks of the DHS data, but also suffer from other limitations. Compared to the DHS data, the HIECS data can be used to construct food consumption expenditure and intake indicators. These data provide information on household consumption and expenditure on various food items, including on both subsidized and nonsubsidized food items. Using these micro-level data, we can examine the implication of food subsidies and confirm the macro-level evidence on the relationships between subsidies and body weight outcomes.

4 MACRO-LEVEL ANALYSIS AND EVIDENCE

4.1 Evolution of Body Weight in the Near East and North Africa Region

This section presents the global and regional (NENA) temporal evolution of body weight. We focus on describing and explaining the evolution of body weight outcomes in the NENA region countries relative to other regions. For this purpose, we employ macro-level GHO data as well as micro-level DHS data. We examine the evolution of BMI as well as overweight and obesity trends.[7] Before showing the temporal evolution, Figure 4.1 provides a recent map of the spatial distribution of body mass index (BMI) across countries of the globe. This figure shows that some of the countries in the NENA region (e.g., Egypt) have among the highest mean BMI in the world.

Figure 4.1 Mean body mass index for women (excluding pregnant women)



Source: NCD-RisC (NCD-RisC 2017)

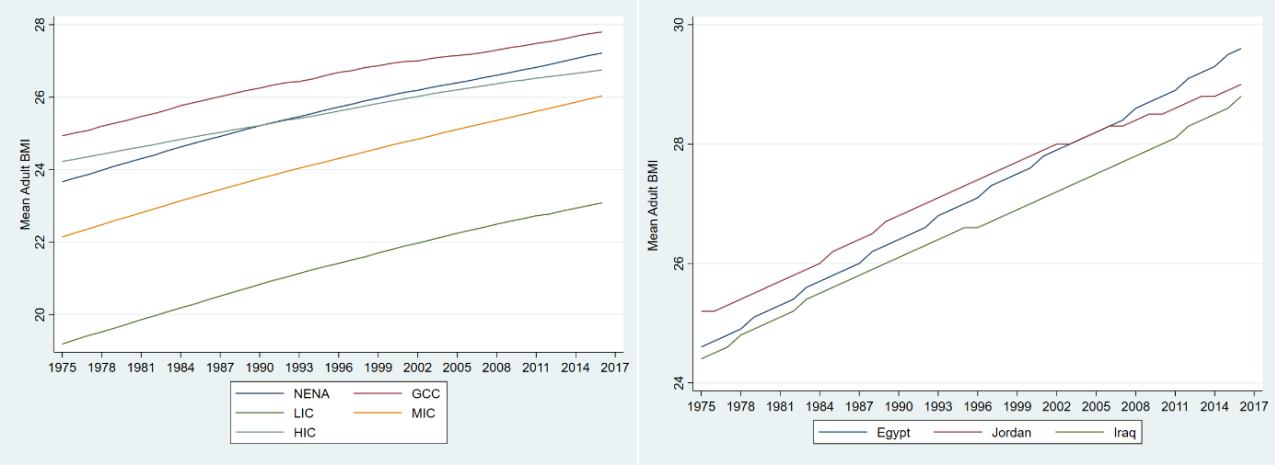
For comparison purposes, we classify the world into five overlapping regions: high-income countries (HIC), low-income countries (LIC), middle-income countries (MIC), NENA countries, and Gulf Cooperation Council (GCC) member countries.[8] The first graph in Figure 4.2 shows the evolution of BMI trends for these five regions, while the second graph provides trends for three NENA region countries – Egypt, Jordan, and Iraq. The graphs in Figure 4.3 provide similar trends for overweight and obesity trends for the five regions and the three NENA countries. Gender-based disaggregated figures are given in the Appendix.

[7] Following WHO guidelines, we define a person to be overweight if his or her BMI is 25 kg/m^2 or above, while individuals with a BMI of 30 or above are classified as obese (WHO 2000).

[8] GCC member countries are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.

Figures 4.2 and 4.3 show that, overall, BMI, overweight, and obesity rates have been increasing worldwide. Overweight and obesity rates almost doubled between the years 1970 and 2016. However, the rates and trends of overweight vary across regions. The NENA region, especially the GCC countries, have the highest BMI and highest rate of overweight and obesity throughout the whole period, except at the beginning of our sample period (1970s) when most countries had comparable rates of overweight. Indeed, most of the world has witnessed comparably increasing overweight rates up until the 2000s. Interestingly, after the 2000s, the trend of BMI and overweight in the NENA region appears to be distinct compared to other regions of the world. Although the increasing trend of BMI and overweight rates slows after the early 2000s for many regions, it continues to increase in MIC and NENA countries. Specifically, whereas most HIC are experiencing a relative slowing in the increase of overweight rates, in the NENA region rates increase even more rapidly. The evolution of overweight rates for the GCC countries are even more concerning. This implies that the increasing trend of overweight in the NENA region deserves due attention.

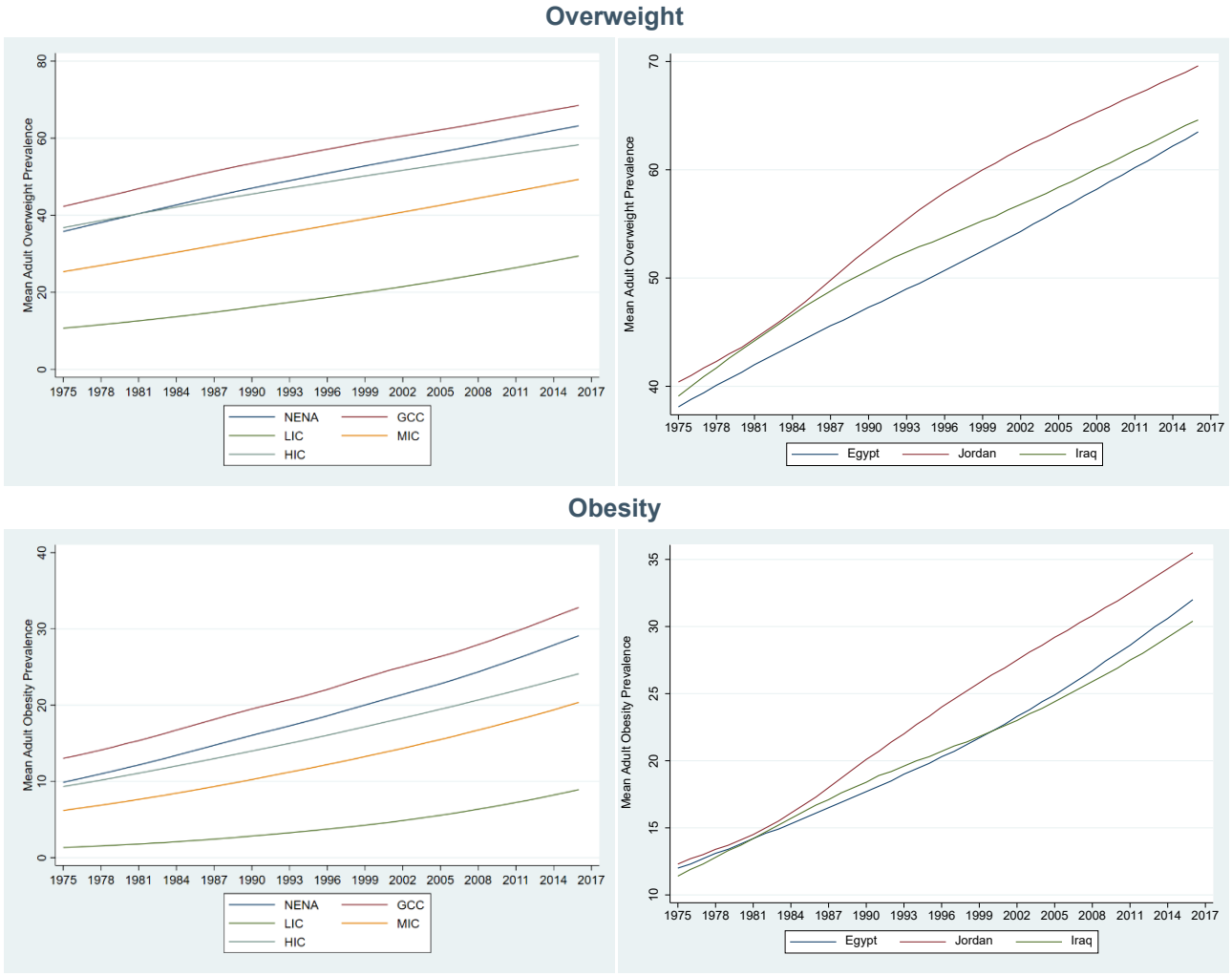
Figure 4.2 Evolution of body mass index, by region and for Egypt, Jordan, and Iraq, 1975 to 2017



Source: Authors' illustration based on GHO (WHO 2019)

The right-hand graphs in Figures 4.2 and 4.3 provide the evolution of BMI and overweight and obesity trends for selected NENA region countries, Egypt, Jordan, and Iraq, the focus countries for our micro-level analysis. The trends for these countries are consistent with the overall trend for the NENA region. For instance, overweight rates for Jordan and Egypt recently have been increasing at greater rates.

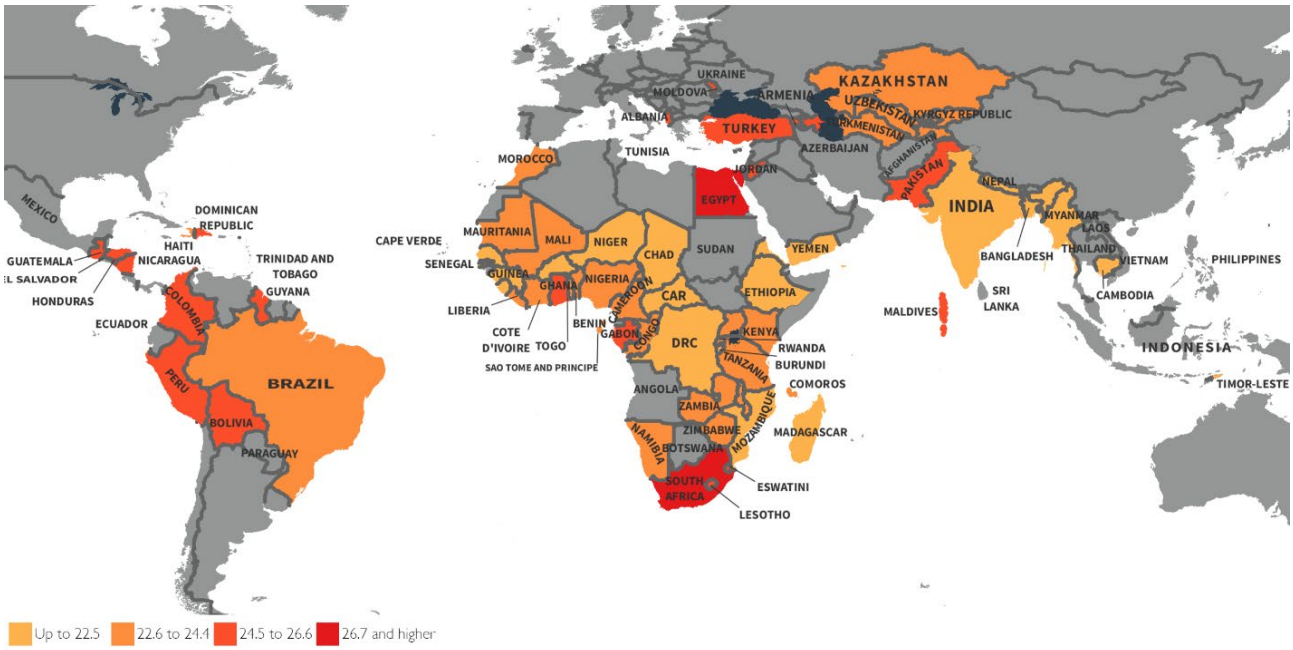
Figure 4.3 Evolution of overweight and obesity rates, by region and for Egypt, Jordan, and Iraq, 1975 to 2017



Source: Authors' illustration based on the GHO (WHO 2019)

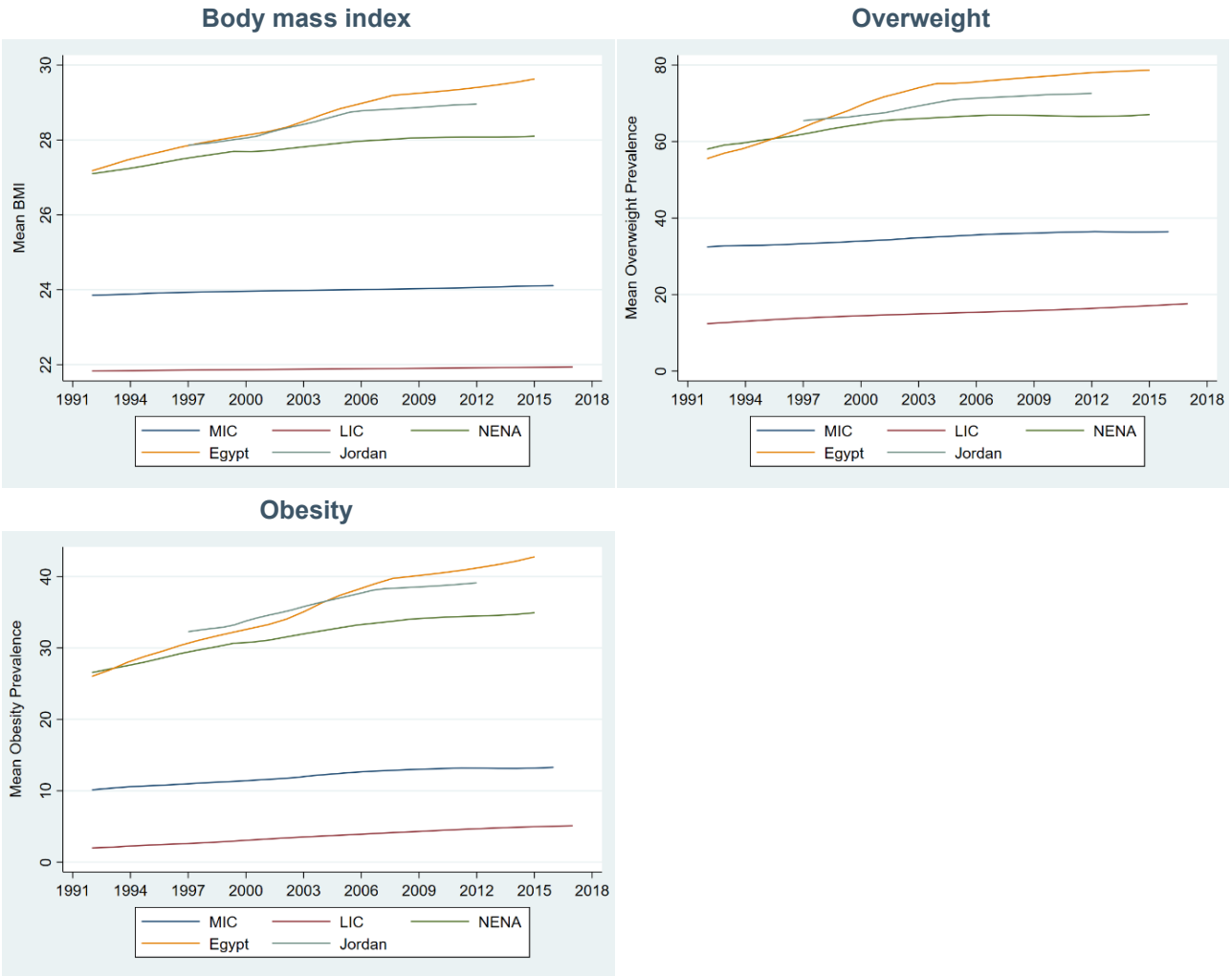
We complement the above analysis of the temporal and spatial evolution of body weight using micro-level data from the DHS program. Unlike the GHO data, which provide country-averaged body weight outcomes, the DHS data provide individual level body weight for women of productive age. However, the DHS program does not cover all countries. Despite these variations, these two datasets complement each other and employing both sources helps to probe the robustness of our analysis. Figure 4.4 provides a global map showing the spatial distribution of body weight (measured by BMI) using the most recent rounds of the DHS data. This map confirms that women in some countries in the NENA region, e.g., Egypt and Jordan, have among the highest average body weight.

Figure 4.4 Mean body mass index for women (adjusted for pregnancy)



Source: DHS (WHO 2019)

Figure 4.5 Evolution of body mass index, overweight, and obesity rates by region and country, 1992 to 2017

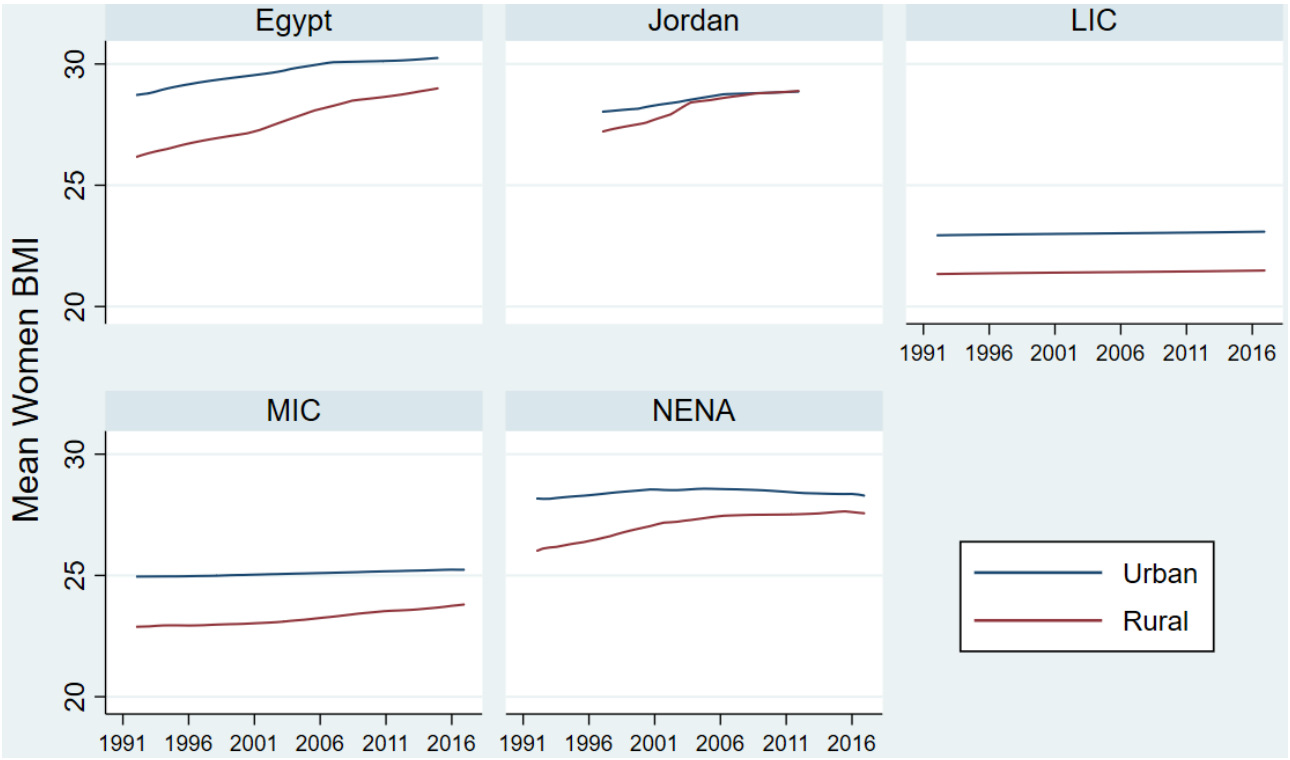


Source: Authors' illustration based on the DHS (DHS 2018)

In Figure 4.5, we compile micro-level individual data from the DHS program to show the evolution of body weight. Besides confirming the GHO data trends (Figures 4.2 and 4.3), the DHS data enables further disaggregation, including rural-urban splits. However, whereas the trends based on the GHO data are aggregate for both male and female, those from the DHS data are only for women, as anthropometric measurements are available only for women of reproductive age. Given global gender differences in overweight and obesity rates, we expect higher overweight and obesity rates in the DHS data than in the aggregate GHO data.

Overall, the evidence in Figure 4.5 confirms the globally increasing trend in body weight, with some NENA countries showing the highest BMI levels and overweight and obesity rates. The illustrations in this figure further confirm that some countries in the NENA region, those with the highest BMI levels and rate of overweight and obesity, are following distinctly increasing trends. Comparing the trends of other MICs and those in the NENA region, overweight and obesity rates for some NENA countries are continuing to increase. For instance, the overweight rates for Egypt have reached about 75 percent in the latest DHS round. These rates are much higher than the global rate of overweight and obesity, implying that the obesity epidemic remains a major threat to public health in the NENA region.

Figure 4.6 Women's body mass index in rural and urban areas by region and country, 1992 to 2017



Source: Authors' illustration based on the DHS (DHS 2018)
Note: LIC = Lower income countries; MIC = Middle income countries; NENA = Near East and North Africa region.

The DHS data allow for further disaggregation of the above trends into rural and urban areas, allowing us to examine the evolution of body weight outcomes in both areas. A recent study by NCD-RisC shows that body weight outcomes in rural areas have been increasing at higher rates than those in urban areas (NCD-RisC 2019). By plotting the evolution of body weight outcomes in rural and urban areas over time, the trends in Figure 4.6 confirm that recent BMI and overweight and obesity rate increases have been higher in rural than urban areas for MICs and some NENA region countries. For instance, in rural Egypt, average BMI increased by 4.2 kilograms per square meter (kg/m^2) (from 25.6 in 1992 to 29.8 in 2015), while the corresponding increase for urban

Egypt was 2.3 kg/m^2 (from 28.6 to 30.9). Similarly, the graphs for Jordan show clear convergence and, hence, a vanishing of rural-urban differences in body weight.

Intuitively, the literature and public discourse on obesity have not fully recognized this interesting and unique pattern. It goes against the common view that urbanization has been a major driver of the rise in BMI and overweight and obesity rates worldwide. However, this pattern can inform public policies aimed at reducing obesity epidemics. For instance, existing efforts and investments for reducing obesity have focused mostly on urban areas and are less likely to sufficiently address the overarching global obesity epidemic in many regions. Indeed, these trends imply the need for attention to rural nutrition and related attributes that may be driving the growth of obesity in rural areas. Despite the need for more studies to examine key drivers of growing rural obesity, national policies need a more integrated approach to address rural and urban obesity rates.

To sum up, the overall trends shown suggest that increasing overweight and obesity rates are major threats to public health in the NENA region. Contrary to the conventional view that overweight and obesity rates are mainly urban problems, we find evidence that rural body weight also is increasing in line with urban rates of recent decades, and, in countries like Jordan, is now on par with urban body weights. In the absence of effective national and regional interventions and efforts to curb these trends, these rates are expected to continue to increase, and, consequently, will add to the already high burden of NCD in the NENA region and globally. At the same time, evolving efforts targeting the overweight and obesity epidemic in the NENA region mainly focus on urban residents (Musaiger 2011). Our findings reinforce the need for new and integrated initiatives to lessen the ever-increasing overweight and obesity rates in rural and urban areas.

4.2 Evolution of Trade (Food) Policies in Egypt, Jordan, and Iraq

In this section we describe the evolution of trade and food policies in selected NENA countries. Worldwide, most trade policies and agreements started after World War II as nations realized the potential of economic and trade relationships and saw a need to ease trade barriers. This perception led to the General Agreement on Tariffs and Trade (GATT), signed by 23 countries in 1947. The agreement aimed at reducing tariffs and technical trade barriers in various sectors. Some of the NENA region countries joined the GATT and other major trade agreements that have heavily shaped trade interactions in the region. Although some NENA countries have similar trade and food policies, their timing and type can vary. In the interest of brevity, we focus on three countries known for high levels of overweight and obesity: Egypt, Jordan, and Iraq. For these countries, we use individual-level data to conduct micro-level analyses.

4.2.1 Egypt

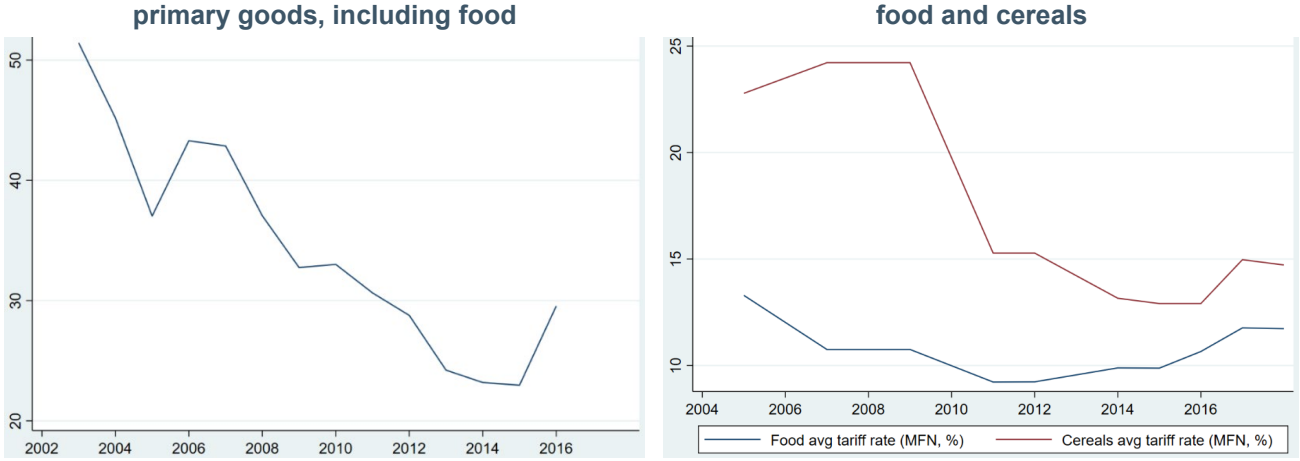
Egypt's current major trade policies were formulated in the 1990s. The country joined the World Trade Organization (WTO) in 1995 and started the Structural Adjustment Program, which involved the signing of economic reform packages between the government and the International Monetary Fund and the World Bank.[9] This reform liberalized the prices of major crops, eliminated subsidies on agricultural inputs, liberalized input markets, eliminated interest rate subsidies on agricultural loans, and shifted mandatory crop rotation to farmers' decision-based rotation. After joining the WTO, Egypt reduced its maximum tariff rate from 50 to 40 percent (El-Hamidi 2008). In 2004, Egypt joined and signed the European Mediterranean Association Agreement (EMAA), which led to removal of tariffs on agricultural goods originating from the European Union (EU) and thereby increased imports from EU member countries. In the same year, the government further reduced

[9] The Structural Adjustment Program encouraged a shift in employment from agriculture to other sectors in the economy. However, agriculture still employs nearly 30 percent of the work force and contributes about 14 percent to the national GDP (Minot et al. 2010).

the average unweighted tariff rate from 27 to 20 percent and eliminated all tariff surcharges (Tellioglu and Konandreas 2017; El-Hamidi 2008). This has encouraged voluminous trade relations between Egypt and EU member countries in subsequent years. Moreover, the government removed all customs service fees on imported agricultural goods, such that there were no quotas or tariff quotas.[10]

Figure 4.7 shows for Egypt the evolution of tariff rates, the import duty tax, on primary products, including food, and specifically for foods in general and for cereals. These patterns reflect the historical evolution of Egypt's trade policies.

Figure 4.7 Evolution in Egypt of tariff rates for primary goods (2003 to 2016) and for food and for cereals (2005 to 2018)



Source: Authors' illustration based on the World Bank WDI (World Bank 2019)

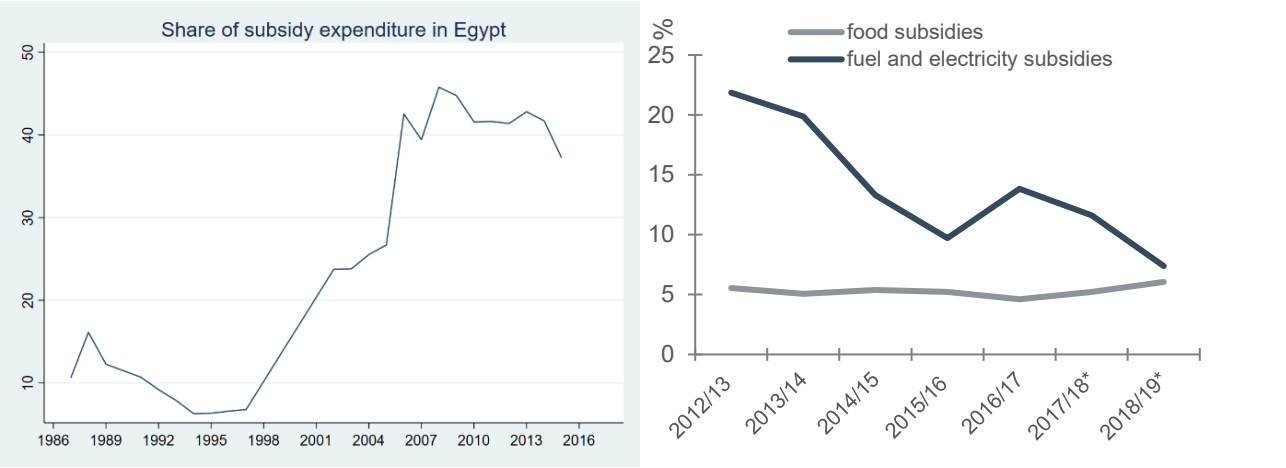
Trade and food policies in Egypt are interlinked, with the former serving as an important instrument to satisfy domestic food demands. Trade, particularly imports, continues to support Egypt's food subsidy program. With increasing population pressure and associated demand for food, Egypt satisfies a substantial share of domestic food demand for cereals through imports, with the corresponding trade deficit increasing in recent years. Since the 1980s, Egypt has satisfied 40 to 50 percent of its domestic wheat demand and consumption from imports. Indeed, Egypt is now one of the largest wheat importers in the world.[11] Meanwhile, Egypt's fruit and vegetable exports are increasing, currently contributing about 30 percent to agricultural exports (Kassim et al. 2018).

Food subsidy programs in Egypt date back to the 1940s (Ecker et al. 2016). The Egyptian food subsidy program provides staple foods at subsidized prices to a majority of the population. The program has evolved through several reforms and milestones. These subsidies are delivered through two separate programs, the Baladi bread (and flour) program and the ration card program. The Baladi bread and flour subsidy program aims to stabilize the availability and price of bread for the broader population. The ration card program provides subsidies for other food items, including sugar and cooking oil. The food subsidy program in Egypt costs the government about 2 percent of GDP and 5 to 6 percent of government expenditure annually (Abdalla and Al-Shawarby 2018).

[10] Besides easing trade barriers using tariff rates, Egypt has introduced several reforms involving removal of nontariff barriers and introduction of export-promotion policies (Minot et al. 2010).

[11] See "The Top Wheat Exporting And Importing Countries In The World," World Atlas, 2019, https://www.worldatlas.com/articles/the-top-wheat-exporting-and-importing-countries-in-the-world.html.

Figure 4.8 Subsidy as share of government expenditure in Egypt (share of total expenditure)



Source: Authors' illustration based on the World Bank WDI and Egypt's Ministry of Finance (World Bank 2019)

The two graphs in Figure 4.8 show the evolution of government subsidies, including food and nonfood subsidies, as a share of the overall government budget in Egypt and disaggregated for food and fuel subsidies. In the first graph, overall government subsidy expenditure includes spending to subsidize or provide grants for (a) specific foods (staple food items) and nonfood commodities (e.g., fuel), (b) agricultural inputs (e.g., fertilizer subsidies), (c) social services and social benefits, and (d) developing marginalized regions. The share of subsidies as a part of government expenditure has been increasing, peaking in the period 2010/11 to about 40 percent of government fiscal expenditure. The share of subsidies fell slightly after 2014, a year which saw important reforms to Egypt's food and fuel subsidy programs. The reforms between 2014 and 2016 included adjustments to food subsidy and fuel subsidy programs, where energy subsidies declined and food subsidies and cash transfers increased, in an effort to at least partially protect the poor from the adverse effects of macroeconomic reform (Abdalla and Al-Shawarby 2018; Breisinger et al. 2019).[12] However, public spending on subsidies and grants remains a substantial share of overall public spending in Egypt, reaching E£200 billion (equivalent to US$27 billion) in fiscal year 2015/16, accounting on average for about 30 percent of annual public spending and 9.7 percent of GDP (Abdalla and Al-Shawarby 2018).

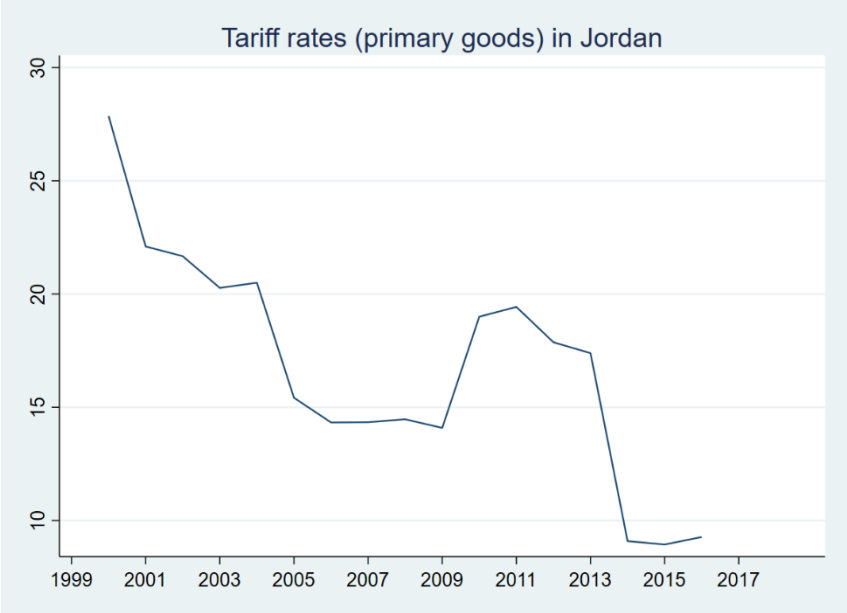
The second graph in Figure 4.8 disaggregates the major components of government spending on subsidies, food and fuel. This graph shows that whereas fuel and electricity subsidies have been declining, the share of food subsidies have remained stable and slightly increased in recent years.

4.2.2 Jordan

The history of trade and food policies in Jordan follow comparable trends to those in Egypt. In 1989, Jordan entered the Arab Cooperation Council. Around this time, it signed a structural adjustment agreement with the International Monetary Fund and the World Bank, with the objective of improving its internal and external economic imbalances. This involved subsidy cuts, scaling-down of import duties, and the introduction of sales tax. The program was briefly suspended at the onset of the Gulf War in August 1990 and then renewed in 1992 after the crisis ended. In the early 1990s, Jordan signed a free trade agreement with Lebanon and food subsidies were minimized. During that time, Jordan worked with the World Bank on an agriculture sector adjustment program, which led to the liberalization of trade in agriculture and eliminated most agricultural subsidies.

[12] These reductions in fossil fuel and electricity subsidies, and the corresponding increases in these prices, saved the Egyptian government E£51 billion (Abdalla and Al-Shawarby 2018).

Figure 4.9 Evolution of trade policies in Jordan (tariff rates)



Source: Authors' illustration based on the World Bank WDI (World Bank 2019)

Jordan has enjoyed a more open economy compared to its neighbors since it joined the WTO in 2000. Jordan also joined the EMAA and EFTA in 2002, moves that significantly reduced tariff rates on agricultural and nonagricultural imports from the EU. During the late 1990s, Jordan benefited from the Oil-For-Food-Program implemented by the United Nations in Iraq, which contributed to increased trade flows in the region. Accordingly, when the Oil-For-Food-Program was halted in 2003, Jordan's agro-trade and overall trade was negatively affected (Minot et al. 2010). In contrast to Egypt, Jordan's food production has been consistently below demand (see Section 4.3) even as imports of key food items are on the rise, a combination that has made Jordan one of the region's most food-import-dependent countries (FAO 2019). The evolution of tariff rates on primary products, seen in Figure 4.9, shows a continuously declining trend. This trend reflects the major shifts associated with the trade policies and events described, including WTO (2000) and EMAA (2002) membership.

In terms of food policies and subsidies, the Jordanian government began subsidizing politically sensitive commodities, e.g., wheat, sugar, powdered milk, tea, rice, and frozen poultry, in the early 1970s. In 1996, the government undertook major subsidy reforms, which caused bread prices to soar and leading to what the media dubbed "bread riots". Since then, producer subsidies for wheat and bread have remained unchanged. In 2018, as part of a tax system structural reform initiative, the government introduced a 10 percent tax on agriculture inputs and outputs. The government also replaced its direct bread subsidy program with a "targeted assistance" program in the form of cash transfers to 6.2 million people, causing bread prices to increase by up to 100 percent (FAO 2018). This shift resulted in mass protests, and a month later agricultural outputs were exempted from the tax, but inputs were still subject to it. Inputs that continue to be taxed include live poultry, fertilizers, pesticides, and veterinary medicines. Table 4.1 presents a more comprehensive list of major changes and reforms in trade (food) policies in Jordan. However, we lack continuous time series data to show the evolution of food subsidies and associated trends in Jordan.

4.2.3 Iraq

Food policies, mainly trade agricultural policies and food subsidy programs, are important instruments in the history of the Iraqi economy. For instance, in 2011 food subsidies in Iraq constituted more than 3 percent of the country's GDP and in 2016 they were more than 30 percent of the government's total expenditure (World Bank 2019; Sdralevich et al. 2014). Currently the Iraqi

government provides in-kind food distribution, including cooking oil, rice, flour, and milk powder, as part of the social safety net programs it implements. Agricultural policies are commonly linked with these food subsidy programs as well as overall food demand. These policies have evolved through important reforms across various regimes and political contexts.

In Iraq, trade policy reforms began in the 1980s, particularly after the expansion of U.S.-Iraq trade relations in 1985. Around that time, U.S.-Iraqi trade expansion via export credits from the United States Department of Agriculture began to increase food imports. The Iraqi government was able to maintain low food prices and increase household purchasing power until the 1991 Gulf War. During the war, and in response to the strict trade embargo on Iraq and the end of the U.S. agricultural export credit, the government introduced a food rationing system that included subsidizing key food items, such as wheat, rice, and flour (USTR 2015; Drèze and Gazdar 1992). The government built irrigation systems administered by farmers, and provided extensive fuel and equipment subsidies to the agricultural sector (Drèze and Gazdar 1992). Imports increased again in the late 1990s as a result of the United Nations Oil-For-Food Program, introduced in 1995, which allowed for increasing food subsidies until the program was suspended during the 2003 Iraq War (Minot et al. 2010).

In the mid-1990s, the Iraqi government faced considerable budget deficits as a result of the trade embargo. In response, it raised water charges on irrigated land, ended distribution of high-yielding seed, subsidized credit, and shifted the burden of canal maintenance onto growers. Compounding the pressure on agriculture, a drought struck the country in 1996 and 1997, severely affecting harvests (World Bank and FAO 2012).[13] In 2004, the Iraq Reconstruction Program commenced after the Second Gulf War ended, which exempted all goods imported for the program from customs (Schnepf 2004). From 2005 to 2008, the government mobilized efforts to strengthen the agriculture industry through fostering the domestic agroindustry and introducing an interest-free credit system for smallholders.

Table 4.1 summarizes the evolution of food and trade policies in the three study countries in the NENA region.

[13] Moreover, a shortage of fodder in 1998 resulted in the forced slaughter of sheep, which exacerbated the effects of a foot-and-mouth disease outbreak taking place at the time (Schnepf 2004).

Table 4.1 Food and trade policies in Egypt, Jordan, and Iraq

	Egypt	Jordan	Iraq
1970s	Egypt signs GATT (1970) October War (1973) and the Open-Door Economy Growth of subsidized commodities and domestic consumption	Subsidized politically sensitive goods (wheat, sugar)	Radical land redistribution Creation of state-enforced cooperatives Saddam Hussein's regime set out to privatize the agricultural sector and support food production through input subsidies
1980s	Reduced ration food beneficiaries Structural Adjustment Program Severe sugar and cooking oil shortages	Free trade agreement (FTA) with Djibouti (1984) Structural Adjustment Program	U.S.-Iraq trade expansion (1985) United States Department of Agriculture export credit Increasing U.S. agricultural imports Increased energy subsidies to the agricultural sector
1990s	Egypt/IMF/WB reform package (1991) Bread and wheat flour are available without restriction Reduction in maximum tariff rate from 50 percent to 40 percent Ration card beneficiaries reduced Decree banning food imports from the EU (1999)	Price subsidy to wheat producers Free trade agreement with Lebanon (1992) Food subsidies reduced Agricultural sector adjustment programmed by the WB Government phased out wheat price subsidy FTA with Egypt, Morocco and Tunisia and EU association agreement (1997) Qualified Industrial Zone Agreement with US (1998)	Gulf War (1991) sanctions: rationing system introduced End of U.S. agricultural export credit Oil-For-Food Program (1995); increased food imports Drought and fodder shortage; disease outbreak (1998)
2000s	EMAA (2004) Food subsidy beneficiaries increased Import duty applied on white sugar	FTA with Syria, Kuwait, Bahrain, United States, and United Arab Emirates and accession to WTO (2001) EU/EFTA (2002), Greater Arab Free Trade Area and FTA with Sudan and Singapore	Iraq War (2003): subsidy system severely disrupted Iraq reconstruction program: all imports exempt from customs duties
2010s	Takaful and Karama conditional cash transfers 20 percent increase in food subsidy allocation per beneficiary	Electronic smart cards to dispense monthly cash transfers Government curtailed wheat subsidy	

Source: WTO and various sources.[14]

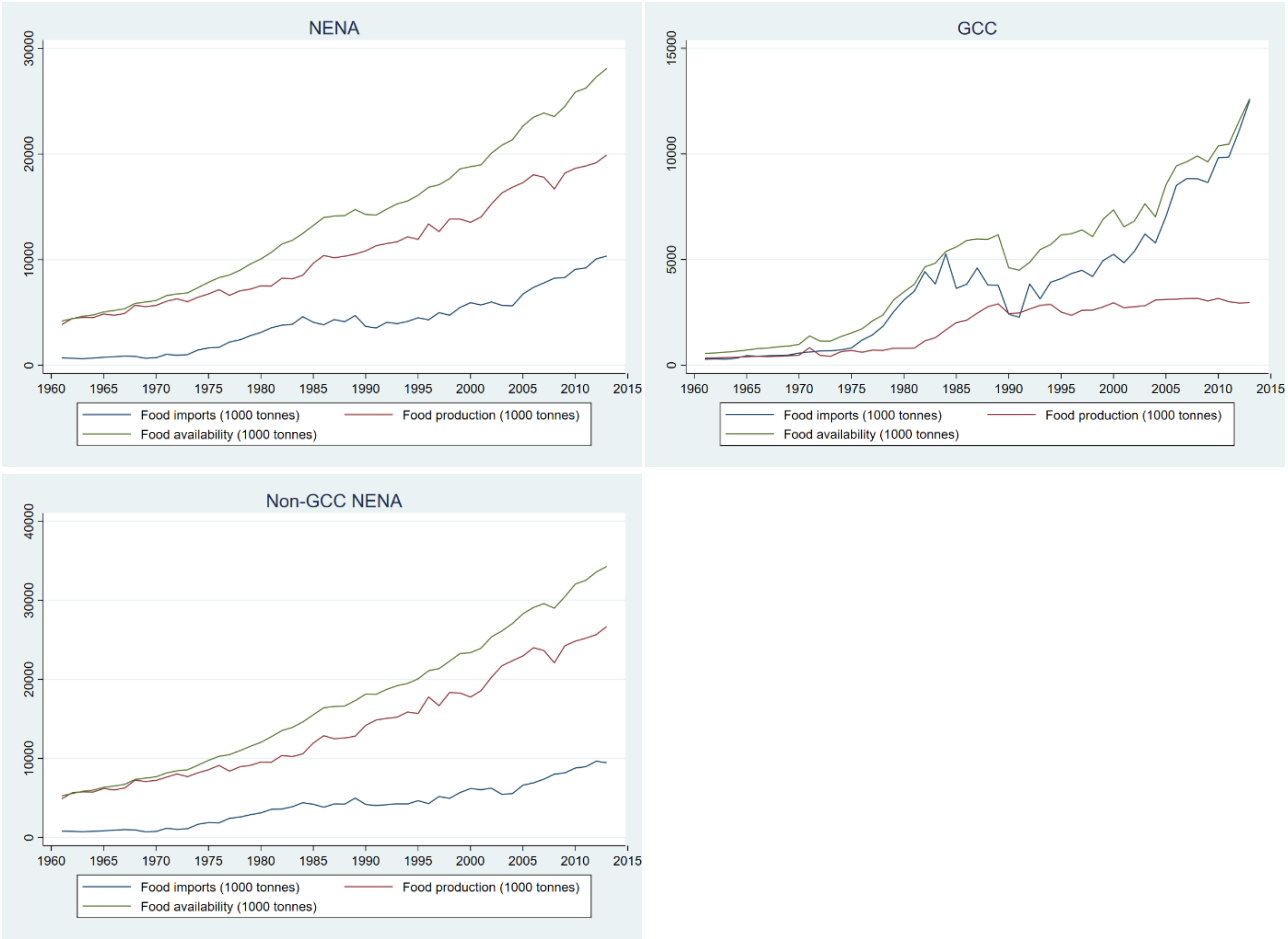
4.3 Evolution of Food Systems in Egypt, Jordan, and Iraq

This section provides empirical evidence on the evolution of food systems in these three countries. Consistent with the global nutrition transition, the food system and food environment in many NENA countries have evolved through key transitions and milestones. Figure 4.10 shows the evolution of domestic food systems in the NENA region. The first graph provides average values for the whole NENA region; the other two disaggregate these values across GCC and non-GCC countries. As expected, food availability has been increasing over time because of rising trends in production and imports. However, some distinct patterns appear over time and across countries. For most of the NENA region countries, the first few decades up until the 2000s saw relatively slowly increasing trends in food imports and production, and, hence, food availability. These trends increased after the 2000s. In particular, food imports sharply increased after 2000, consistent with

[14] For Egypt, see El-Hamidi (2008); FAO (2010); Galal and Hoekman (1996); Harik (1992); Karray (2016); Scobie (1981; 1983); Tellioglu and Konandreas (2017); World Bank (2010). For Iraq, see Schnepf (2004); Drèze and Gazdar (1992); World Bank and FAO (2012); Telleria et al. (2012); USTR 2015. For Jordan, see WTO (2008); Soliman and Mashhour (2012); Akayleh (2013).

evolving trade policies and reduced tariff rates in most of these countries. The NENA region countries also show some sharp differences. Domestic production represents a good share of food supply in most of the non-GCC countries, yet it is negligible in the GCC countries because of local climatic and agroecological conditions, which means that the latter rely exclusively on imports to satisfy their domestic food demand. In the GCC countries, production increased up until 2000, but mostly stagnated after this period.

Figure 4.10 Evolution of food systems in Egypt, Jordan, and Iraq



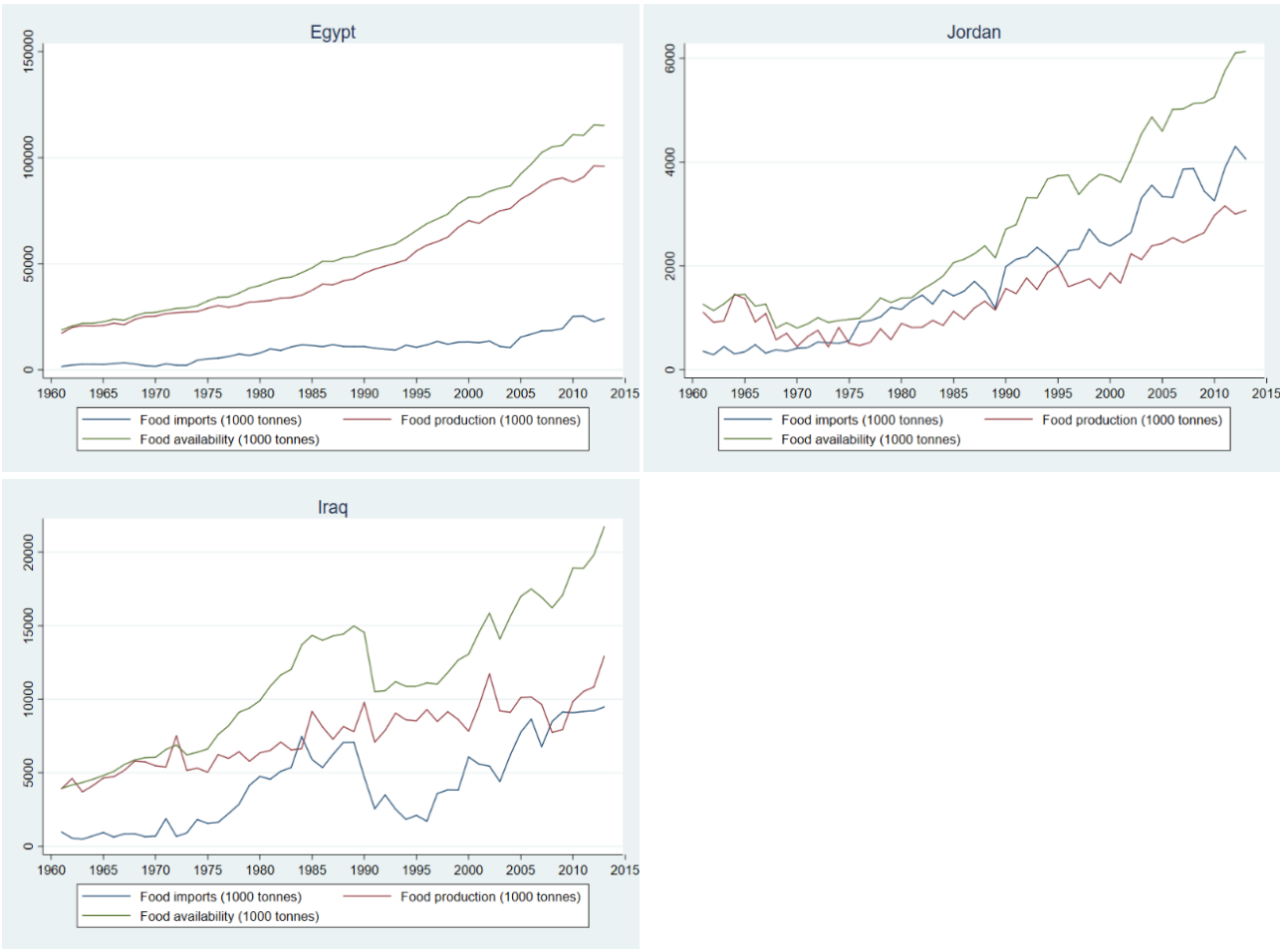
Source: Authors' illustration based on the FAOStat (FAO 2019)

In Figure 4.11, we further disaggregate the above trends across countries. We clearly see that, despite the overall increasing trends of food supply, countries in the NENA region have been following slightly different trends in food production and imports. For instance, Egypt's overall food supply has been smoothly increasing along with domestic production, with imports increasing at slower rates. Domestic food production seems to be responding to growing food demand throughout the whole period, driven mainly by steady increases in agricultural productivity (Nin-Pratt et al. 2018). This is slightly different in the case of Jordan, where food imports are higher than domestic food production. This seems particularly the case post-1990, after which food import trends rose at higher rates than domestic production.

The food environment in Iraq has evolved slightly differently, following two distinct time trends: before 1991 (the Gulf War) and afterward. Until 1991, food supply and food imports increased in Iraq, after which both food imports and availability declined for a few years before rising again in the early 2000s. The decline in food imports (and the overall food supply) in the years immediately after 1990 may be attributed the trade embargo levied on Iraq following its invasion of Kuwait. This decline continued until 1995, when the United Nations initiated the Oil-For-Food program.

Recently, the contribution of food imports and domestic production to Iraq's overall food supply appears to be comparable, especially after 2008.[15]

Figure 4.11 Evolution of food systems in Egypt, Jordan, and Iraq



Source: Authors' illustration based on the FAOStat and authors' own calculations (FAO 2019)

Overall, these figures and associated trends imply that food trade, particularly imports, remains an important and integral element of food supply in these NENA countries. Given these countries' growing populations and agricultural potential, the importance of food imports is likely to continue growing (Nin-Pratt et al 2018). Therefore, policies affecting imports can have important ramifications on the food environment, with critical nutritional and public health implications.

Table 4.2 shows decade-spanning growth rates in overall food supply and its contributors (imports and domestic production) across NENA countries. We compute decade-level averages and growth rates. For most countries, overall food supply quadrupled in the period 1960–70 to 2010–13. The contributions of imports and domestic production varies over time and countries. For instance, the overall role of food imports seems much higher in the GCC countries, followed by Jordan. The role of trade also seems to vary over time. For instance, Egypt's import dependence increased from 10 percent in the 1960–70 period to 21 percent in the 2010–13 period. Similarly, Jordan's food import dependence doubled from 1960–70 to 2010–13 (31 percent to 68 percent).

[15] In 2008, the Iraqi government introduced alternative reforms to foster the agroindustry sector, including the introduction of interest-free loans for agricultural investments (Telleria et al. 2012).

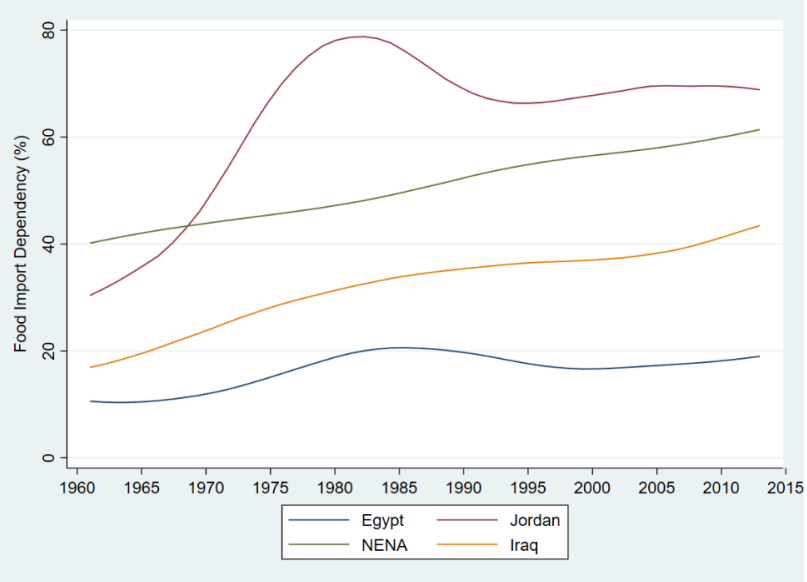
Table 4.2 Evolution of food systems in Egypt, Jordan, and Iraq and by region

	1960–70	1970–80	%	1980–90	1990–2000	%	2000–10	2010–13	%
	Average (million mt)		increase	Average (million mt)		Increase	Average (million mt)		Increase
Imports									
Egypt	2.38	5.05	111.6	10.84	11.46	5.6	16.13	20.18	25.1
Jordan	0.37	0.78	110.9	1.49	2.30	54.8	3.31	3.67	10.8
Iraq	0.73	2.25	205.7	5.88	3.15	-46.4	7.15	8.49	18.7
GCC	0.41	1.36	234.6	3.91	4.05	3.6	7.39	9.26	25.3
NENA	0.73	1.83	151.0	4.05	4.56	12.4	7.05	8.42	19.4
Production									
Egypt	21.66	29.13	34.5	38.38	57.35	49.4	81.11	88.26	8.8
Jordan	0.95	0.64	-32.7	1.08	1.71	58.9	2.40	2.72	13.4
Iraq	4.79	5.92	23.6	7.71	8.45	9.6	9.50	9.92	4.4
GCC	0.40	0.67	66.9	1.97	2.67	35.6	3.02	3.07	1.8
NENA	4.87	6.71	37.9	9.43	12.58	33.4	16.91	18.15	7.3
Availability									
Egypt	23.22	33.16	42.8	48.57	67.50	39.0	95.14	104.97	10.3
Jordan	1.16	1.09	-5.6	2.01	3.50	74.5	4.72	5.29	12.0
Iraq	5.04	7.69	52.6	13.48	11.37	-15.7	16.37	18.04	10.2
GCC	0.75	1.93	157.2	5.29	5.97	12.8	8.56	10.07	17.7
NENA	5.15	8.09	56.9	13.10	16.49	25.9	22.51	24.80	10.2

Source: FAOStat and authors' own calculations (FAO 2019)
Note: GCC = Gulf Cooperation Council; NENA = Near East and North Africa region.

Figure 4.12 shows the evolution of countries' food import dependence, which has been increasing in most countries. Despite significant cross-country differences, the NENA countries import about 60 percent of their domestic food consumption. However, the substantial country and time variations in food import dependence are worth mentioning. For instance, Jordan's food import dependence peaked in the 1980s, reducing slightly after the early 1990s.

Figure 4.12 Food import dependency in Egypt, Jordan, and Iraq and for the Near East and North Africa region

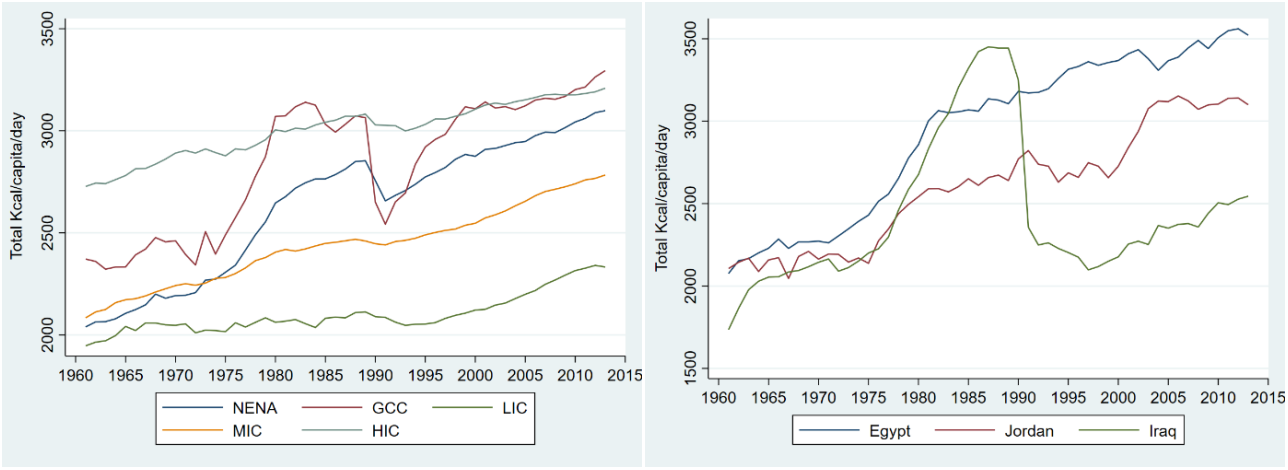


Source: Authors' illustration based on the FAOStat and authors' own calculations (FAO 2019)

Figure 4.13 further confirms that per capita calorie intake has almost doubled in the past five decades (1960s to 2010s) for the whole NENA region as well as for the selected countries studied here. The first graph in Figure 4.13 shows the relative growth of per capita calorie intake in the NENA region, relative to other HICs, MICs, and LICs. This graph shows that on average the NENA

countries in general, and the GCC countries in particular, have enjoyed increasing calorie intake, which now compares with the average calorie intake in HICs. The increased daily calorie intake is much higher for NENA countries than for HICs and MICs as a whole.

Figure 4.13 Food supply (daily caloric intake per capita) in selected regions and in Egypt, Jordan, and Iraq



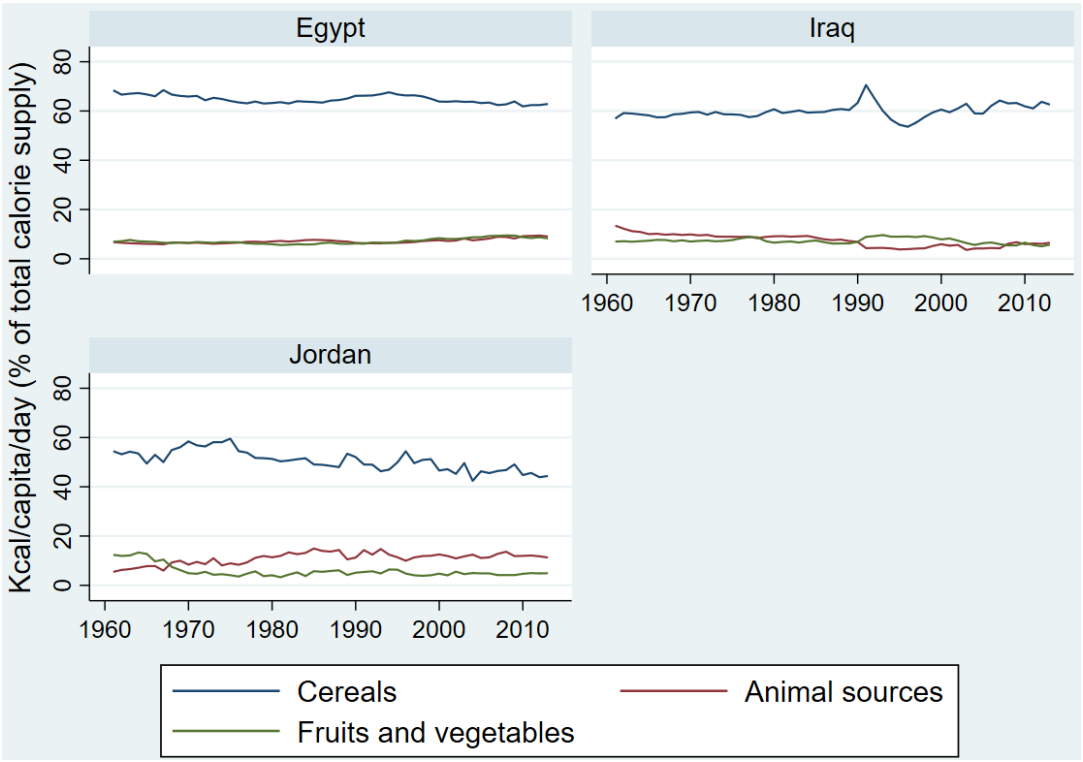
Source: Authors' illustration based on the FAOStat and authors' own calculations (FAO 2019)
Note: NENA = Near East and North Africa region; GCC = Gulf Cooperation Council; LIC = Lower income countries; MIC = Middle income countries; HIC = High income countries;.

Figures 4.14 and 4.15 show the contributions of various food types and their share of overall calorie intake. Despite some differences in trends across countries, a large share of total calorie intake comes from cereals, with the smallest share coming from fruits and vegetables, which contribute less than 10 percent of daily calorie intake in most countries. Specifically, about two-thirds of the calorie intake for Egypt comes from cereals. In Jordan, by contrast, the contribution of animal source food and fruits and vegetables is relatively higher. The trend in the contribution of cereals and other food items remain stable over time for most NENA countries.

Figure 4.14 Source of caloric consumption by region

Source: Authors' illustration based on the FAOStat and authors' own calculations (FAO 2019)
Note: NENA = Near East and North Africa region; GCC = Gulf Cooperation Council.

Figure 4.15 Source of caloric consumption in Egypt, Jordan, and Iraq



Source: Authors' illustration based on the FAO Stat and authors' own calculations (FAO 2019)

Although the trends in the above tables and figures provide information on aggregate food imports and import dependence, most countries have varying comparative advantages and policies for producing different types of food items, thereby reducing imports of different foods. Because different types of food items have varying nutritional and public health implications, we further disaggregate them into four groups: cereals, sugars, and vegetable oils.

Table 4.3 Import dependence of Near East and North Africa region countries for cereal, sugar, and vegetable oil

millions mt (imports share of availability, %)	Average 2010–13		
	Cereal	Sugar	Vegetable oil
Imports			
Egypt	16.27 (44.4)	1.13 (37.5)	1.47 (91.9)
Jordan	2.21 (95.2)	0.35 (110.7)	0.13 (88.8)
Iraq	4.91 (51.4)	0.77 (102.7)	0.84 (100.9)
GCC	4.83 (104.6)	0.96 (159.8)	0.43 (140.3)
NENA	5.49 (58.6)	0.83 (91.1)	0.56 (104.0)
Production			
Egypt	20.54	2.16	0.37
Jordan	0.09	0.00	0.03
Iraq	4.88	0.00	0.02
GCC	0.34	0.00	0.11
NENA	4.18	0.33	0.13
Availability			
Egypt	36.68	3.01	1.60
Jordan	2.32	0.32	0.15
Iraq	9.55	0.75	0.84
GCC	4.62	0.60	0.31
NENA	9.37	0.91	0.54

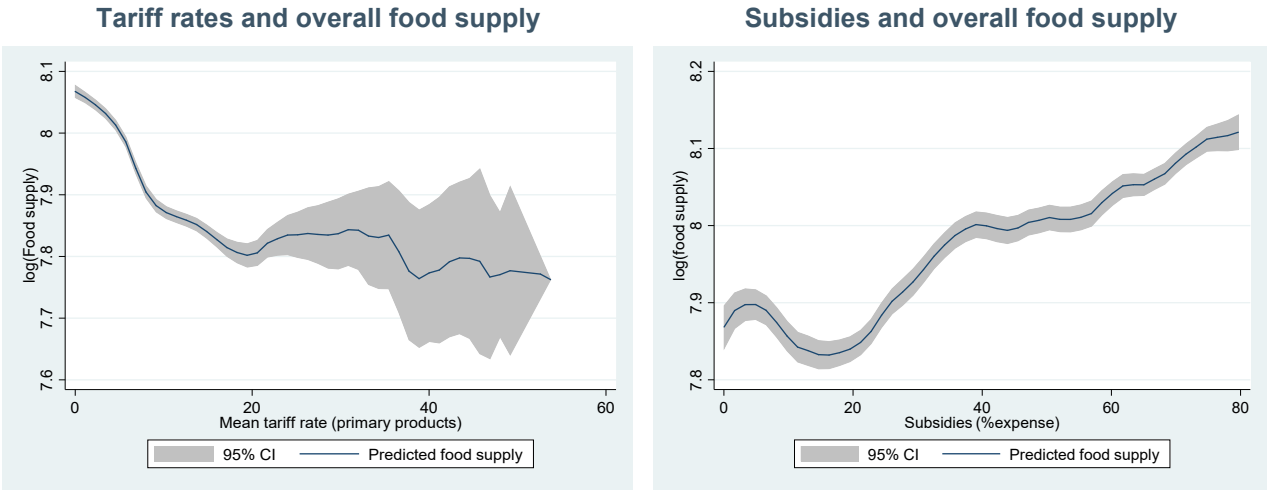
Source: FAOStat and authors' own calculations (FAO 2019)
Note: GCC = Gulf Cooperation Council; NENA = Near East and North Africa region.

Table 4.3 reports most recent average values of imports, production, and overall food availability associated with these food items. Food-specific import dependence—that is, the share of imports in overall food availability—are given in parentheses. In particular, the values in parenthesis in Table 4.3 highlight the role of imports in the food environment of the NENA countries. Notably, different countries have varying dependence on imports for various types of food items. For example, Egypt imports 44 percent of its cereal, 38 percent of its sugar, and 92 percent of its vegetable oil. Jordan satisfies more than 90 percent of its cereal, sugar, and vegetable oil demands through imports. In contrast, Iraq produces almost all of its cereal, while importing most of its required sugar and vegetable oil. Overall, the results in Table 4.3 highlight the import role of trade and imports in NENA countries' food systems.

4.4 Empirical Relationships between Trade (Food) Policies and Body Weight

This section explores potential relationships between trade (food) policies and domestic food availability, as well as between these policies and ultimate nutritional outcomes. As discussed in Section 2, trade policies can affect domestic food environment through several channels. Focusing on a few important instruments and indicators of trade policies, we examine the important associations between alternative trade (food) policies and domestic food supply, and alternative trade (food) policies and overweight and obesity rates. The first graph in Figure 4.16 shows the relationship between tariff rates (on primary products, including food) and overall food supply (food availability), while the second graph shows the relationship between subsidies (as share of government expenditure) and food supply. These graphs show that both lower tariff rates and higher subsidies are associated with higher food supply.

Figure 4.16 Food policies and food availability

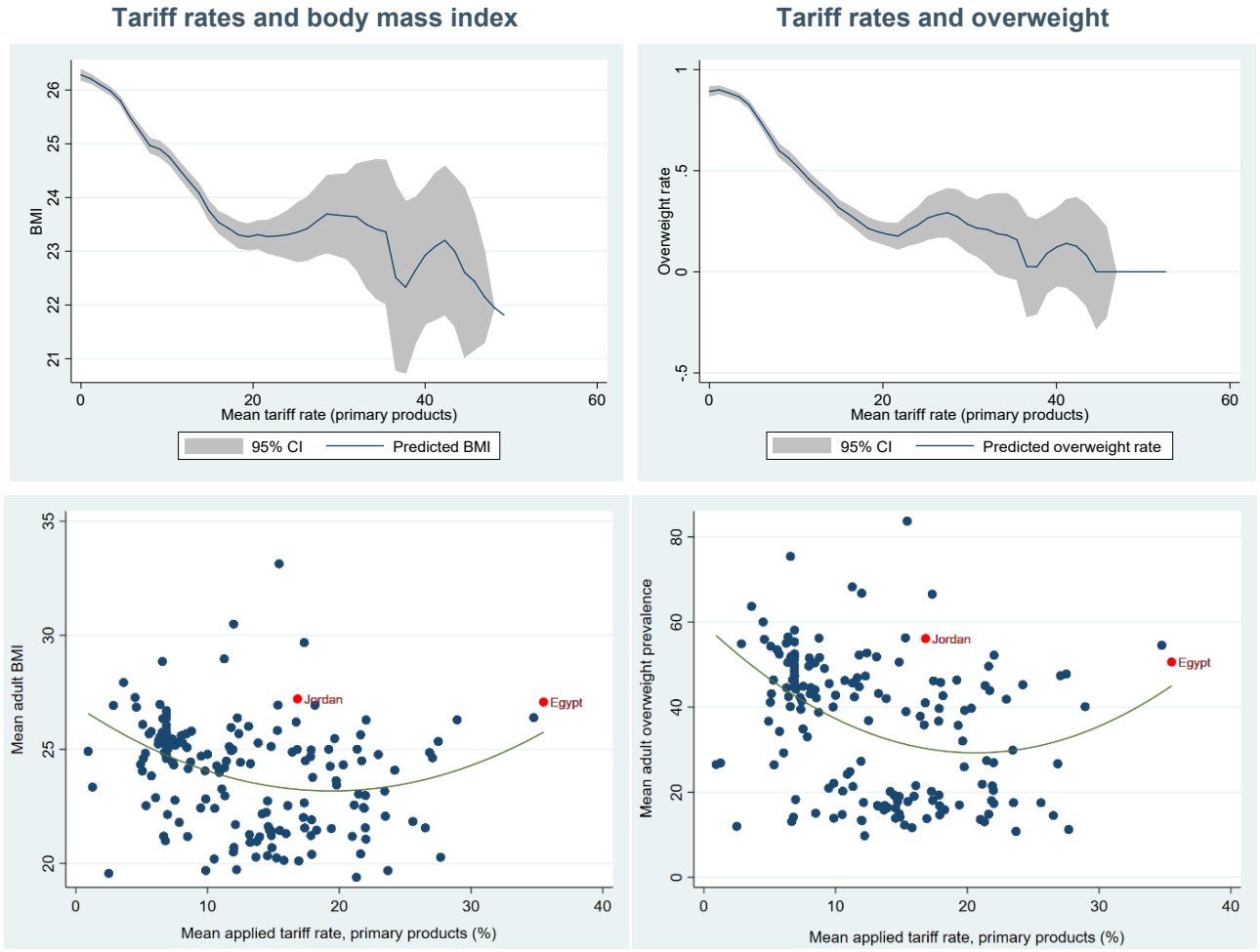


Source: Authors' illustration based on the FAOStat and authors' own calculations (FAO 2019)

Figure 4.17 plots the relationship between tariff rates on primary products and body overweight and obesity rates. There exists an inverse relationship between average tariff rates on primary products and overweight rates.[16] This is consistent with our expectations, as lower trade encourages imports and, hence, increases domestic food supply. The graphs in the first row provide average relationships; while those in the second provide information on the relative position of Jordan and Egypt.

[16] These hold for both the macro- and micro-level WDI and DHS data, respectively.

Figure 4.17 Food policies and body weight

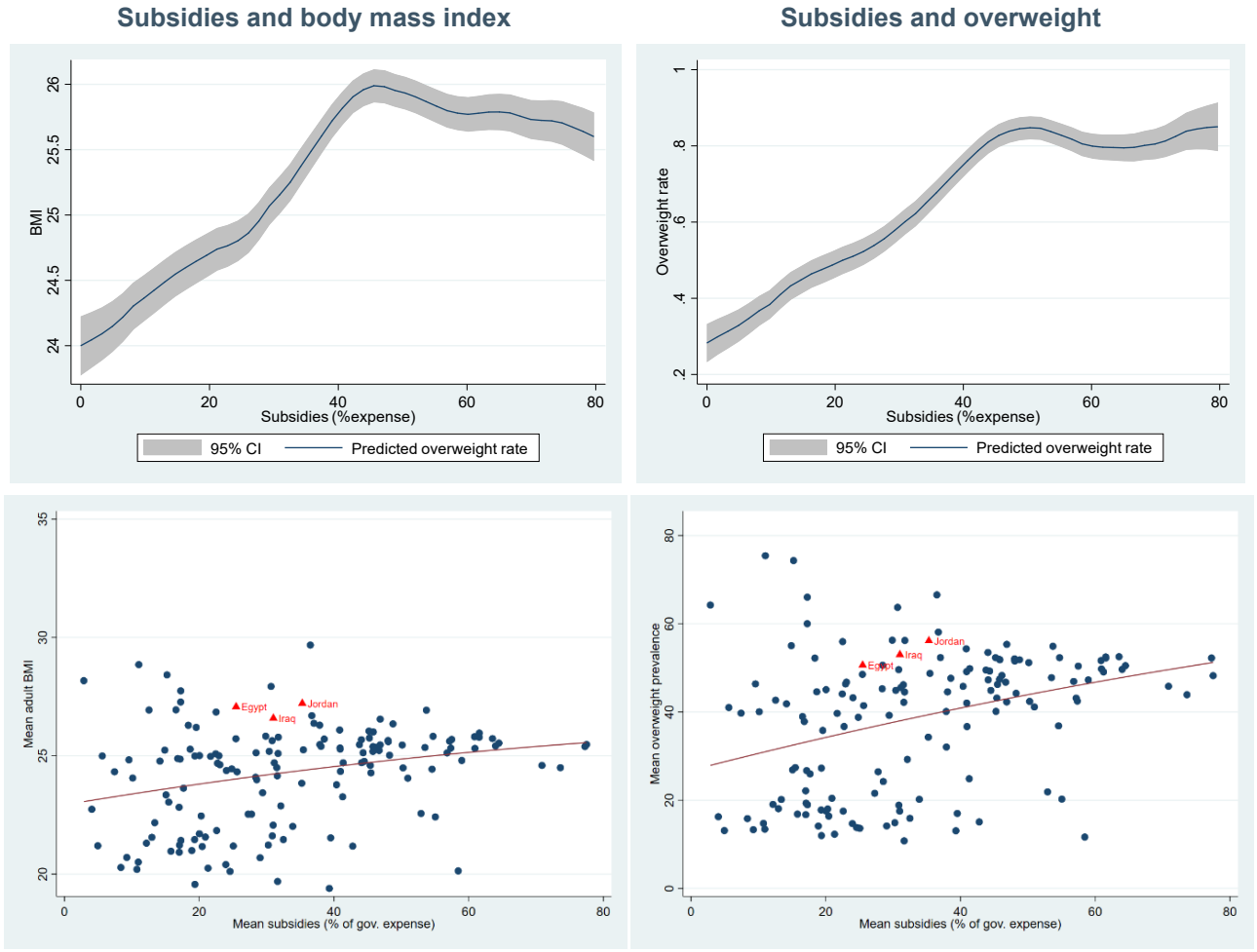


Source: Authors' illustration based on the GHO and World Bank's WDI (World Bank 2019; WHO 2019)

We also examine the association between government spending on subsidies and food availability, as well as ultimate relationships between subsidies and body weight outcomes. We have information on aggregate spending on subsidies, rather than the specific share of government expenditure on food subsidies. This is a potential limitation that could affect the accuracy of the relationship between food subsidies and body weight outcomes. However, agricultural input and food subsidies remain major components of the overall subsidy spending in most countries. For instance, in Egypt food subsidies accounted for 24 percent of commodity subsidies over the period 2012 to 2016 (Abdalla and Al-Shawarby 2018).

The graphs in Figure 4.18 show that government expenditure on subsidies is positively associated with body weight. The first row of graphs shows average global relationships between share of government expenditure on subsidies and body weight; the graphs in the second row provide the relative position of selected NENA countries. Overall, these figures suggest that governments' subsidies are strongly linked with nutrition and health outcomes. These patterns are consistent with previous micro-level evidence (Kochar 2005; Asfaw 2006; Jensen and Miller 2011; Ecker et al. 2016). This implies that, besides the common intention and objective of food and input subsidies – that is, improving undernutrition and ensuring price stability – governments need to consider the public health and nutritional implications of subsidies.

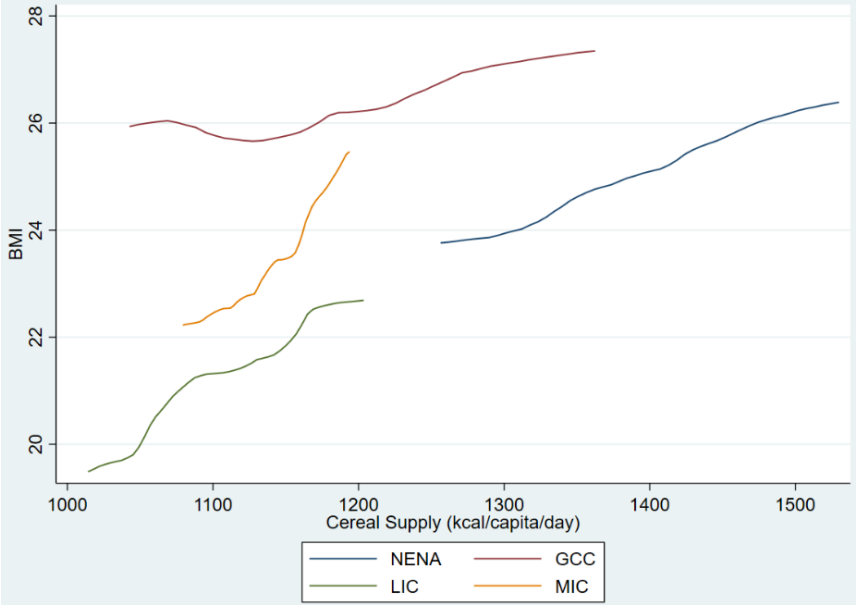
Figure 4.18 Food policies and food availability



Source: Authors' illustration based on the GHO and World Bank WDI (World Bank 2019; WHO 2019)

Following the conceptual framework in Section 2, trade and food policies can affect nutritional outcomes by influencing the availability and affordability of foods in domestic food markets. To explore potential channels through which trade and food policies may relate to and affect nutritional outcomes, we examine some of the relationships and channels described in our conceptual framework. This will involve investigating potential associations between food availability (and affordability) and body weight. Figure 4.19 shows that higher food availability (measured in terms of calorie per capita consumption) are associated with higher overweight and obesity rates. We focus on cereal availability as cereals represent the largest share of calorie intake in many countries and are known to be energy-dense diets. Higher per capita cereal calorie intake is associated with higher BMI for all regions, including the NENA region.

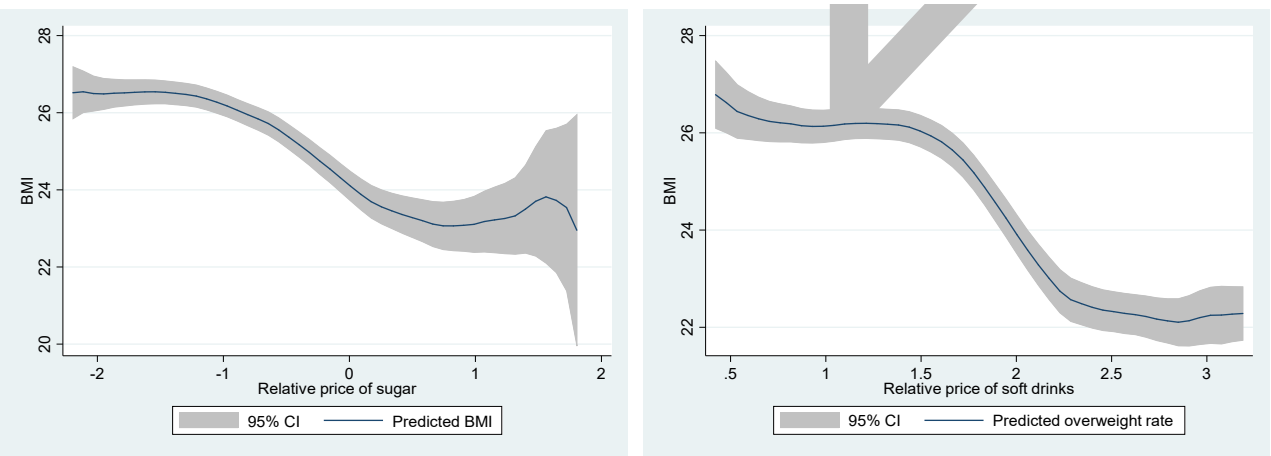
Figure 4.19 Cereal supply (availability) and body weight



Source: Authors' illustration based on the GHO and FAOStat (FAO 2019; WHO 2019)
Note: NENA = Near East and North Africa region; GCC = Gulf Cooperation Council; LIC = Lower income countries; MIC = Middle income countries.

The price of food items is one key channel through which trade and food policies can affect nutrition and body weight. To show this, we employ the relative price of "unhealthy" diets following Headey and Alderman (2019) and examine its effects on body weight. Figure 4.20 shows the relationships between the relative price of unhealthy foods and body weight (BMI). The first graph indicates that countries characterized by a low relative price of sugar are more likely to have higher body weight. The second graph shows a similar negative correlation between the relative price of soft drinks and BMI. This is consistent with our conceptual framework, which links trade and food policies to the price of food items and ultimately to body weight outcomes. These results corroborate other studies showing that global variations in the distribution of overweight and obesity rates may be partially explained by spatial variations in prices of food items (e.g., Headey and Alderman 2019).

Figure 4.20 Relative prices of unhealthy foods and body weight



Source: Authors' illustration based on the GHO (WHO 2019) and Headey and Alderman (2019)

These unconditional relationships are informative about the linkage between trade (food) policies and body weight outcomes. However, they may be confounded by other factors and, thus, may not be causal relationships. For instance, countries with varying income levels and economic growth rates may have systematically different trade policies and nutritional outcomes. Similarly,

countries have varying cultural contexts, farming systems, levels of urbanization, natural resources, and dietary patterns, all of which may affect the relationship between trade (food) policies and body weight outcomes. These figures are also based on pooled data, whereas countries' trade policies and body weight outcomes may evolve over time. We thus need an approach that accounts for potential differences in temporal and spatial variations in these differences across countries.

We now apply a more rigorous empirical approach that can capture both observable and unobservable differences. The following fixed-effects model controls for time (year) and country fixed effects, along with several other country characteristics that may vary over time. This approach allows us to exploit the implication of potential dynamics in trade (food) policies on temporal variations in intermediate and ultimate nutritional outcomes. More specifically, we estimate the following equation:

$$Y_{ct} = \alpha_c + \beta_1 TF_{ct} + \beta_2 X_{ct} + \alpha_t + \varepsilon_{ct} \quad (1)$$

Y_{ct} stands for the intermediate or ultimate nutritional outcome of country *c* for the year *t.* α_c represents country fixed effects, which can control for any unobservable time-invariant differences across countries, including cultural, geographic, and climate-related factors that remain broadly constant over time. TF_{ct} stands for measures and indicators of trade and food policies for each country and time period. X_{ct} captures additional observable time-varying characteristics, including GDP, population size, and level of urbanization. α_t captures time trends, which can control for any aggregate trends in the evolution of food systems or aggregate nutritional transitions. The empirical model specified in equation (1) thus exploits temporal variations in trade (food) policies to uncover their nutritional and public health implications.[17] These estimates and relationships are expected to be more conservative and robust than those based on cross-sectional and unconditional correlations given in the figures. We rely on individual-level data from the DHS program for these estimations.

The results in Table 4.4 show that higher tariff rates are associated with lower BMI. This holds across alternative specifications and measures of tariff rates, including average tariff rate on all products, tariff rate on primary products, and tariff rates on cereals. In these specifications, we are controlling for country and time fixed effects as well as several country characteristics that vary over time, including GDP per capita, population size, and share of urban population. In the interest of maximizing sample size, we separately estimate the implication of alternative food policies.

[17] As we are following countries across several decades, unobserved factors and error terms in equation (1) can be correlated over time. We thus cluster standard errors at the country level.

Table 4.4 Trade policies and body mass index outcomes: Evidence from DHS data

	(1) BMI	(2) BMI	(3) BMI	(4) BMI	(5) BMI	(6) BMI
Average tariff rates on all products	−0.040***	−0.051***				
	(0.003)	(0.004)				
Average tariff rates on primary products			−0.016***	−0.022***		
			(0.003)	(0.003)		
Average tariff rates on cereals					−0.071***	−0.077**
					(0.015)	(0.037)
Log (GDP per capita)		4.818***		4.276***		3.378
		(0.522)		(0.532)		(3.347)
Log (GDP per capita)-squared		−0.374***		−0.303***		−0.197
		(0.041)		(0.041)		(0.204)
Log (population)		−2.626***		−2.485***		−3.364***
		(0.306)		(0.308)		(0.749)
Urbanization (share of urban population)		0.047***		0.031***		−0.036
		(0.009)		(0.009)		(0.031)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.190	0.190	0.139	0.139	0.094	0.094
Observations	2,113,363	2,113,363	2,113,363	2,113,363	1,498,982	1,498,982

Source: DHS data and authors' analysis.
Notes: Standard errors, clustered at village level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results in Table 4.5 report the relationship between government subsidies and body weight outcomes. The result show that temporal increases in subsidies are associated with higher BMI and higher rates of overweight and obesity rates.

Table 4.5 Subsidies and body mass index, overweight, and obesity outcomes: Evidence from DHS data

	(1) BMI	(2) BMI	(3) Overweight	(4) Overweight	(5) Obesity	(6) Obesity
Subsidies (share of government expenditure)	0.066***	0.083***	0.005***	0.007***	0.003***	0.002***
	(0.005)	(0.006)	(0.000)	(0.001)	(0.000)	(0.000)
Subsidies (share of government expenditure)-squared	−0.001***	−0.001***	−0.000***	−0.000***	−0.000***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (GDP)		4.657***		−0.093		0.139**
		(1.008)		(0.086)		(0.059)
Log (GDP)-squared		−0.332***		0.009		−0.011**
		(0.079)		(0.007)		(0.005)
Log (population)		−3.356***		−0.038		−0.120***
		(0.587)		(0.052)		(0.033)
Urbanization (share of urban population)		0.072***		0.008***		−0.002**
		(0.012)		(0.001)		(0.001)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.203	0.204	0.156	0.156	0.093	0.093
Observations	980,707	980,707	980,707	980,707	980,707	980,707

Source: DHS data and authors' analysis.
Notes: Standard errors, clustered at village level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results in Table 4.6 complement the above findings by showing the association between trade (food) policies and food supply. The first two columns show the associations between tariff rates and domestic food availability (measured in daily per capita calorie), while the second two columns show similar relationships between subsidies and food supply. This table shows that

higher tariff rates are negatively associated with food supply and higher government subsidies are positively associated with food availability. These findings suggest that trade and food policies may influence domestic food availability and affordability, which in turn may affect nutritional and public health outcomes. This evidence is consistent with our hypothesis that lower tariff rates can increase physical access (food availability) and economic access (food affordability) to foods. Similarly, food subsidies can increase consumer purchasing power, an effect that can increase demand for food. The physical availability and economic affordability of these foods are expected to influence individuals' diets and dietary patterns, and hence nutritional outcomes (undernutrition and overnutrition).

Table 4.6 Food policies and food supply: Evidence from FAOSTAT data

	(1) Food supply (log kcal)	(2) Food supply (log kcal)	(3) Food supply (log kcal)	(4) Food supply (log kcal)
Average tariff rate on primary products	−0.001**	−0.001*		
	(0.000)	(0.000)		
Subsidies (share of government expenditure)			0.002**	0.002**
			(0.001)	(0.001)
Subsidies (share of government expenditure)-squared			−0.000**	−0.000**
			(0.000)	(0.000)
Log (GDP)		0.108***		0.124***
		(0.020)		(0.028)
Log (population)		−0.000		0.000
		(0.000)		(0.000)
Urbanization (share of urban population)		0.001		0.000
		(0.001)		(0.001)
Year fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R-squared	0.335	0.417	0.365	0.461
Observations	2,635	2,599	2,296	2,261

Notes: Standard errors, clustered at country level, are given in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.0$.
Source: DHS data and authors' analysis.

Table 4.7 Average tariff rates on sugar and confectionery food items and body weight outcomes

	(1) BMI	(2) BMI	(3) Overweight	(4) Overweight	(5) Obesity	(6) Obesity
Average tariff rate on sugars and confectionery products	-0.455***	-0.258***	-0.040***	-0.026***	-0.023***	-0.016***
	(0.078)	(0.076)	(0.006)	(0.006)	(0.004)	(0.005)
Subsidies (%)	1.638***	0.911***	0.128***	0.075***	0.070***	0.045***
	(0.199)	(0.221)	(0.016)	(0.018)	(0.012)	(0.016)
Subsidies (%)-squared	-0.034***	-0.017***	-0.003***	-0.001***	-0.001***	-0.001**
	(0.004)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
Women characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic indicators	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.202	0.280	0.166	0.235	0.106	0.139
Observations	599,291	598,209	599,291	598,209	599,291	598,209

Notes: Standard errors, clustered at each DHS cluster for each round, are given in parentheses. The base education outcome is no education while the base wealth quintile is the poorest wealth quintile. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We also disaggregate tariff rates by selected food products and explore potential relationships between tariff rates on unhealthy foods and body weight outcomes. Table 4.7 provides estimation results on the relationship between tariff rates on sugars and confectionary products as well as

governments' spending on subsidies. The results in Table 4.7 show that a reduction in tariff rates on sugars and confectionery products is associated with an increase in BMI. On the other hand, temporal increases in government spending on subsidies are associated with higher body weight outcomes. Countries increasing their investment on subsidies, including food, agricultural, and non-food items, are more likely to witness an increase in body weight.

Table 4.8 Average tariff rate on fats and oils and body weight outcomes

	(1) BMI	(2) BMI	(3) Overweight	(4) Overweight	(5) Obesity	(6) Obesity
Average tariff rate on fats and oils	-0.539***	-0.320***	-0.047***	-0.033***	-0.027***	-0.020***
	(0.092)	(0.094)	(0.007)	(0.008)	(0.005)	(0.006)
Subsidies (%)	1.743***	1.010***	0.137***	0.085***	0.075***	0.051***
	(0.215)	(0.248)	(0.018)	(0.021)	(0.013)	(0.017)
Subsidies (%)-squared	-0.039***	-0.021***	-0.003***	-0.002***	-0.002***	-0.001**
	(0.005)	(0.006)	(0.000)	(0.001)	(0.000)	(0.000)
Women characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic indicators	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.202	0.280	0.166	0.235	0.106	0.139
Observations	599,291	598,209	599,291	598,209	599,291	598,209

Notes: Standard errors, clustered at each DHS cluster for each round, are given in parentheses. The base education outcome is no education while the base wealth quintile is the poorest wealth quintile. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.8 shows the association between tariff rates on fats and oils and body weight. This table shows that countries increasing tariff rates on fats and oils are more likely to experience modest reductions in BMI and in overweight and obesity rates. These relationships remain robust across all specifications. The size and implication of tariff rates on fats and oils are modest and comparable to those based on tariff rates on sugars and confectionery foods.

5 MICRO-LEVEL ANALYSIS AND EVIDENCE

This section complements the macro-level analyses presented in Section 4. We compile several household surveys for the three study countries for which data are available. The purpose of this micro-level analysis is twofold: to confirm most of the macro-level evidence documented in Section 4, and to investigate micro-level relationships that we cannot establish through macro-level data, whether because of context variations or lack of data.

For these two purposes, we compile three types of household surveys that can provide information on body weight outcomes and potential factors to explain body weight trends and variations across individuals. These three datasets are DHS, HIECS, and LSMS. The DHS data for Egypt and Jordan date back to the 1990s and can show the micro-level evolution of body weight outcomes as well as their potential drivers.

The HIECS data complement some of the drawbacks of the DHS data, although these data also suffer from some limitations. We thus additionally employ the HIECS data for Egypt, which provide nationally representative coverage of large number of households. The HIECS data contain detailed information on household income, expenditures, consumption, and anthropometric information for some members of the household. We employ one specific round of the HIECS data for Egypt, that of 2011, which provides both anthropometric measures as well as important food policy indicators. The HIECS data provide food and non-food consumption expenditures (including

subsidized and nonsubsidized food items), both of which are missing from the DHS dataset. With these data we can examine the implication of food subsidies and probe the macro-level evidence on the relationships between subsidies and body weight outcomes.

Neither the DHS nor the HIECS data provide information on trade-related indicators.[18] However, given our knowledge of potential channels through which trade and food subsidies can affect nutritional outcomes, we examine the implication of alternative trade and food policies on the intermediate outcomes as well as the relationship between these intermediate outcomes and body weight outcomes. As discussed in Section 2, food availability and food prices are the most vital channels through which food policies may affect nutritional body weight outcomes. We thus investigate the relationships between body weight outcomes and prices of food items, particularly the prices of "unhealthy" foods. For this purpose, we merge our micro-level data with (governorate level) price data from the World Food Program. Specifically, for each country we merge the individual-level DHS/HIECS/LSMS data with the governorate-level prices of food items, and then examine potential linkages between food category prices and individual body weight measures.

5.1 Egypt

For Egypt, we employ two household surveys, DHS and HIECS. The DHS data for Egypt include six rounds with complete anthropometric information for women of productive age.[19] Table 5.1 provides average body weight outcomes across rounds for rural and urban samples. These data show that the average body weight and the prevalence of overweight and obesity has increased substantially over time. For instance, the last round in 2015 shows that 75 percent of women in Egypt are overweight, with the rate of obesity amounting to 47.5 percent. The overall obesity rate has doubled between 1992 to 2015. The increase in obesity rates appears to be much higher for rural areas, jumping from about 15 percent in 1992 to 44 percent in 2015, while the increase in obesity rates for the urban population went from 36 percent to 51 percent. This indicates that overweight and obesity trends have been increasing more in rural areas than urban areas, a trend consistent with recent global evidence showing that much of the global increase in BMI comes from rural residents (NCD-RisC 2019).

Table 5.1 Body mass index, overweight, and obesity in Egypt (DHS)

	1992	2015	% change
Full sample			
Mean body mass index (kg/m2)	26.8	30.3	12.9
Mean overweight (%)	56.8	75.2	32.4
Mean obesity (%)	23.8	47.5	99.5
Rural			
Mean body mass index (kg/m^2)	25.6	29.8	16.4
Mean overweight (%)	45.8	73.1	59.4
Mean obesity (%)	14.9	44.1	196.3
Urban			
Mean body mass index (kg/m^2)	28.6	30.9	8.0
Mean overweight (%)	71.8	77.6	8.1
Mean obesity (%)	35.9	51.2	42.5

Source: DHS (2018)

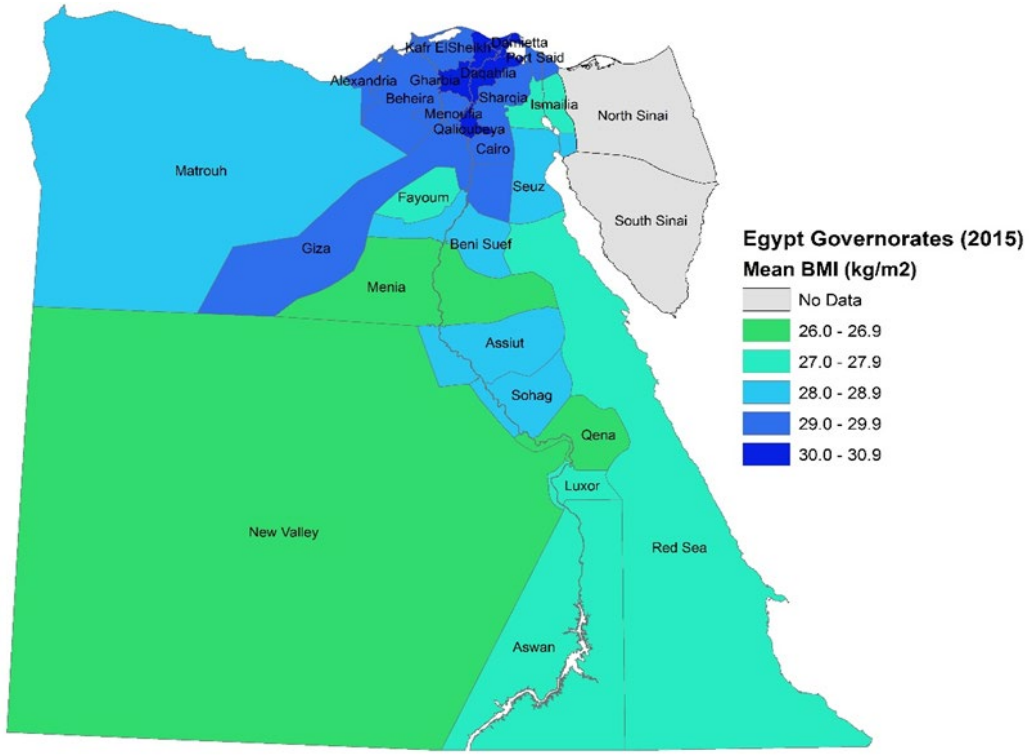
In an attempt to explain the distribution of body weight across governorates in Egypt, we map the distribution of BMI (Figure 5.1). Although the overall mean BMI is generally high in most of the governorates, we can observe some differences. Highest rates of overweight and obesity are

[18] We even lack information on whether consumed food items are imported or produced in the local economy.

[19] We exclude pregnant women from our sample as these may inflate average body weight outcomes.

observed in urban governorates, those located closer to ports, and in the Nile Delta region. The highest BMI rates are observed in Damietta and the lowest are observed in New Valley.

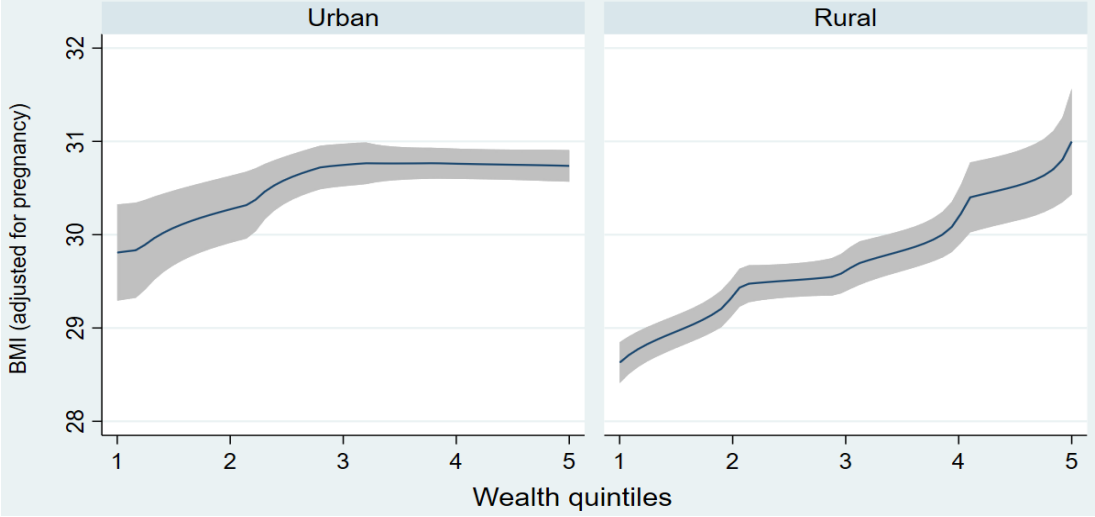
Figure 5.1 Distribution of body weight (BMI) across governorates in Egypt



Source: Authors' illustration based on the DHS (2018)

To further examine the distribution of body weight outcomes across wealth and income of individuals, we report some bivariate associations between obesity and wealth indicators. The DHS data provide indicators of household wealth in terms of wealth quintiles (Rutstein and Johnson 2004), while the HIECS data provide information on household income. The graphs in Figure 5.2 show the relationship between BMI and wealth quintile of households. Notably, BMI increases with wealth quintile, and more so in rural areas. This is consistent with the positive association between body weight outcomes and socioeconomic status documented in several African countries and LMICs (Popkin 1999; 2003; Siervo et al. 2006). However, this pattern is inconsistent with the evidence from developed countries and HICs (Kim, Symons, and Popkin 2004; Monteiro et al. 2004; Tafreschi 2015). The wealth indicator in the DHS data is not sufficiently continuous (Rutstein and Johnson 2004) to allow us to observe potential changes in the relationship between body weight and wealth across the distribution of household wealth.

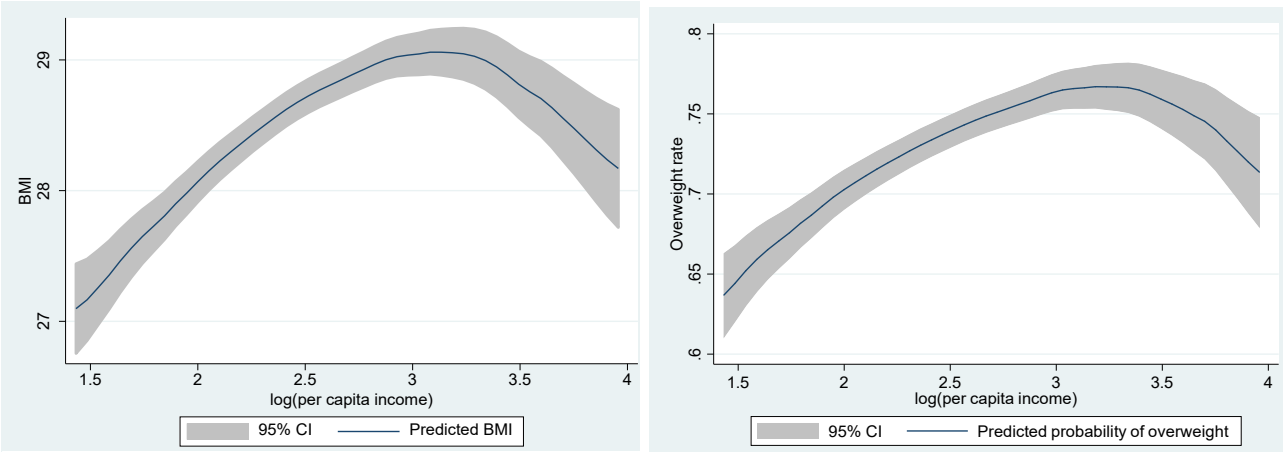
Figure 5.2 Household wealth and body mass index in Egypt



Source: Authors' illustration based on the DHS (2018)

Figure 5.3 shows a nonlinear relationship between body weight outcomes and income per capita – an initial positive relationship up to some level of income and then a negative relationship afterwards. This is consistent with the macro-level relationship between GDP per capita and body weight outcomes seen in Section 4, as well as with other studies showing an inverted U-shape relationship between income and body weight outcomes (e.g., Egger, Swinburn, and Amirul Islam 2012; Tafreschi 2015). At the macro-level, this means that the relationship remains positive in most LMICs, while turning to negative for HICs or as countries grow economically. At the micro-level, this implies that as individuals earn higher income, up to some level, they are more likely to spend it on additional energy consumption, while a further increase in income may encourage investment in more "healthy" diets. This is consistent with the Engel curve's prediction that food demand increases with income, more so for those households with lower income.

Figure 5.3 Household income by body mass index and overweight prevalence in Egypt



Source: Authors' illustration based on the DHS (2018)

The positive associations between body weight and socioeconomic status imply the need for tailored interventions to address overweight and obesity in Egypt and other NENA countries. These countries are economically growing, implying that their overweight and obesity rates as well as their adverse consequences are expected to further increase. Furthermore, the distinct relationship between body weight outcomes and socioeconomic status among the NENA and HICs imply that the usual strategies and campaigns that have been effective in tackling obesity rates in developed countries may not be effective in the NENA countries. Reducing the epidemics of overweight and

obesity in NENA countries may require distinct interventions, including those that can address sociocultural barriers and perceptions.

To understand the implication of trade and food policies on individuals' nutritional outcomes, it is crucial to identify and examine potential mechanisms through which these policies can affect such outcomes. As shown in our conceptual framework (Figure 1), food and trade policies can affect nutritional outcomes through two intermediate channels and outcomes. First, food and trade policies can influence the food system by increasing (or decreasing) the availability of specific type of food items. Second, trade and food policies can directly affect the price of food items, which in turn can affect individuals' food choices and nutritional outcomes. To indirectly test these mechanisms, we examine the links among food subsidies, food prices, and individuals' body weight outcomes.

Table 5.2 shows the estimated relationship between participation in food subsidy programs and body weight outcomes. The first panel shows relationships at the extensive margin; the second panel shows relationships at the intensive margin of participation in food subsidy programs. A positive association is seen between participation in food subsidy programs and body weight outcomes: households with ration cards have higher body weight outcomes. The results are consistent with the findings in Ecker et al. (2016), who conducted a more rigorous evaluation of the impact of food subsidies and concluded that food subsidies may lead to overnutrition. However, these results are based on old data from before the major food subsidy system reforms that took place in Egypt in 2014. Whether these patterns hold after the reforms remains an important empirical question for future research.

Table 5.2 Participation in food subsidy programs and body weight in Egypt

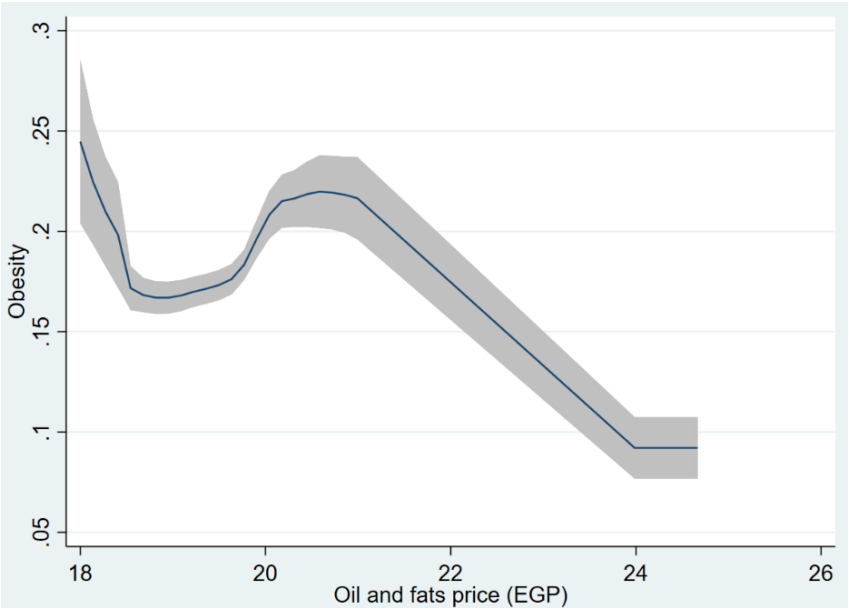
	(1) BMI	(2) Overweight	(3) Obese
Panel A: Extensive margin of participation			
Ration card (household has ration card)	0.368***	0.018*	0.033***
	(0.127)	(0.011)	(0.011)
Log (per capita income)	4.210***	0.323***	0.247***
	(0.602)	(0.057)	(0.056)
Log (per capita income)-square	−0.626***	−0.049***	−0.037***
	(0.102)	(0.010)	(0.010)
Socioeconomic characteristics	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes
R-squared	0.059	0.043	0.047
Observations	9,668	9,668	9,668
Panel B: Intensive margin of participation			
Number of adults registered on ration card	0.161**	0.014**	0.017**
	(0.081)	(0.006)	(0.007)
Log (per capita income)	4.068***	0.243**	0.242**
	(1.215)	(0.108)	(0.118)
Log (per capita income)-square	−0.543**	−0.030	−0.031
	(0.237)	(0.020)	(0.023)
Socioeconomic characteristics	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes
R-squared	0.063	0.055	0.052
Observations	4,208	4,208	4,208

Notes: Standard errors, clustered at household level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 5.4 presents relationships between the prices of various food items and body weight outcomes of women. The estimated relationships show that lower food prices are associated with higher body weight outcomes. In particular, prices of "unhealthy" foods, e.g., oil and fats, are

negatively correlated with body weight outcomes. This is consistent with the macro-level relationships observed in Section 4 and our conceptual framework linking trade and food policies to the price of food items and ultimately to body weight outcomes. These results corroborate studies showing that global variations in the distribution of overweight and obesity rates may be partially explained by spatial variations in prices of food items (e.g., Headey and Alderman 2019).

Figure 5.4 Obesity and price of unhealthy foods (oils and fats) in Egypt



Source: Authors' illustration based on the DHS (2018) and WFP (2019) prices

5.2 Jordan

We employ five rounds of DHS data for Jordan collected in 1997, 2001, 2007, 2009, and 2012. As for Egypt, these DHS data are only for women of reproductive age. These data can show the evolution of body weight outcomes over time and across socioeconomic groups. Table 5.3 provides the evolution of body weight outcomes in Jordan across rounds for both rural and urban samples. This table shows that in general body weight and hence the rate of overweight and obesity has been increasing over time. For instance, overall BMI increased from 27.4 kg/m^2 in 1997 to 29 kg/m^2 in 2012, corresponding to an increase in overweight prevalence rates from 62 to 73 percent. As for Egypt, the increase in overweight rates appears to be much higher for rural areas, jumping from 57 percent in 1997 to 74 percent in 2012, while the increase in overweight rates for the urban population ranges from 63 percent to 73 percent. These figures clearly show that overweight and obesity have been increasing more in rural areas than in urban areas, a trend consistent with recent global evidence showing that much of the global increase in BMI comes from rural residents (NCD-RisC 2019). Although the causes and drivers of this increase in overweight and obesity in rural areas remain unknown, it calls for due policy attention.

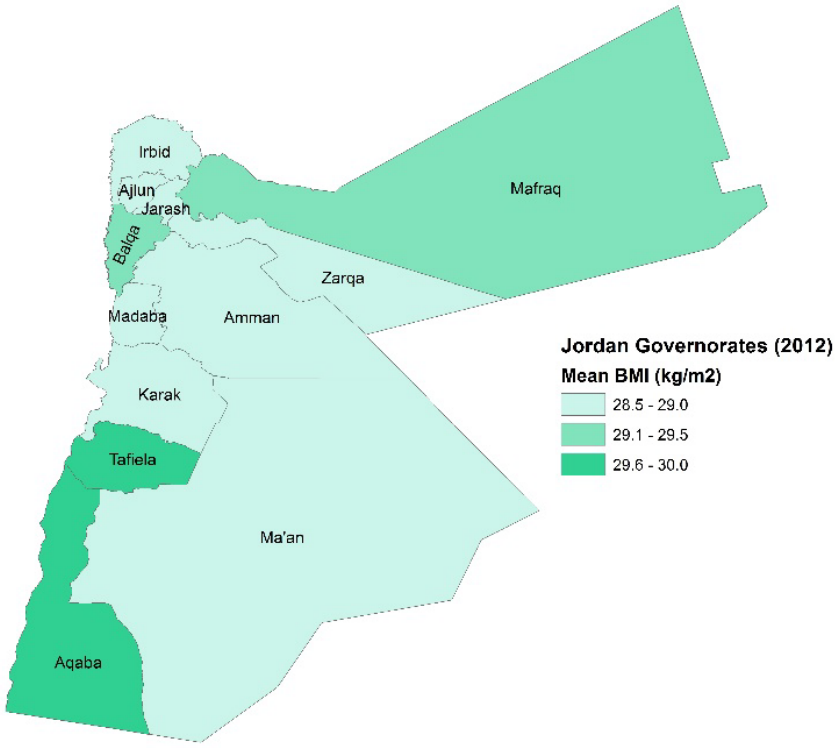
Table 5.3 Body mass index, overweight, and obesity in Jordan (DHS)

	1997	2012	% change
Full sample			
Mean body mass index (kg/m2)	27.4	29.0	6.0
Mean overweight (%)	61.5	73.2	19.1
Mean obesity (%)	28.2	40.2	42.6
Rural			
Mean body mass index (kg/m^2)	26.7	28.9	8.0
Mean overweight (%)	56.8	73.5	29.5
Mean obesity (%)	27.3	40.4	47.9
Urban			
Mean body mass index (kg/m^2)	27.5	29.0	5.3
Mean overweight (%)	62.8	73.1	16.5
Mean obesity (%)	28.4	40.2	41.4

Source: DHS (2018)

The map in Figure 5.5 shows spatial variation in body weight across Jordanian governorates. As expected, average body weight varies significantly across governorates. The highest body weight (as measured by BMI) is observed among women living in Tafiela, while the lowest body weight prevails in Madaba and Zarqa governorates.

Figure 5.5 Average body weight across governorates in Jordan



Source: Authors' illustration based on the DHS (2018)

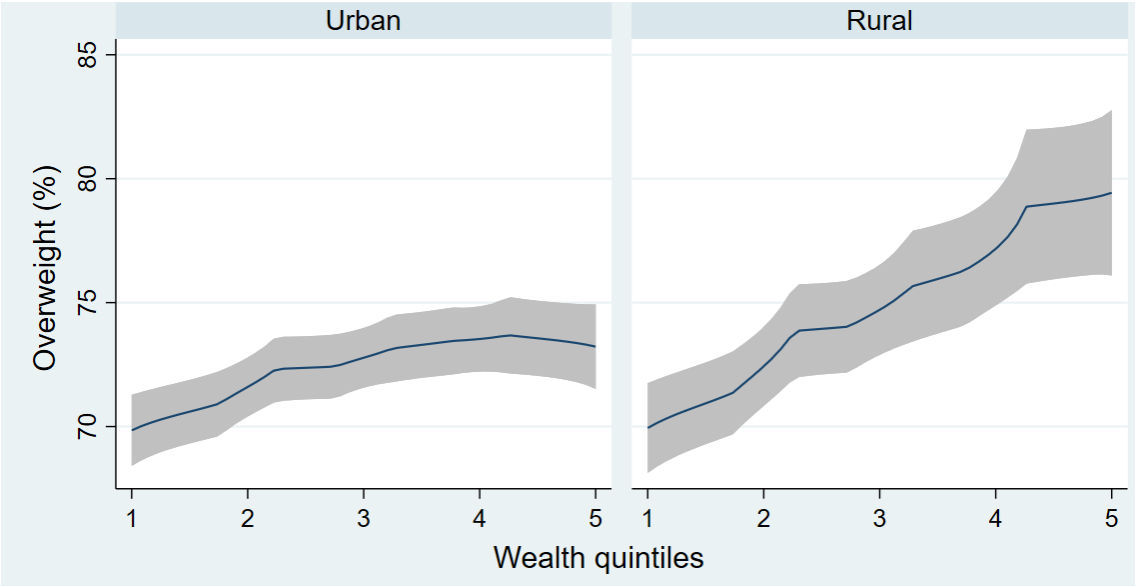
We also examine the distribution of body weight outcomes across wealth quintiles. Figures 5.6 and 5.7 show the relationship between body weight outcomes and wealth quintiles. Consistent with the case in Egypt, higher wealth is associated with higher body weight outcomes, and more so in rural areas. The positive relationship between body weight and wealth indicators is strong in the rural sample, though the relationship gets weaker in urban areas. However, as the wealth index and wealth quintiles we employ here are not sufficiently continuous, we may not be able to observe the relationships between wealth and body weight throughout the whole wealth distribution. Nonetheless, the empirical patterns and relationships between socioeconomic status and body

weight outcomes are intuitive and consistent with existing evidence from other LMICs (Popkin 1999; 2003; Siervo et al. 2006; Egger, Swinburn, and Amirul Islam 2012; Tafreschi 2015).

Figure 5.6 Household wealth and body mass index in Jordan, rural/urban

Source: Authors' illustration based on the (DHS 2018)

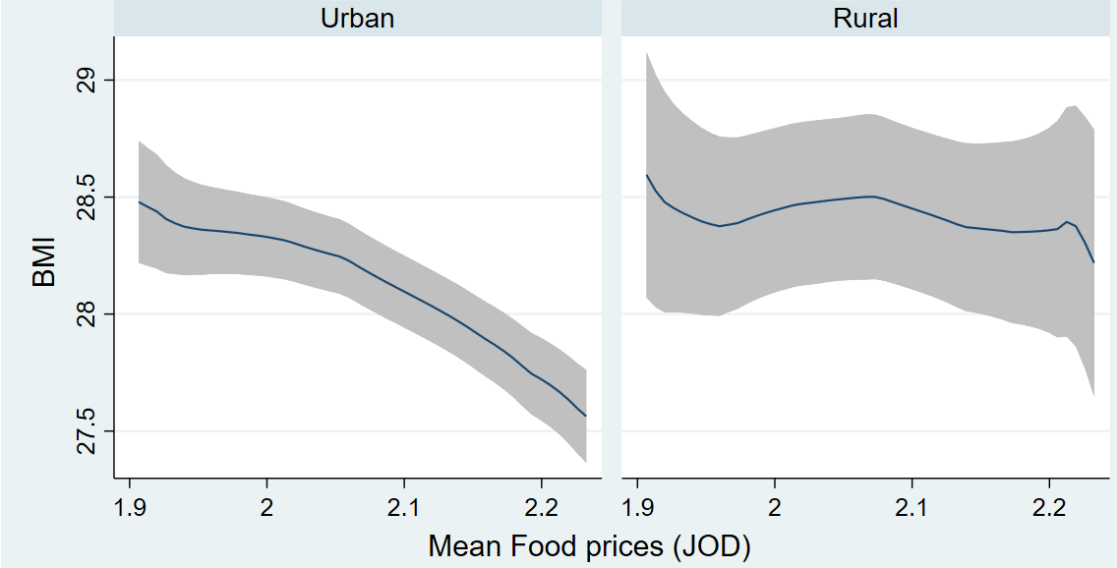
Figure 5.7 Household wealth and overweight prevalence in Jordan, rural/urban



Source: Authors' illustration based on the DHS (2018)

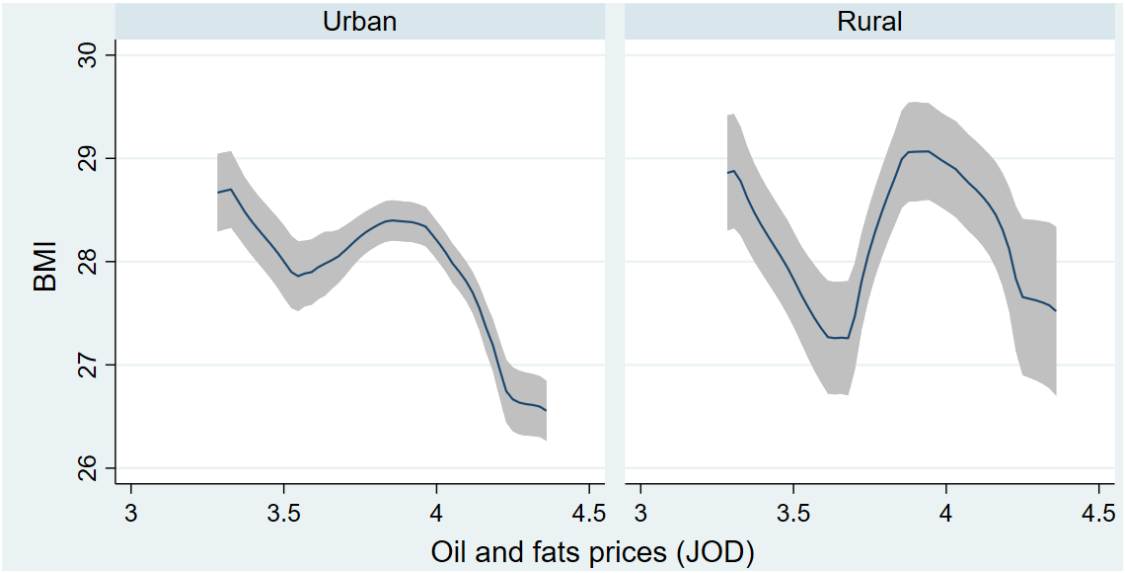
We also examine the relationship between prices of food items, particularly those found in unhealthy diets, and body weight outcomes. As shown in Figures 5.8 and 5.9, the price of unhealthy foods, e.g., oil and fats, is negatively correlated with body weight outcomes. This suggests that lower food prices may encourage consumers to overconsume or substitute these products over other potentially healthier foods, and, in doing so, ultimately increase their energy consumption in ways that may trigger an increase in body weight outcomes. As discussed in Section 2, many NENA region countries import a substantial share of their food, particularly vegetable oils and fats, implying that trade policies have important effects on domestic prices. For instance, increased tariff rates on imported oils and fats are likely to increase the domestic price of these food items. In terms of policymaking, the inverse relationship between prices of unhealthy foods and body weight suggest that policy instruments, e.g., taxes, that can affect the prices of these diets may help address existing overweight and obesity trends in the NENA region.

Figure 5.8 Body mass index and food prices in Jordan



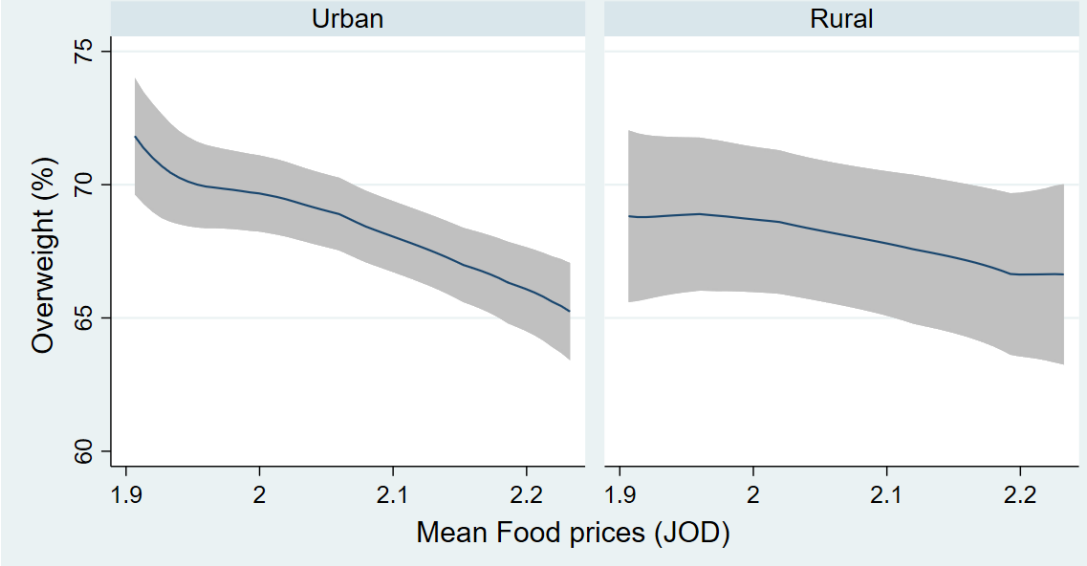
Source: Authors' illustration based on the DHS (2018) and WFP (2019) prices

Figure 5.9 Body mass index and price of unhealthy foods (oils and fats) in Jordan



Source: Authors' illustration based on the DHS (2018) and WFP (2019) prices

Figure 5.10 Overweight prevalence and food prices in Jordan



Source: Authors' illustration based on the DHS (2018) and WFP (2019) prices

Figure 5.11 Overweight prevalence and price of unhealthy foods (oils and fats) in Jordan

Source: Authors' illustration based on the DHS (2018) and WFP (2019) prices

5.3 Iraq

Because we lack DHS and HIECS data for Iraq, we rely on a different data source: the Living Standard Measurement Survey–Integrated Surveys on Agriculture (LSMS-ISA) program. These data are collected by the Iraqi government's Central Organization for Statistics and the Kurdistan Regional Statistics Office with technical support from the World Bank. We particularly employ the second round Household Socio-economic Survey collected in 2012, the only round that collects anthropometric measures. Interestingly, these data are nationally representative, covering more than 25,000 households and more than 70,000 individuals. This broad representation allows for disaggregated analysis on the distribution of overweight and obesity rates across various dimensions. The data also provide anthropometric measures for both males and females.

Table 5.4 provides average body weight outcomes, including overweight and obesity rates for the full sample as well as more disaggregated rural and urban average values. Nationally, the mean BMI is 26.6 kg/m^2 with overweight and obesity prevalence rates amounting to 57 and 22

percent, respectively. As expected, body weight outcomes (and hence overweight and obesity rates) are higher in urban areas and higher among women. However, we lack longitudinal data to examine the temporal evolution of body weight across genders as well as across rural and urban areas.

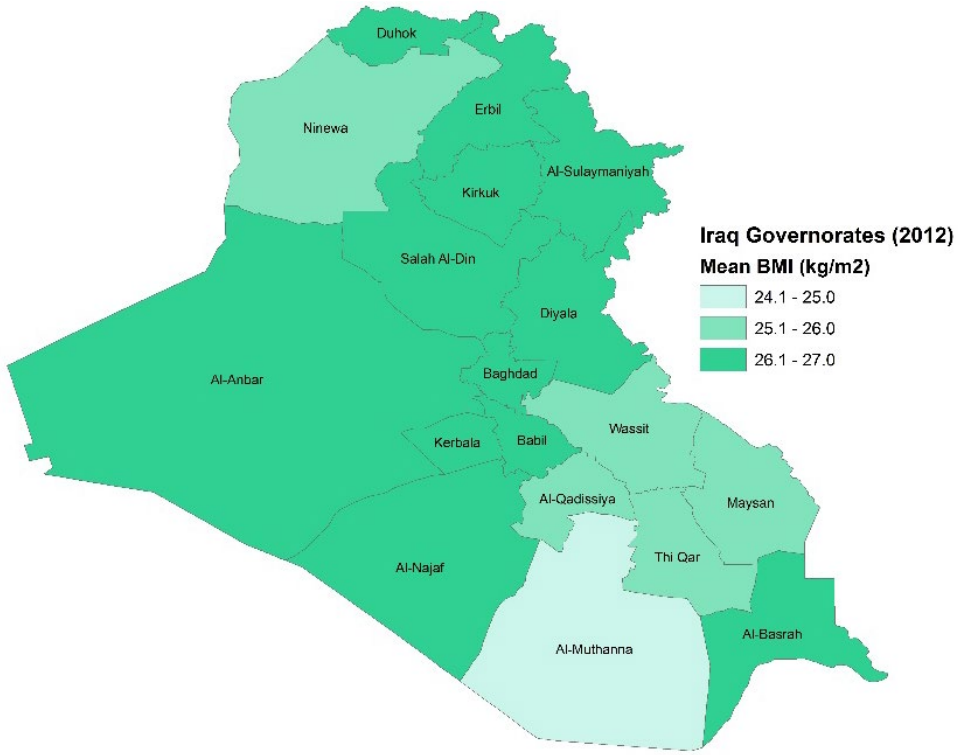
Table 5.4 Body mass index, overweight, and obesity in Iraq (LSMS)

	Males	Females	Total
Full sample			
Mean body mass index (kg/m2)	25.7	27.4	26.6
Mean overweight (%)	50.1	62.1	56.9
Mean obesity (%)	14.8	28.2	22.4
Rural			
Mean body mass index (kg/m^2)	25.9	27.1	26.5
Mean overweight (%)	52.7	59.7	56.5
Mean obesity (%)	16.4	26.1	21.7
Urban			
Mean body mass index (kg/m^2)	25.5	27.5	26.7
Mean overweight (%)	48.5	63.4	57.1
Mean obesity (%)	13.9	29.4	22.8

Source: Iraq's Household Socio-Economic Survey (World Bank 2012)

Overweight and obesity rates also vary across regions, as shown in Figure 5.12. The highest body weight is observed among individuals living in the major cities, including Baghdad and Salah Al-Din, while individuals living in more remote areas, like Al-Muthanna, have the lowest body weight.

Figure 5.12 Average body mass index across governorates in Iraq

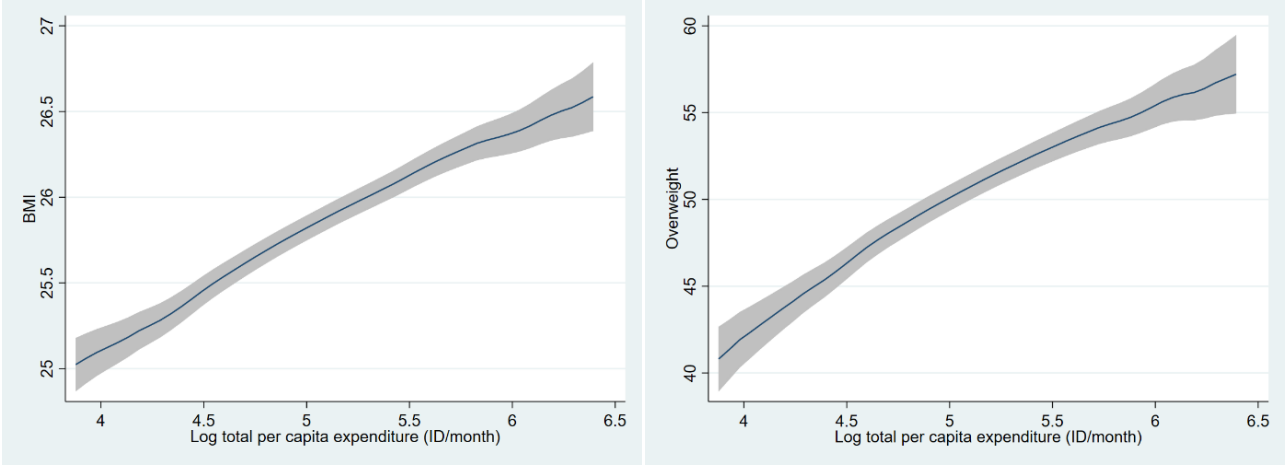


Source: Authors' illustration based on Iraq's Household Socio-Economic Survey (World Bank 2012)

We next examine the relationship between body weight outcomes and individuals' socioeconomic characteristics. We employ per capita total expenditure as a proxy for income and explore potential links between body weight and economic status. The graphs in Figure 5.13 show such empirical relationships. Consistent with the evidence for Egypt and Jordan, we can observe

that higher per capita expenditures are positively associated with body weight, with those spending more on food and nonfood items being more likely to be overweight and obese. This finding is intuitive, as expenditures on food items account for a large share of overall household expenditures. Again, this is consistent with the macro-level relationships between income per capita and body weight outcomes, where we observe positive association for LMICs and negative association for HICs.

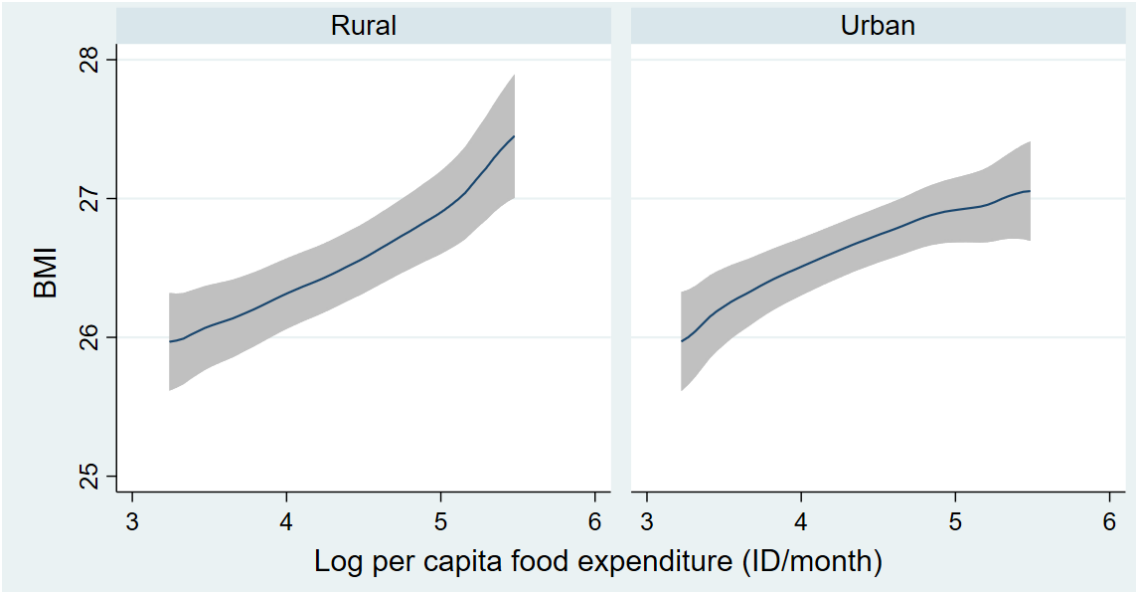
Figure 5.13 Per capital expenditure by body mass index and overweight rate in Iraq



Source: Authors' illustration based on Iraq's Household Socio-Economic Survey (World Bank 2012)

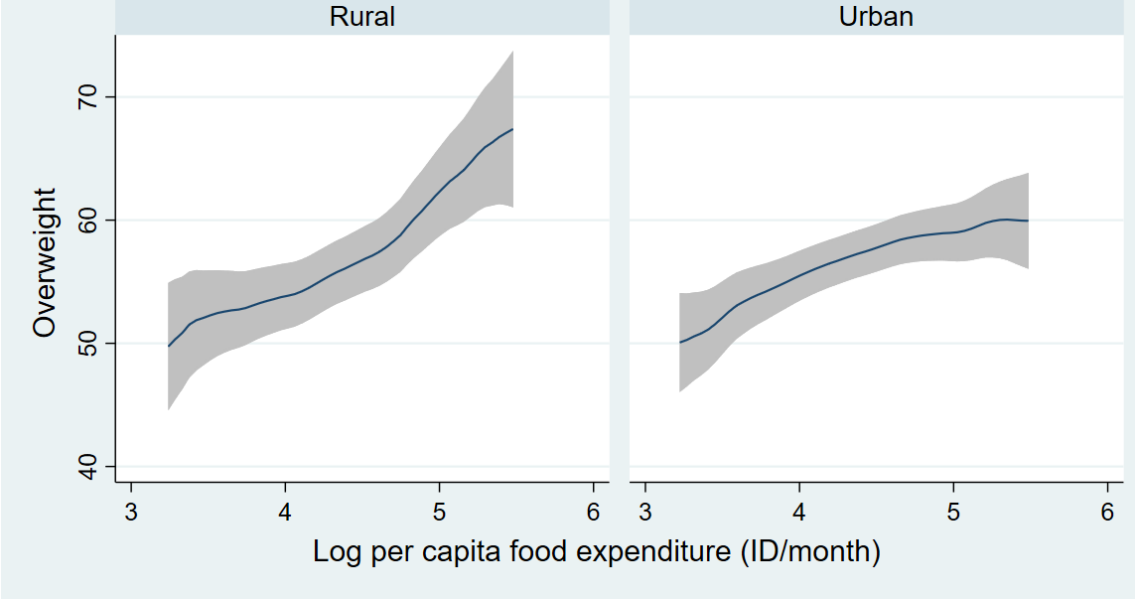
To uncover potential differences in the implications of socioeconomic status in rural and urban areas, we also examine the relationship between per capita expenditure and body weight for rural and urban areas separately. Figures 5.14 and 5.15 show that the relationship between per income (proxied by per capita expenditure) and body weight is stronger in rural areas than in urban areas. This is consistent with the hypothesis that a higher share of increase in income is more likely to be used for consumption purposes in rural areas than in urban areas. Consequently, a proportional increase in income may have varying effects on body weight in urban and rural areas.

Figure 5.14 Per capita expenditure and body mass index in Iraq, rural/urban



Source: Authors' illustration based on Iraq's Household Socio-Economic Survey (World Bank 2012)

Figure 5.15 Per capita expenditure and overweight rate in Iraq, rural/urban



Source: Authors' illustration based on Iraq's Household Socio-Economic Survey (World Bank 2012)

6 SUMMARY AND POLICY RECOMMENDATIONS

This study examines the evolution of food policies, food systems, and body weight outcomes in the NENA region. It investigates the implications of important food policies, mainly trade and government food subsidies, on the region's rising overweight and obesity rates. We employ both descriptive and predictive approaches to examine the relationships between food policies, immediate food system indicators, and body weight outcomes. To address major data scarcity challenges in the NENA region, which deserve due policy attention and significant investment, we compiled several datasets that allow both macro and micro-level analyses of the evolution of trade (food) policies and associated obesity trends.

We find that overweight and obesity trends in the NENA region follow some distinct patterns that have given the region its high current rates of overweight and obesity. Overweight and obesity rates in the NENA region have been increasing, more so than in other regions of the world. These increased rates have been observed both in rural and urban areas of the NENA region. Indeed, body weights in rural areas of the region has been rising at higher rates than in urban areas.

Consistent with this pattern, food systems in the NENA region have evolved substantially, where overall food supply quadrupled in the period from 1960 to 2013 and food import dependence likewise increased. Our findings show significant relationships between alternative trade (food) policy indicators and food availability indicators, and ultimately important relationships between trade policies and body weight outcomes. Conditional on other observable factors, countries with low tariff rates have higher overweight and obesity rates, while higher subsidy rates (as a share of government expenditure) are significantly associated with higher overweight and obesity rates. An increase in tariff rates on sugar and confectionary foods, for instance, is associated with a reduction in overweight and obesity rates. Similarly, countries experiencing an increase in tariff rates on fats and oils are more likely to experience a reduction in average body weight. These findings contribute to evolving debates on the role of fiscal policies and instruments to combat obesity and associated NCDs (WHO 2015; Thow et al. 2018). Economic affordability of foods appears to be among the important mechanisms for overall public health, as we find inverse relationships between the prices of "unhealthy" foods and body weight outcomes.

These findings have important implications for informing public health policies in the region. The ever-increasing trend in obesity rates, particularly in rural areas, calls for integrated interventions that can address diet-related weight gains and the associated burden of NCD in the NENA region. As the region's population increases and arable land and water resources continue to shrink, trade and food policies will have to respond accordingly. Integrating nutritional targets and designing nutrition-sensitive food policies will both be crucial to address the adverse public health implications of trade (food) policies. A comprehensive effort will involve region-wide and domestic efforts and initiatives. Recently, economists and policymakers have considered the idea of integrating health costs into trade agreements. In particular, health costs may have to be built into the cost-benefit analysis for new trade agreements. Thus, the early stages of negotiations will have to involve relevant public health stakeholders (UNDP 2013).[20]

Because of the complex nature of transnational trade agreements and policies, most countries and initiatives have focused on domestic policies to influence the production, consumption, and price of unhealthy foods. These domestic and complementary policies can address unintended (adverse) dietary and public health impacts of trade policies. For instance, many governments have enacted alternative forms of taxes on energy-dense foods (Thow, Quested, et al. 2011; Zhen et al. 2014; Cawley and Frisvold 2015; Nakhimovsky et al. 2016). Some Pacific island nations, for example, have begun to tax fat-rich foods and sugary drinks, a policy that has reduced the consumption of such food items (Thow, Quested, et al. 2011). The Mexican sugar-sweetened beverage tax has been a major nationwide policy intervention to encourage consumers to switch to healthier diets (Colchero et al. 2017; Backholer, Blake, and Vandevijvere 2017). Some NENA countries have made efforts to introduce sugar-sweetened beverage taxes, as in Saudi Arabia's recently introduced 50 percent excise tax on sugar-sweetened beverages.

Other domestic regulations, subsidies, and incentives have been employed to discourage consumption of unhealthy foods and encourage that of healthy foods, especially in European and developed countries. Tailoring agricultural production and instruments to produce healthy and nutritious food products may be an important policy avenue, especially for countries with agricultural production potential. For instance, some NENA countries have agricultural input subsidies, providing additional avenues and policy instruments to influence domestic food systems. Finally, regulating food marketing and nutrition labeling practices can help reduce the consumption of unhealthy foods (Nestle 2006; Chopra, Galbraith, and Darnton-Hill 2002).

In some NENA countries, certain foods are supported by government food subsidies. These programs will have to be more nutrition-sensitive. Previous evaluations of these programs as well as our findings highlight the need for reforms in NENA region food subsidy programs. Some countries, including Egypt, have already started reforming their subsidy programs. To date, the most effective reforms have involved a gradual shift from direct subsidization of goods toward smart, targeted cash transfers (Sdralevich et al. 2014). Given food subsidy programs' substantial inefficiencies, economic distortions, and leakages, improving the targeting and modalities of these programs can improve their impact and reduce potential adverse public health implications. Overall, the above lessons provide vital inputs to design and introduce similar instruments to address the increasing obesity rates and associated NCD burden in the NENA region.

[20] This would constitute an important change as most such policies are not usually influenced by health professionals but, rather, by diplomats and trade policymakers (Blouin, Chopra, and van der Hoeven 2009).

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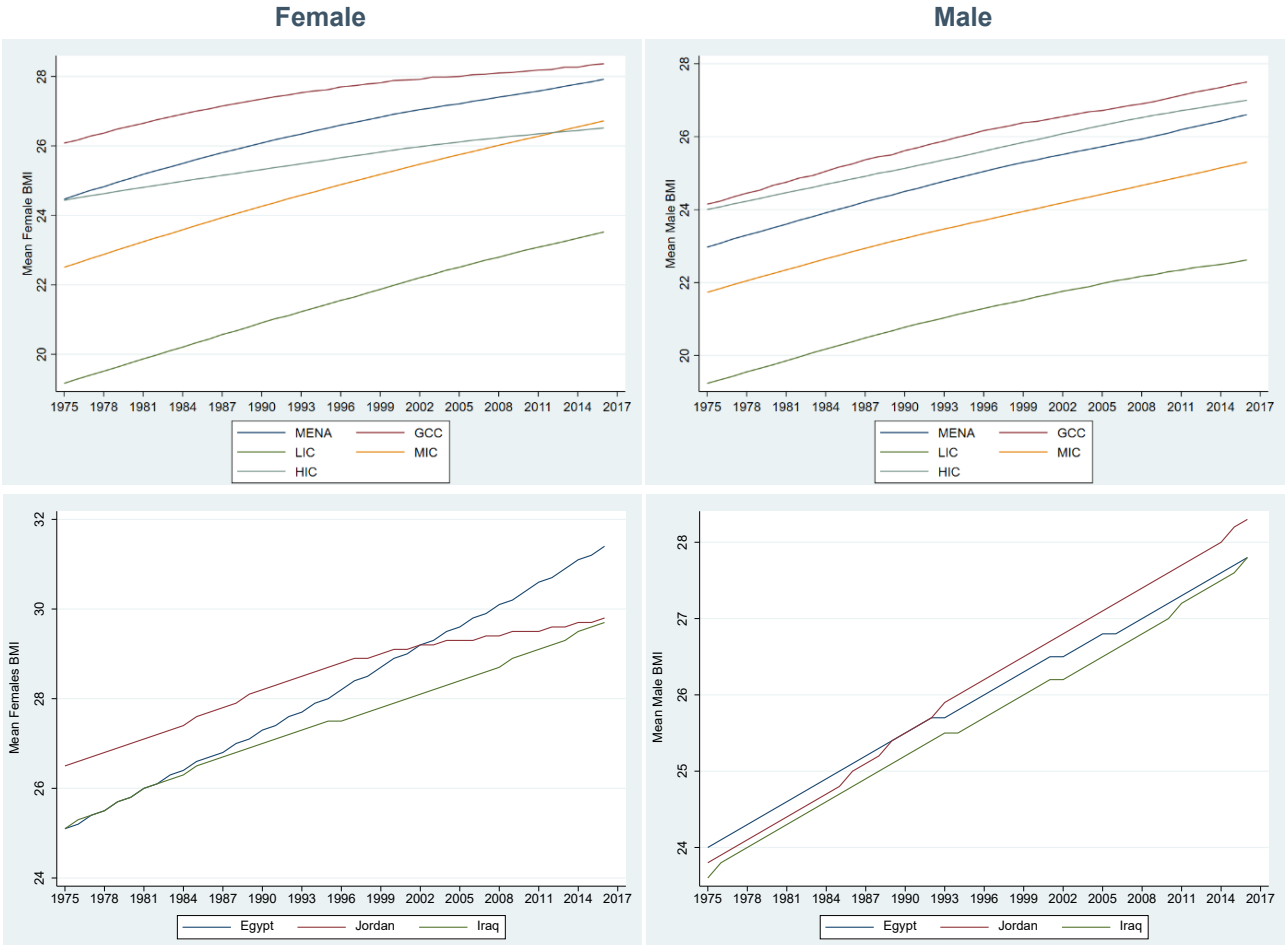
APPENDIX

Appendix Table 1 Near East and North Africa Open Data Inventory (ODIN) weighted score and ranking, by country

	Open Data Inventory Score									
	All	Health outcomes	Intl. trade	Labor	National accounts	Pop. & vital statistics	Poverty & income	Price indexes	Repro-ductive health	Global rank
Oman	65.9	70	75	70	67	85	70	89	70	27
Morocco	57.5	50	63	65	50	60	55	78	60	42
Palestine	55.9	55	69	60	78	50	55	61	60	50
Tunisia	51.7	35	69	70	61	65	45	61	50	63
UAE	50.7	0	63	60	61	75	0	67	65	67
Kuwait	50.2	45	69	50	33	55	0	61	55	68
Qatar	41.4	40	63	50	50	65	50	50	50	93
Egypt	38.9	35	44	30	33	45	40	50	35	109
KSA	35.4	45	75	60	67	45	0	0	0	127
Lebanon	34.4	40	56	50	33	50	30	39	35	129
Algeria	32.1	30	50	45	39	50	35	44	40	137
Iraq	25.6	35	31	20	33	40	0	33	35	156
Sudan	23.8	40	44	0	39	0	40	39	40	160
Libya	15.1	0	25	25	28	30	0	17	0	175

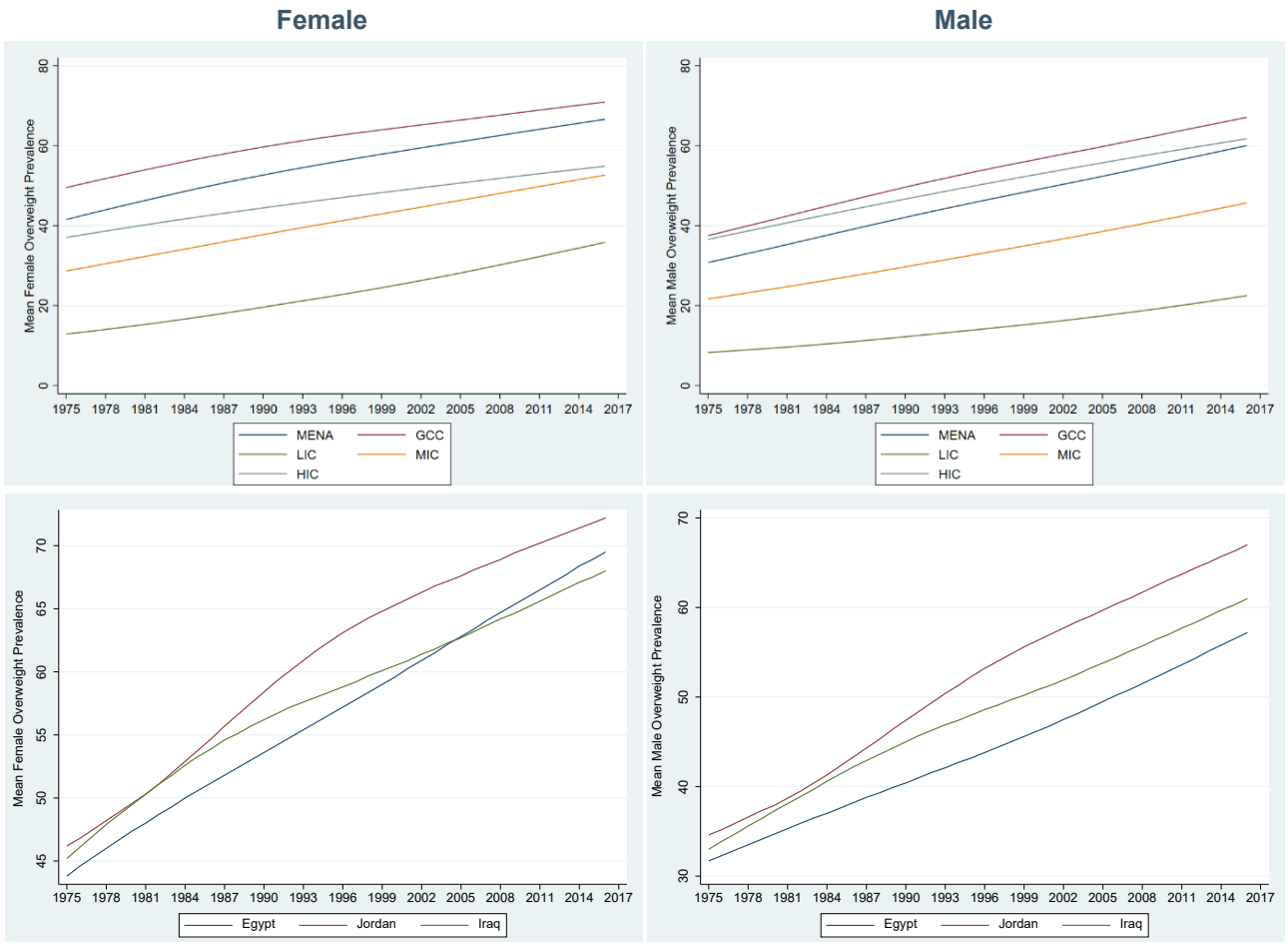
Source: Open Data Watch, Open Data Inventory, www.OpenDataWatch.com

Appendix Figure 1 Evolution of body mass index, 1975 to 2017, by sex



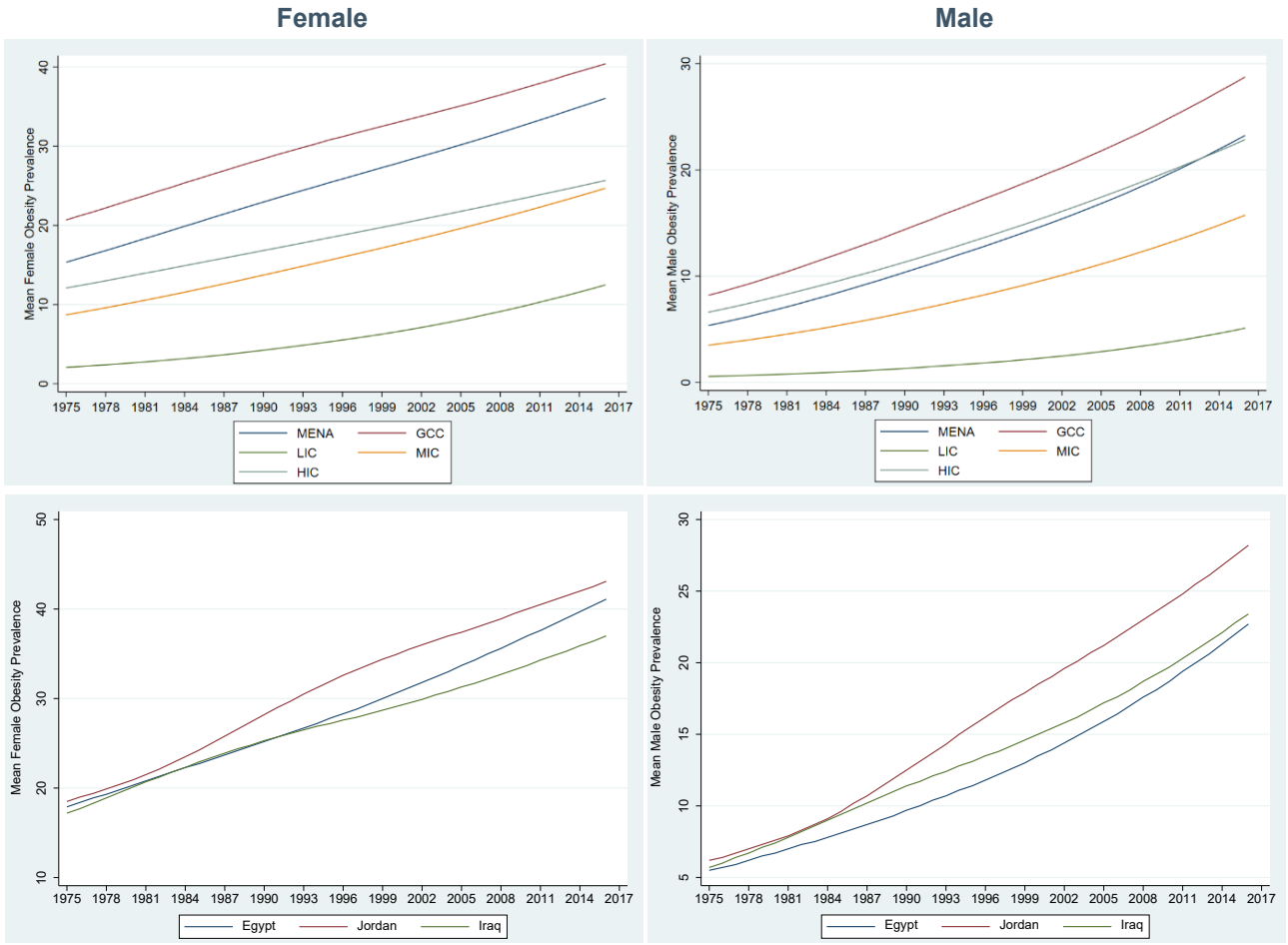
Source: Authors' illustration based on the GHO (WHO 2019)
Note: MENA = Middle East and North Africa region; GCC = Gulf Cooperation Council; LIC = Lower income countries; MIC = Middle income countries; HIC = High income countries.

Appendix Figure 2 Evolution of prevalence of overweight, 1975 to 2017, by sex



Source: Authors' illustration based on the GHO (WHO 2019)
Note: MENA = Middle East and North Africa region; GCC = Gulf Cooperation Council; LIC = Lower income countries; MIC = Middle income countries; HIC = High income countries.

Appendix Figure 3 Evolution of prevalence of obesity, 1975 to 2017, by sex



Source: Authors' illustration based on the GHO (WHO 2019)
Note: MENA = Middle East and North Africa region; GCC = Gulf Cooperation Council; LIC = Lower income countries; MIC = Middle income countries; HIC = High income countries.

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