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Social Stratification of Children's Diet and Nutrition: Understanding Women's Situation in Addis Ababa

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Abstract

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Background: Childhood undernutrition is the cause of nearly half of all deaths in under-five children. In sub-Saharan African countries, this problem is further complicated by the rising prevalence of overweight. Mothers play a key role in child care and nutrition, however, in cities that are undergoing rapid social and economic changes, little is known about their lived experiences and challenges. Moreover, little is known about the influence of the neighbourhood food environment and family socio-economic conditions of food acquisition and intake in sub-Saharan Africa. Therefore, the study aims to understand the nexus between mothers' child care and feeding experiences, neighbourhood food environment, diet diversity, and family socioeconomic status. **Methods:** A mixed qualitative and quantitative study design was used. The qualitative component involved thirty-six in-depth interviews with mothers who had children under the age of five years. A thematic analysis approach was used to analyse verbatim transcripts. For the quantitative component, two rounds of cross-sectional household surveys were conducted. The sample was drawn from all districts of Addis Ababa; a total of 5467 households with mother-child pairs. Data were analysed using a generalised estimating equation (GEE) and mixed-effect logistic regression model. **Results:** Urban mothers are under pressure to ensure their child gets adequate care and food; the changes in their environment owing to the reconstruction of city and migration further limit their ability to do so. Mothers expressed that their decision of what to feed their children is influenced by children's preferences, perceived safety of the food, familiarity with the food, and affordability.

Children receiving the recommended minimum diet diversity totaled 59.9% (58.5–61.3). Having an adequately diverse diet was associated with having an educated mother, and being from the wealthier and more food-secure households. Animal source and vitamin-A-rich food groups are the least affordable and consumed food groups in the study settings. Families with uneducated mothers, in the lowest wealth group and those who perceived food groups to be unaffordable, consumed a less diverse diet.

The prevalence of stunting was 19.6% (18.5–20.6) and that of over-weight/obesity was 11.4% (10.6–12.2). Maternal education level was associated with both forms of malnutrition; children with uneducated mothers were more likely to be stunted (AOR: 1.8; 1.4–2.2) and less likely to be overweight/obese (AOR: 0.61; 0.44–0.84), while being from the highest wealth household and from a severely food insecure household were associated with a higher likelihood of obesity and stunting, respectively. Conclusion: Child nutritional outcomes and diet quality vary by the socioeconomic status of the family; particularly that of mothers. Therefore, efforts to improve diet and nutritional outcomes of children need to consider mechanisms to strongly support mothers.

Keywords: malnutrition, urban mothers, diet diversity, preschool children, social stratification, affordability, Addis Ababa, Ethiopia

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To my parents, Ema and Baba

List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I. **Hanna Y. Berhane**, Eva-Charlotte Ekström, Magnus Jirström, Yemane Berhane, Christopher Turner, Beatrix W. Alsan and Jill Trenholm. Mixed blessings: A qualitative exploration of mothers' experience of child care and feeding in the rapidly urbanizing city of Addis Ababa, Ethiopia. PLoS One. 2018 Nov 20; 13 (11):e0207685. doi: 10.1371/journal.pone.0207685
- II. **Hanna Y. Berhane**, Eva-Charlotte Ekström, Magnus Jirström, Yemane Berhane, Christopher Turner, Beatrix W. Alsan and Jill Trenholm. What Influences Urban Mothers' Decisions on What to Feed Their Children Aged Under Five—The Case of Addis Ababa, Ethiopia. Nutrients 2018, 10, 1142; doi: 10.3390/nu10091142.
- III. **Hanna Y. Berhane**, Magnus Jirström, Semira Abdulmenan, Yemane Berhane, Beatrix W. Alsan, Eva-Charlotte Ekström. Social stratification, diet diversity and malnutrition among preschoolers: a survey of Addis Ababa, Ethiopia. Nutrients 2020, 12, 712; doi:10.3390/nu12030712
- IV. Semira Abdulmenan, **Hanna Y. Berhane**, Magnus Jirström, Yemane Berhane, Beatrix W. Alsan, Eva-Charlotte Ekström. The social stratification of availability, affordability and consumption of food in families with preschoolers in Addis Ababa; part of the EAT Addis Project (manuscript)

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Abbreviations

ACIPH	Addis Continental Institute of Public Health
AOR	Adjusted Odds Ratio
FMOH	Federal Ministry of Health
GEE	Generalised Estimating Equation
HAZ	Height for Age Z-score
HFIAS	Household Food Insecurity Access Scale
LMICs	Low- and Middle- Income Countries
OR	Odds Ratio
NCDs	Noncommunicable Diseases
PCA	Principal Component Analysis
SD	Standard Deviation
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UNICEF	United Nations Children's Fund
WDDI	Women's Diet Diversity Indicator
WHO	World Health Organization
WHZ	Weight for Height Z-score

Introduction

In the past few decades, the world has made substantial progress in reducing under-five mortality; from 12.6 million in 1990 to 5.3 million in 2018 (1). Despite this remarkable ongoing progress, the current pace of reduction in child mortality levels is not enough to reach the goals set by the Sustainable Development Goals (SDGs). SDG 3 has set a target to reduce under-five mortality to less than 25 per 1000 live births by 2030 (2). Meeting this target is particularly difficult for Sub-Saharan African countries, which are currently experiencing the highest under-five mortality; where one in thirteen children die before their fifth birthday (3). The majority of these deaths are preventable, with nearly half of these deaths attributed to malnutrition (1).

Malnutrition

Good nutrition is critical for the optimum growth and development of a child; however, globally there are 238 million under-five children affected by at least one form of malnutrition (4). In Africa, stunting is still unacceptably high (5,6) and overweight/obesity rates are increasing rapidly (6), a phenomenon referred to as the double burden of malnutrition. A shift in diet from one that is low fat and low sugar to a more refined, high sugar and fat diet, accompanied by a sedentary lifestyle, are the key drivers for the double burden of malnutrition (7–10).

The consequences of child malnutrition last throughout a person's life and even transcend to the next generation. Stunted children exhibit higher risk of being overweight later in life when exposed to changes in diet (11). Further, obesity in adulthood, especially among mothers, compromises fetal outcomes (11,12). The rise in childhood obesity is also associated with the increase in the prevalence of noncommunicable diseases (NCDs), such as diabetes, hypertension and cardiovascular diseases which take the life of 2.6 million people annually (12–14). This cycle of malnutrition poses a huge burden to the health care system due to the changes in the disease burden (13,15). Childhood under- and over-nutrition has indirect costs pertaining to reduced school performance, frequent absenteeism for the child and escorting parent, loss of productivity, and premature mortality (12,16,17). Cumulatively, the negative cyclic phenomena cause economic distress to many individual households and the countries at large (18,19).

Considering the persistently high prevalence of stunting and rapid rise in overweight children in Sub-Saharan Africa, understanding the factors that influence the magnitude of child malnutrition in urban areas of Ethiopia is crucial for breaking the cycle of malnutrition and to synergistically eliminate both forms of malnutrition.

Why focus on the urban context?

First, the rapid pace of urban population growth in Sub-Saharan Africa (SSA) is alarming, and understanding the situation is critical if these countries are to respond reasonably to the associated challenges. In the next three decades alone, the number of urban dwellers is expected to increase globally by 2.5 billion; nearly 90% of these will be in Asia and Africa (20), which is attributed to high fertility rates and rural-urban migration. The rapid population growth in urban settings, if not managed properly, could lead to the proliferation of slum areas that are vulnerable to food and livelihood insecurity (20).

Second, the type of malnutrition within urban settings is shifting; from predominantly undernutrition to double burden malnutrition, due to changes in dietary patterns and shift in physical activity level (9,13,21). Improving road and transport systems, availability of diverse food outlets within the vicinity of residential quarter (22), and the increasing availability of cheap processed ready-to-eat foods (23) has contributed to changes in dietary habits.

Third, despite increasing evidence about the influence of the food environment on the diet of families, there are limited studies that seek to understand the different dimensions of the food environment in low- and middle-income countries (LMICs).

Fourth, the inequality between the rich and poor in urban areas is large and continues to widen, with cities struggling to offer their residents basic services, such as adequate and uniform levels of housing, health care and clean water (24,25). Income inequality is also one of the features of urban areas; this is a particular concern, given that access to food in urban areas is highly reliant on purchased foods (25,26). The widening economic inequality aggravates the risk of household food insecurity and thus child malnutrition (27,28). Currently, growing urban poverty is a serious survival and developmental challenge.

Why emphasize the mother's role?

The causes of malnutrition have been well described using the UNICEF conceptual framework (29). The framework illustrates the complex interaction of various individual, interpersonal, household and contextual factors and their

effects on child nutritional outcomes. At the heart of this model lies the concept of “child care practice”, which relates to the caring capacity of mothers. The quality of care that a mother can provide has both direct and indirect pathways that have the potential to transform the diet and nutritional outcomes of their children. To ensure that their children are getting adequate care and nutrition, mothers also need access to various resources and to interact with the food environment.

Mothers, who are often the primary caretakers of children, are the gatekeepers for ensuring that children are well-fed and healthy. Although it is closely linked to the household’s access to food, the amount and type of food that a child receives/ingests is determined by care-related practices such as breastfeeding, initiating complementary feeding and practicing hygienic food preparation (30,31).

In order to provide the care and support needed for the optimum growth and development of children, mothers fully exploit available resources, both from within the household and from what is available in her environment. As the women’s role evolves in an urban setting to combine a career with the added responsibility of housekeeping and caring for a child, they endure great stress (32), which may compromise their ability to provide proper child care and feeding (33,34).

In situations where mothers have to cope with these activities, access to reliable social support is critical. Social support has been conceptualized differently by different scholars; social support for this work is defined as an interpersonal process that functions to promote the wellbeing of an individual or to support them to thrive, either in the face of adversity or where there are opportunities for growth (35). Having access to appropriate social support could have multiple benefits, including the sharing of the burden of work, worries, and stress. Additionally, having reliable social support enables the mother to engage in income-earning activities and even free up a mother’s time, allowing time for self-care, which is essential for her wellbeing (36). Previous studies have shown that those who have social support around them are likely to follow dietary recommendations (37). On the contrary, having a low level of social support has been associated with the consumption of highly processed foods (38) and a higher risk of malnutrition (39).

Another important maternal resource is education. Children whose mothers had higher levels of education were shown to have better dietary diversity (40,41) and reduced risk of stunting (42,43). This is related to educated mothers having better health-seeking and reproductive behaviours, improved hygiene practice and better provision of diversified diet, as they are more likely to be financially better off (44–46). Better income and less child caring time may also be associated with higher consumption of sugary drinks and increased risk of overweight/obesity (47,48), as educated mothers who have a professional career may have limited time for child care and cooking. Educated mothers also have better access to information/advertisements and pro-

motional materials that pull them towards trendier but less healthy alternatives. Although a higher maternal education level is largely an advantage, it needs to be complemented with proper nutritional counseling to utilize education as a tool to combat malnutrition.

Dietary Intake and Diversity in urban settings

Adequate intake of diets that are of a balanced composition of both macro- and micro-nutrients are essential for normal child development (49,50). Dietary diversity measures the quality of intake and has been associated with better nutritional status; for example, higher diet diversity scores have been associated with higher height-for-age z-scores (HAZ) (51,52). Diet diversity has also been associated with a lower risk of stunting (53–55). Additionally, the consumption of animal-source protein, such as milk, eggs, and meat, has been associated with reduced risk of stunting (53,55,56).

In urban areas, households rely on what is available on the market, as urban food production is almost non-existent. Urban markets avail a wide range of food items, including highly advertised processed and savory snacks, contributing to a shift in diet (22,23). Contrary to the recommendation to consume more fruits and vegetables and to limit fat and sugar intake (57), children's diets in urban areas are continuously evolving to include more processed food and sugary drinks, which are associated with obesity (58,59). In Ethiopia, although the rising overweight/obesity levels are logically linked to a shift in diet, there is limited empirical evidence to support this. In urban areas, food preference is one of the key intermediate factor between access to food and actual consumption (60,61). In the following paragraphs, some key factors related to dietary intake and diversity are discussed.

Household food insecurity

Food security, a household's ability to access a safe and sufficient amount of food, has been persistently part of the malnutrition narrative in sub-Saharan Africa. Persistent lack of access to a sufficient amount of food has been associated with limited diet diversity (62,63); which in turn is associated with severe wasting and stunting (64). Nowadays, because of the cumulative effect of reduced consumption of home-cooked healthy meals due to price or convenience, coupled with the regular consumption of cheap ready-to-eat foods, household food insecurity is also shown to be associated with obesity (65). Thus, understanding the influence of the wider food environment, which considers aspects such as availability, convenience, and affordability (66); is critical for informing nutrition programmes.

Food availability

Households can access food from the market, or their production and transfers; however, urban households are dependent on the market. Urban markets include formal and informal stores, ranging from street vendors to high-end supermarkets (67). A wide variety of products, comprising fresh produce, ready-to-eat meals, highly processed snacks, and drinks are available within the markets. The availability of an adequate supply of healthy food is critical for individuals to make a healthy diet choice (68). Fortunately, in urban areas, food choices are expanding with the advancement of technologies and transport systems that can preserve food longer, deliver in optimum time and minimize wastage of food before reaching the consumer (69,70).

Affordability of food

Access to food and its consumption is also highly influenced by a household's ability to purchase the desired food items (68). Even if a food item is available on the market, the ultimate food choice will be made based on price, or the ability of the household to pay for that food item (71). Household diet quality is dependent on the relative household income. In low-income settings, households need to spend up to 91% of their income to meet the recommended serving of fruit and vegetables, thus, in such settings, most households are unlikely to consume the recommended amount and diversity that constitutes a healthy diet (72,73).

Household wealth

The household wealth index, which is a composite measure of a household's living standard, has been associated with both forms of malnutrition in low-income settings. Children from the poorest households suffer from undernutrition due to a combination of factors, including an inadequate amount of food, poor dietary diversity, poor living conditions and/or recurrent infections (74–78). Childhood overweight/obesity is attributed to access to refined sugary snacks and drinks. Ultra-processed foods are made available on the market at a relatively cheaper price, even poor households are exposed to processed foods and thus become vulnerable to overnutrition/obesity (79–83).

Justification of the study

The Sustainable Development Goals (SDGs) commit all countries to end hunger and malnutrition by 2030. However, childhood malnutrition in low-in-

come settings remains a major public health problem and its high burden complicates child survival efforts. In low-income settings, little attention is given to the important role that mothers play in child care and feeding, along with the influence of social and food environments in improving the nutritional status of children.

Food choices, particularly selecting and purchasing appropriate food for children, is a complex matter. Understanding how mothers/caregivers make difficult decisions in choosing food for their family/children and what factors influence their decisions in urban settings that are dominated by scarcity is critical for strengthening nutrition-related interventions. Mothers/caregivers interact with the food environment that influences the demand for and use of food (9,83). Additionally, the accessibility of different products, food types, and distance from home influences family food decisions (83). The rapidly changing urban food context further adds to complexities as new retail outlets emerge, and the market increasingly avails more processed, convenient and ready-to-eat foods (5,23,84). Hence, understanding what influences mothers' decisions in making food choices, the diet and nutritional status of preschoolers, and to what extent socioeconomic factors and affordability of foods affect diet and nutrition, are all critical to designing an inclusive and focused intervention for urban dwellers. Addis Ababa, one of the largest and rapidly growing city in Africa, shares the urban characteristics described above (67,85). Nonetheless, there is limited existing research to understand these complexities and to support efforts to improve the nutritional status of children who live there.

Conceptual framework

This study draws lessons learned from several theoretical frameworks that are merged into a single conceptual model (Figure 1). The UNICEF model (1990) of the causal pathway to malnutrition provides a starting point (29) and accommodates the “care” concept, which is highlighted by Engle et al. (31). It emphasizes the critical role of mothers/caregivers in child feeding, nutrition, and health. It also identifies the resources that a caregiver needs to have to provide the necessary care, which includes knowledge, health (both mental and physical), autonomy and control over resources, social support and adequate time (reasonable workload) (30,31). Further, the model was modified to embrace the food environment concept, which encompasses availability, affordability, preference, and convenience of food (83,86). This modification was made by considering the importance of these concepts and how they could potentially influence mother's food selection and the dietary intake of the child. Finally, it is theorized that, by understanding the unique role of urban women in child nutrition and the many factors affecting her food choices and ability to provide adequate and nutritious food for her children, we can create evidence-based interventions that address child malnutrition in urban settings.

This thesis will focus on the elements of the model included within the red box in figure 1 below.

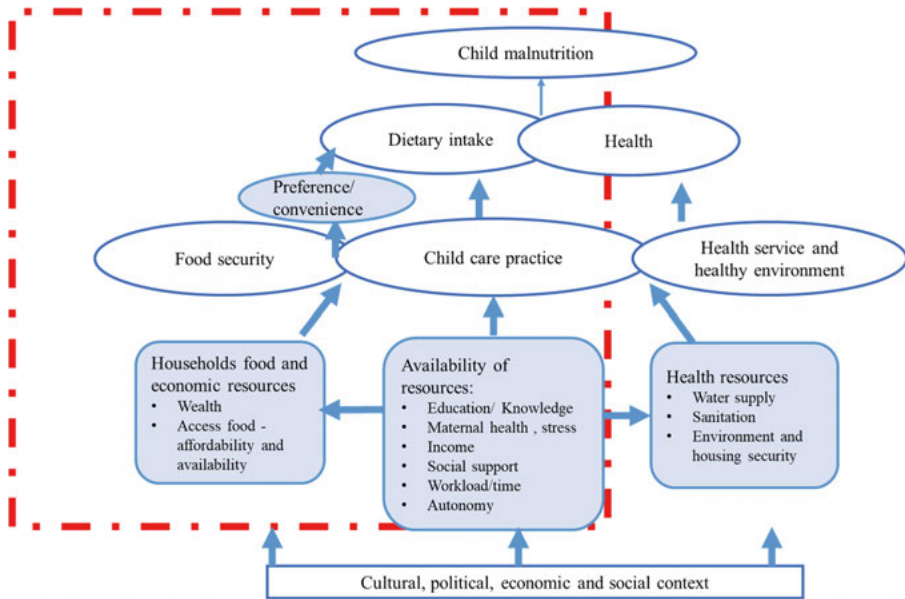


Figure 1. Conceptual map for child nutritional outcomes and dietary diversity among preschoolers in Addis Ababa, Ethiopia (adapted from the extended care model).

Objectives

1. To explore the experiences of child care and feeding amongst mothers with children under five years of age in Addis Ababa, Ethiopia (Study I)
2. To understand urban mothers' motivations in selecting food for their children in Addis Ababa, Ethiopia (Study II)
3. To assess the diet diversity and nutritional status of preschoolers in Addis Ababa, Ethiopia and to evaluate the relative importance of socio-economic resources (Study III)
4. To assess the quality of household diet, its social stratification as well as the relative importance of perceptions of availability and affordability (Study IV)

Methods

Study Area

Ethiopia is the 14th most populous country in the world and second in Africa with an estimated population of 109 million (87,88). The share of urban population is one of the lowest in the world, however, in the coming two decades, the urban population size is anticipated to triple: from 15.2 million to 42.3 million (88). Considering that there is a huge expansion of youth in this population; harnessing the demographic dividends may present the country with an opportunity to meet the vision it has set out to achieve, which is becoming a middle-income country by 2025 (88).

Addis Ababa, Ethiopia's capital, is one of the fastest-growing cities in the continent and the home of 25% of the urban population in the country (85). Although the fertility rate in the city is below replacement (89), there is a continuous population growth within the city due to a significant level of migration (90). The unplanned rapid population growth of the city is worrisome, as it is outpacing the development of critical infrastructures and services, such as health care, transportation systems, housing, and sanitation (88). However, to alleviate the housing problems, large housing blocks have been developed around the city and often at the periphery; where residents have been resettled to new residential areas (91).

The city's expansion to accommodate the ever-increasing population has led to a reduction in open green public spaces, and diminished agricultural land, thereby limiting the potential for urban agriculture (92). Unemployment is another concern for the city, with more than one-fourth of the city's dwellers not involved in any income-earning activity. Females account for only 53% of the active task force, of which 13.9% are involved in the informal employment sector (90). Addis Ababa also has the highest literacy rates in the country; with 83.7% of females and 91.8% of males having a basic level of literacy (89).

Addis Ababa is administratively divided into ten sub-cities (Figure 2). Each sub-city, depending on its size, is further divided into ten to fifteen woredas (districts). Currently, there are about 116 woredas in total, all of which have an independent administrative unit that provides basic services.

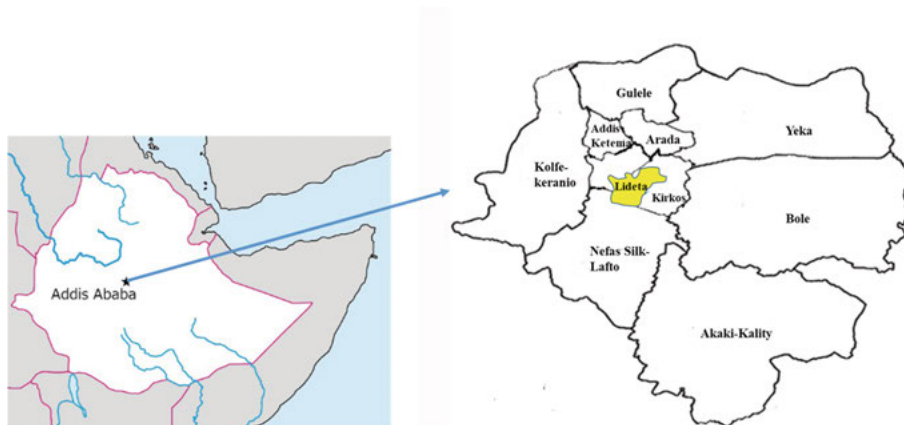


Figure 2. Addis Ababa's administrative sub-cities

Study Design

This thesis is built on the findings attained from four papers, each of which has different aims and employed a mix of both qualitative and quantitative study designs. The first two papers are based on the initial qualitative study, and the last two were based on a cross-sectional community-based study. Below is an overview of the papers included in this thesis (Table 1).

Table 1. Overview of papers included in the thesis

	Paper I	Paper II	Paper III	Paper IV
Design	Cross-sectional (Qualitative)	Cross-sectional (Qualitative)	Cross-sectional (Quantitative)	Cross-sectional (Quantitative)
Participants	36 mothers with children below the age of five years		Mother-child pairs from 5467 households	
Data collection method	In-depth interview using a semi-structured interview guide		Interviews using structured questionnaires, anthropometric measurements	
Data Analysis	Thematic Analysis	Thematic Analysis	Generalised Estimating Equation	Mixed effect logistic regression models

Qualitative study (Papers I & II)

Participants and data collection

To understand urban mothers' experiences of child care and feeding, one sub-city was selected to serve as a microcosm. For this study, Lideta sub-city, which is one of the innermost, and oldest, with nearly a quarter of million inhabitants, was purposively selected. Mothers were recruited from all ten of the woredas/districts within Lideta. The main inclusion criteria were that mothers had to have had at least one child under the age of five years and lived in Addis Ababa for at least 6 months. Health extension workers in the woredas were initially contacted to serve as a gateway to the community.

When inviting mothers to our study, efforts were made to diversify them by the age of their child, their educational level, work status, and involvement in community initiatives among other categories. In the end, in-depth interviews were carried out with thirty-six mothers. All of the informants were invited to participate in person; for those who agreed to participate, the time and place of the interview was selected in consultation with the mothers. On the day of the interview, a verbal introduction to the topic of discussion was given and verbal informed consent was obtained from the participant before starting the interview. In order to promote an informal discussion that served to motivate the mothers to discuss their experiences in as much depth as possible, the interviews were carried out in a relaxed atmosphere. Further, the interview started by gathering some general household information with an opening question asking the mother to tell us a bit about her daily activities.

To facilitate the interview process, a semi-structured interview guide was used. The guide was first prepared in English, and, once the research team agreed on its contents, it was translated into Amharic (the national language) for the interview. The initial interviews were conducted by trained research assistants. Research assistants with prior experience of doing qualitative research were recruited, all held post-graduate degrees and were given additional training prior to starting data collection. The training session included an orientation to the objectives of the study, the study guide, the importance of obtaining informed consent, and the use of audio recorders as well as a refresher on how to conduct in-depth interviews.

The interviews followed the principles of naturalistic inquiry, where each interview was conducted as an open discussion using open-ended questions and follow-up probes. During the fieldwork, I observed several of the interviews and reviewed my field-notes at the end of each day to provide feedback to the research assistants. When necessary, I consulted with the research team to enrich the interview guide; lessons learned from each interview and emerging topic areas were subsequently integrated as the fieldwork continued.

After carrying out some preliminary analysis, I carried out a second set of interviews to enable me to delve deeper into the emerging themes. The interviews started by asking the mothers to describe their daily activities in order to understand the competing demands of their work as well as any economic and time constraints that may affect their role as caregivers. Further, questions on child feeding practices and their motivation for food choice were asked, along with probes that explored other areas, including support systems, common child foods, availability of street food and their composition.

Data Analysis

The analysis process started during data collection where I was on-site during the whole process, listening to the interviews and reviewing the summary notes from each interview. As themes emerged, these were discussed among the research team as a whole, and, as needed, additional interviews were carried out to explore emerging issues in more depth. Once the interviews were completed, they were transcribed and translated into English for analysis. All translations were further verified by listening to the audio files.

The analysis followed a thematic analysis approach, as described by Braun and Clark (93), and began with a thoughtful reading of the transcripts through a theoretical lens (86,94). Paper I employed Kumfer's resilience framework (94), which gives an all-rounded perspective to understand the daily struggles of mothers when dealing with her multiple duties. In Paper II, the food environment framework was used; this framework highlights the importance of domains such as availability, affordability, convenience and desirability in an individual's food acquisition, and consumption (86).

Two members of the research team independently read and re-read the transcripts to develop the initial codes. Following this, themes were developed by assembling the codes that were related to each other and which described similar experiences. The themes were further redefined until consensus was reached among the research team. At this stage, the draft findings were presented to fellow academics and culturally competent stakeholders to verify the interpretation of the results.

Quantitative study (Papers III & IV)

Study design and population

A cross-sectional household survey was carried out in two rounds to account for seasonal variation in household food availability and consumption. Accordingly, data were collected in the pre- and post-harvest seasons. At the design stage of the study, a stakeholder engagement workshop was carried out,

during which specific issues related to the objectives of the study were discussed in depth.

The participants in this study included pairs of mother/caregiver and child under the age of five years in the selected households.

Sample size and sampling procedure

This study used a multi-stage sampling procedure. Initially, all 116 woredas of Addis Ababa were included; then, one cluster from each woreda was selected using simple random sampling. Clusters were formed by dividing the woredas into roughly five geographical zones: north-west, north-east, central, south-east, and south-west. This method was adopted because updated enumeration area maps were not available at the time of the study. Once a cluster was selected, a systematic sampling approach was used. Starting from one randomly selected household, every 3rd household was visited until 60 households per cluster were recruited. All households that fulfilled the inclusion criteria (have at least one child under the age of five years, and have a respondent mother present) were included in the study.

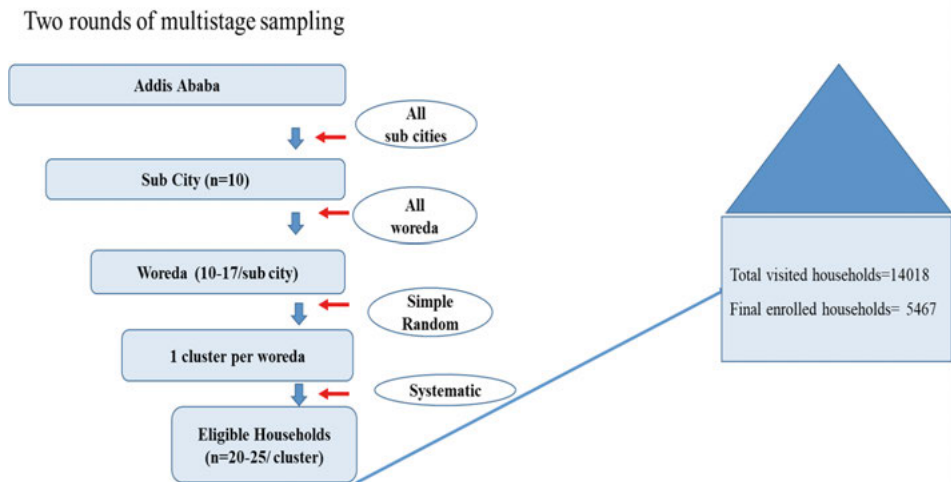


Figure 3. Schematic representation of the sampling procedure

Data collection

Data for this study were collected using an interviewer-administered structured questionnaire. The questionnaire was developed after a thorough review of the literature and by drawing on the vast experience of the diverse research team. Additionally, the findings from the qualitative study were used to inform the development of the questionnaire. Standard pretested questionnaires were adapted for some modules and new tools were developed for others. The

final tool was then modified and further developed after several rounds of scrutiny by the research team.

The final questionnaire was composed of seven modules, including the following sections: household roster; housing and assets; household food insecurity access scale; availability, affordability and consumption; women's status; urban agriculture; and anthropometry. Though the questionnaire had more sections at the beginning, after the pretest, some of the sections were removed to reduce the duration of the interview and to make the respondent feel as comfortable as possible. The questionnaire was initially developed in English and then translated into Amharic (the official language) for the interview. The translation was completed by a panel of five bilingual experts; slight modifications were also made to clarify wordings in the Amharic questionnaire after the pretest.

Anthropometric measurements to assess children's length/height and weight were done. A child's weight was measured using the UNICEF digital scale once wet diapers were removed, and the child was dressed in light clothing and without shoes. Height/length of the child was also measured, using the UNICEF-recommended model with a wooden board, after the child had removed their shoes (95,96). All anthropometric measurements were standardized before data collection began (96).

All field staff received detailed training on the study objectives, procedures and ethical conducts prior to any data collection taking place. Households were given unique identifying numbers, and trained field staff collected electronic data from households using a tablet that was pre-programmed using an open-data kit (ODK). The quality of the data was checked continuously by the research team member, generating data reports on data completeness, accuracy and providing feedback. This was completed alongside on-site supervision during the whole data collection period.

Assessment of exposure and outcomes

The socio-demographic information of the study participants was summarized by mother's age (15–24, 25–34, 35–44, and 45+ years), family size (2–4, 5–7, 8 and above), head of household (male-headed or female-headed), marital status (currently in a union, married/living together or single, divorced/widowed/separated), and current involvement in income-earning activity (yes or no). Child age was categorized into six age groups (0–5, 6–11, 12–23, 24–35, 36–47, 48–59 months) and sex (male or female).

Main explanatory variables

The highest completed grade/school year of the mother was recorded and the responses were categorized into never attended/not finished 1st grade, grade 1–4, grade 5–8, grade 9–12, and college-educated, considering the Ethiopian educational system.

A relative measure for each household's living standards, the wealth index, was computed using Principal Component Analysis (PCA) (97). Households were then categorized into their respective wealth tertile or quintile.

The household food insecurity access scale (HFIAS) was used to assess whether households had experienced any food insecurity conditions in the past 30 days. The household was then categorized as food secure, or mildly, moderately and severely food insecure, according to the severity (98).

Consumption of food in families and children was assessed using a 16-food-group reference, whereby the research assistants showed a photo gallery of common foods within each category. The food groups include cereals, white roots tubers, vitamin-A-rich vegetables, green leafy vegetables, other vegetables, vitamin-A-rich fruits, other fruits, organ meat, flesh meat, eggs, fish, legumes, nuts and seeds, dairy, oils and fats, sweets and spice condiments (99).

For children, the food groups were recategorized into 7 food groups while the households were recategorized into 11 food groups, mimicking a modified version of the women's minimum diet diversity indicator (WDDI) (99), hereafter referred to as "family food" group. When forming these food groups, the research team used the WDDI because it considers micronutrient adequacy. Further, the team made modifications to split some of the groups in the WDDI considering the diet patterns of the study population. For example, in Ethiopia, availability, as well as consumption of fish, is rare, while meat is a big part of the culture. Hence, the food group "meat and fish" was split. Similarly, the food group "vitamin-A-rich fruits and vegetables" was also split.

The family food groups were used as a reference to measure perceived availability and affordability. To assess availability and affordability, mothers were asked "Whether any of the foods shown in the photo were available on the market" and/or "How often can your family afford to consume any of these foods?" The responses were then categorized as either available or not available, and affordable or not affordable, for each family food group.

Outcome variables

Dietary assessment for this study used a combination of two complementary methods: first, mothers were asked to recall all the food items consumed by the selected child in the last 24 hours (99). For each food mentioned, mothers were asked to recall the ingredients used in order to make the list more comprehensive. Following that, the mothers were shown photos of common foods within the different food groups. Based on the recommended 7 food groups for children, the child was grouped as having an adequately diverse diet if they had consumed 4 out of the 7 food groups; if not, they were considered as having inadequate diet diversity (100).

To measure household consumption, a similar approach was used whereby the research assistant asked about the consumption of the food groups in the past 24 hours whilst showing photos of common foods within each group. All food groups were independently reported as consumed or not consumed.

Using the WHO Anthro software (101), the Z-scores of indices height-for-age (HAZ), and weight-for-height (WHZ) were computed. Children were then categorized as stunted if their HAZ was below minus 2 standard deviation (SD) from the reference (HAZ <-2SD). Similarly, if their WHZ was +/- 2SD they were categorized as wasted (WHZ<-2SD) or overweight/obese (WHZ> 2SD) (95).

Data Analysis

The main outcomes and explanatory variables were summarized as percentages, along with their 95% confidence intervals (CI) if categorical, and, for continuous variables, their mean and standard deviations were calculated. For Paper III, the Mantel-Haenszel test was used to check for trends in the increase/decrease of prevalence of child nutritional outcomes within the different strata. Additionally, generalised estimating equation (GEE) was used to test the independent effect of socioeconomic resources with both the child's diet and nutritional outcomes, while adjusting for potential confounders and controlling for clustering effect. Paper IV used mixed-effect logistic regression models to compute the unadjusted and adjusted associations between family food consumption and perceived affordability, wealth, and education, while accounting for clustering effects. *P*-values of <0.05 were considered as statistically significant. All analysis was carried out using STATA version 14.

Ethics

Ethical approval for this study was obtained from the institutional review board of the Addis Continental Institute of Public Health under the reference ACIPH/IRB/004/2015. Permission to conduct the study was obtained from all sub-city and woreda health offices. Before starting the interview with the mothers, the first 5–10 minutes were spent explaining the objective of the study and its procedures and that the mother's participation was voluntary. For the qualitative in-depth interviews, the participating mothers were informed about the use of audio recorders and their permission to record was asked before starting the interview. Verbal informed consent was obtained from all participating mothers before starting the interviews. Data were then stored securely and only accessible to the research team members.

Results

The results section of this thesis is organized to first describe the mothers' experiences of child care and feeding (Paper I), followed by a description of how mothers navigate within the wider social context to select food and feed their children (Paper II). Thereafter, the magnitude of child malnutrition, dietary diversity, and their social stratifications are described (Paper III). Finally, the thesis presents aspects of the food environment, including affordability and availability, that affect family food consumption (Paper IV). The first two papers are based on qualitative data and the latter two on quantitative data.

Qualitative findings

Mothers' experiences of child care and feeding (Paper I)

Urban living increasingly necessitates the involvement of mothers in economic activities. In such situations, mothers struggle to find the right balance between being a mother and working outside the home for economic gain.

"... his [her husband] job is temporary; therefore, we barely make it, especially at times when he is out of job... there will not be any money. I could have gone out to work, but he always says wait till the kids grow and start going to school ... the kids should not be raised by another person ... so I am waiting for my kid to start school."

The deteriorating social support traditions for child care and the lack of trustworthy child care alternatives is a serious challenge for mothers/caregivers in urban settings.

"No mother wants to leave her children with someone else by choice. Unless it is a must ... unless they need the income to survive ... that is the only reason why they leave their children ... to work and attend other social obligations ... otherwise so many things could happen ... the child may fall down and end up disabled. They (alternative caregivers) might feed them food that was not prepared in a hygienic way."

The continuous internal and external migrations in search of better education or employment that involve the nucleus and extended family also diminish the social support traditions. Additionally, in rapidly growing cities, the demolition of old neighborhoods and the abrupt resettlement of families due to the expansion of the city destabilizes the social fabric and further intensifies a mother's state of uncertainty. The mothers expressed that such moves create great disruption in their lives due to the loss of their social support networks, convenient employment/economic opportunities and, at times, even affordable shelter.

"I moved to this house recently, I used to live in a rented house nearby but that was demolished so I moved to another house which was also demolished. So now I take shelter in people's houses ... we stay with whoever is willing to let us stay."

Although mothers endure multiple challenges to survive in a harsh urban setting, at times what they do have is the unwavering religious faith that provides them with the strength to push through and persevere.

"God has his way, we live on God's grace ... when things get difficult, I don't even have someone to talk too ... all I do is calm myself and think what God will give me in future."

Mothers' decisions about what to feed their children (Paper II)

Mothers' decisions about what to feed their children were influenced by their children's preferences. Mothers indicated that children are only willing to eat the foods that they like, hence they often follow their desire when preparing food. For mothers who had children who had already started school, they mentioned that their children wanted to have similar kinds of foods as their friends in school. Although mothers want to pack the lunch box with diverse foods, they do not want their children to feel inferior at school for not having something similar to their friends, so they pack whatever the child asks for. Additionally, the children nowadays are tempted by what they see, and there are many food vendors situated around the house and schools.

"... since it is close by we buy chips for them every 2 or 3 days."

Despite the mothers' awareness of the importance of dietary diversity, there was an obvious gap in translating what they know into practice. Mothers were also concerned about the safety and quality of the food they purchase, including the risk of contamination and food tampering/adulteration.

"I have heard that some stores forge the expiry date on the package..."

"... the flour prepared at home has a 10-fold better quality ... when you prepare at home you can make sure it is clean ... but when you buy the powder from the shop there are impurities so it is not good for kids."

The mothers' ability to have more planned and ordered food acquisition and preparation practices were dependent on the availability of financial resources, and on the availability of space to store, and prepare food.

"We can't afford to eat eggs, meat or chicken regularly (they are expensive) ... those are special holiday meals for our family."

Furthermore, their selection of food was also influenced by the type of religion the family follows, their ancestral food habits, perceived health benefits, and perceived social norms.

Quantitative findings

Households and children (0–59 months) included in the study (Papers III & IV)

For this population-based survey, a total of 14,018 randomly selected households were visited to identify eligible study participants. Subsequently, a total of 5531 eligible households were invited to participate in the study after excluding households with no under-five children ($n=8293$) and where the respondent mother was not available after three visits ($n=194$). With only a 1.2% ($n=64$) refusal; a total of 5467 households were included in the study. For the analysis of child diet diversity, 4858 children were included after excluding incomplete observations and households where the child was aged below 6 months. Anthropometric measurements were taken from all under-five children in the eligible households ($n=6253$). Children who refused to be measured ($n=164$), those with incomplete measurements ($n=68$), or those who had implausible anthropometric values ($n=199$) were excluded; therefore, 5822 children were included in the final analysis (Figure 4).

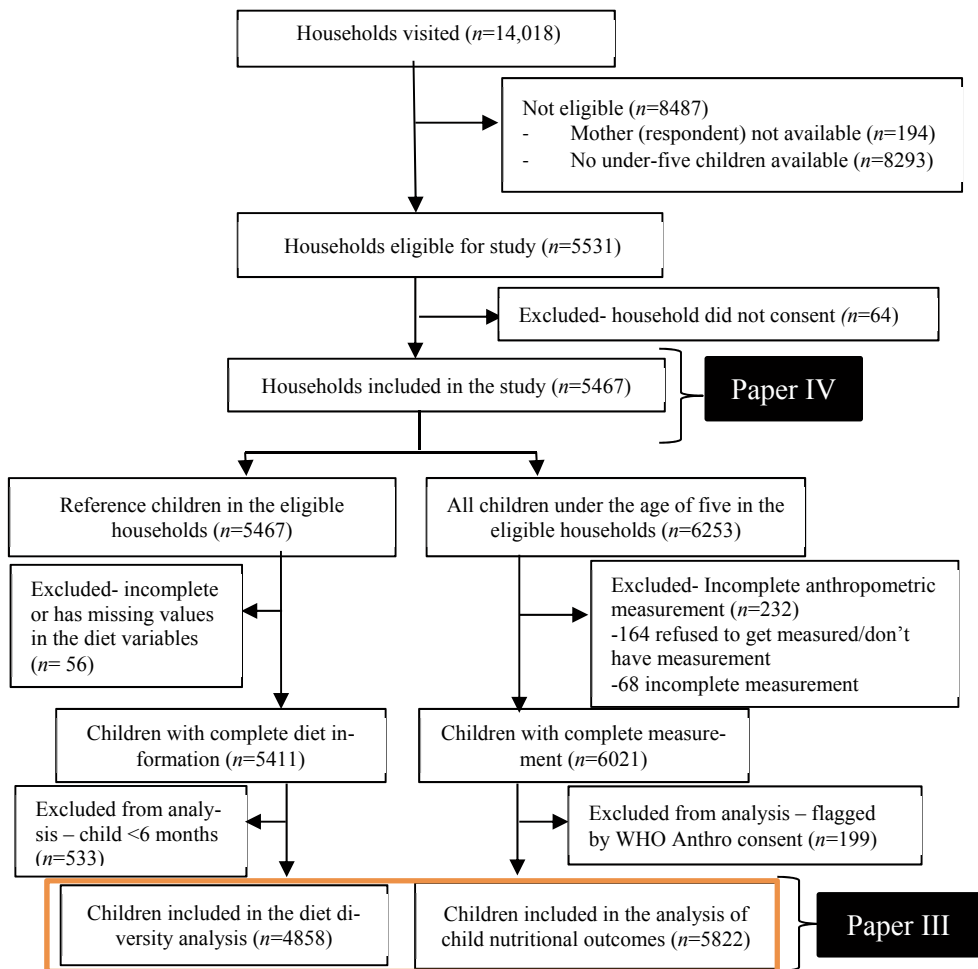


Figure 4. Flowchart of households and children included in the study

Households', mothers' and children's characteristics

The majority of the households in the study were male-headed 4729 (86.5%). Most, or more than 60%, of the households, had a family size of 2–4 (65.1%), lived in a rented house (67.6%) and were food secure (61.5%). Approximately 9 out of 10 mothers in this study, were either married or living together with a partner (88%). At the time of the study, only a fourth (26.2%) of the mothers were earning an income, and 2579 (47.2%) had completed primary school. The mean age of mothers included the study was 30.5 years \pm 7.8 SD; while, for the children, it was 25.8 months \pm 15.8 SD. The male to female ratio was 1.09 (Table 2).

Table 2. General households, maternal and child characteristics, Addis Ababa, Ethiopia

Level	Characteristics (<i>n</i> =5467)	<i>N</i>	%
Household	Male-headed households	4729	86.5
	2-to-4 family size	3561	65.1
	Housing ownership (<i>n</i> =5452)		
	Privately owned	1165	21.4
	Rented from private	2,329	42.7
	Rented from public	1,360	24.9
	Rent-free	598	11.0
	Household food insecurity		
	Food secure	3362	61.5
	Mildly food insecure	500	9.2
	Moderately food insecure	1070	19.6
	Severely food insecure	535	9.8
Maternal	Age (mean± SD)	30.5±7.8	
	Marital status		
	Married/living together	4813	88.0
	Education		
	Never attended/finished 1st grade	752	13.8
	Grade 1–4	498	9.1
	Grade 5–8	1638	30.0
	Grade 9–12	1482	27.1
	College	1097	20.1
	Involved in income-earning activity	1432	26.2
Child	Sex (Male)	2847	52.1
	Age (months) (mean± SD)	25.8±15.8	

Child nutritional status and social stratification (Paper III)

The total number of children who were found to have at least one form of malnutrition was 1782 (30.61%). Stunting was the most prevalent form (19.6%; 95% CI 18.5–20.6%), followed by overweight/obesity (11.4%; 95% CI 10.6–12.2%) and wasting (3.2%; 95% CI 2.8–3.7%).

All forms of malnutrition were present in all socioeconomic strata (Figure 5). The difference across the different socioeconomic strata; i.e., education, wealth, and household food security, was not statistically significant for wasting ($p>0.05$). The prevalence of stunting and overweight/obesity, however, showed significant variation along the socioeconomic strata ($p>0.001$). The largest differences in the prevalence of stunting and overweight were observed for changes in maternal education; the prevalence of stunting was 9.9 percentage points higher among children who had mothers who never attended school compared to children whose mothers had a college education. Conversely, the prevalence of overweight/obesity was 7.2 percentage points higher among

children with college-educated mothers compared to children whose mothers had never attended school.

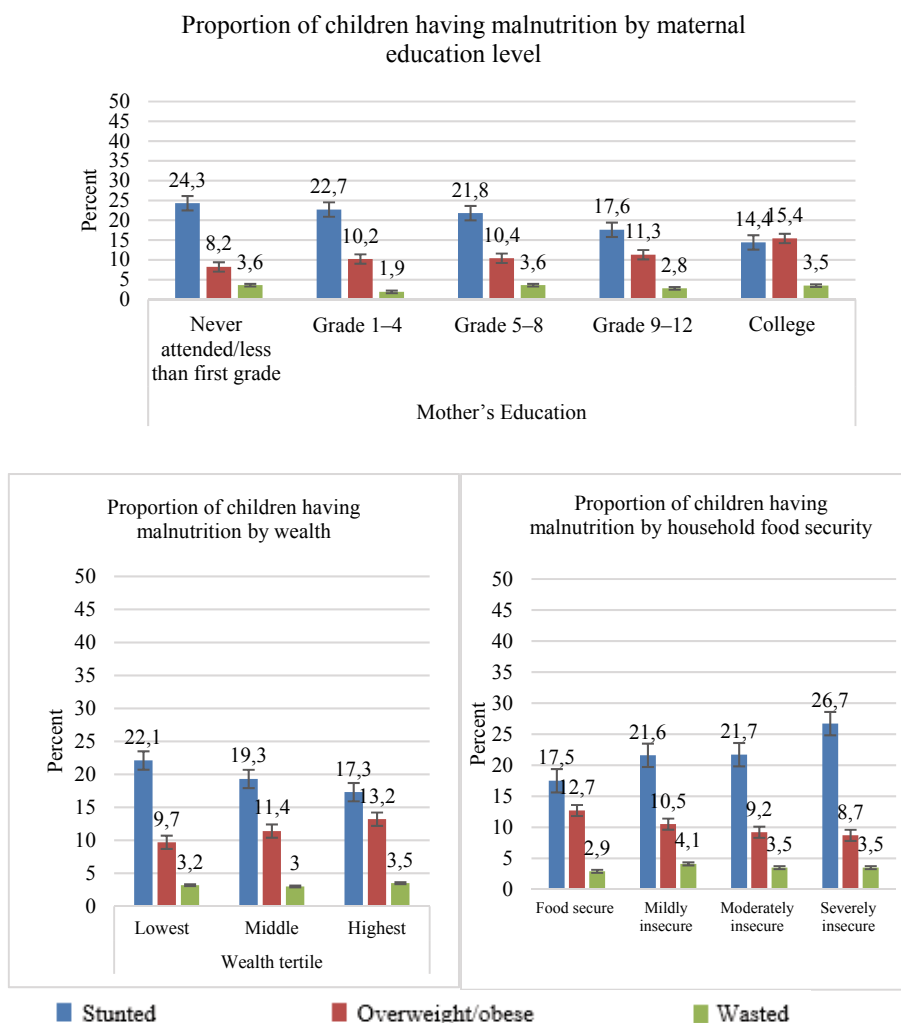


Figure 5. Proportion of children having malnutrition by household wealth, maternal education and household food security; percent (95% CI)

Maternal education was significantly associated with both stunting and overweight/obesity; children with uneducated mothers (never attended/finished a grade) were more likely to be stunted (AOR: 1.8, 95%CI: 1.4–2.2), and less likely to be overweight/obese (AOR: 0.61, 95%CI: 0.44–0.84) as compared to children with college-educated mothers. The likelihood of being stunted was also higher in boys (AOR: 1.38, 95%CI: 1.03–1.86) and in children from severely food insecure households (AOR: 1.42, 95%CI: 1.14–1.76). On the reverse, although no association was found between household wealth and

stunting, the odds of being overweight was higher among children in the highest wealth households compared to the lowest.

Child dietary diversity and social stratification (Paper III)

The proportion of children who obtained the minimum recommended dietary diversity (4 out of 7 recommended food groups) was 59.9% (95% CI: 58.5–61.3%). Although inadequate diet diversity was observed in all socioeconomic strata, adequate diet diversity was at least 20 percentage points higher in the highest groups compared to the lowest groups in all socioeconomic strata (Table 3).

Table 3. Percentage of children receiving the recommended dietary diversity (≥ 4 food groups) by selected socioeconomic variables in Addis Ababa, Ethiopia

		<i>n</i> (%)	95%CI
	All	2911(59.9)	58.5–61.3
Wealth	Lowest (<i>n</i> =1616)	794(49.1)	46.7–51.6
	Middle (<i>n</i> =1647)	995(60.4)	58.0–62.8
	Highest (<i>n</i> =1595)	1122(70.3)	68.1–72.6
Education	never attended/less than grade1 (<i>n</i> =688)	293(42.6)	38.9–46.3
	grade 1–4 (<i>n</i> =440)	191(43.4)	38.8–48.1
	grade 5–8 (<i>n</i> =1444)	811(56.2)	53.6–58.7
	grade 9–12 (<i>n</i> =1338)	901(67.3)	64.8–69.9
	College (<i>n</i> =948)	715(75.4)	72.7–78.2
Food security	Severely insecure (<i>n</i> =476)	158(33.2)	28.9–37.4
	Moderately insecure (<i>n</i> =952)	466(49.0)	45.8–52.1
	Mildly insecure(<i>n</i> =455)	251(55.2)	50.6–59.8
	Secure (<i>n</i> =2975)	2036(68.4)	66.8–70.1
Sex	Male (<i>n</i> =2541)	1545(60.8)	58.9–62.7
	Female (<i>n</i> =2317)	1366(59.0)	57.0–61.0

Children in the highest wealth tertile were more likely to obtain an adequately diverse diet (AOR: 1.67, 95%CI: 1.42–1.96). Similarly, the odds of obtaining an adequately diverse diet was 3 times higher among children with college-educated mothers (AOR: 3.05, 95%CI: 2.41–3.87) and from food-secure households (AOR: 3.13, 95%CI: 2.51–3.90). No significant association was observed in dietary diversity of boys and girls (Table 4).

Table 4. Association between child diet diversity (≥ 4 food groups) and selected socioeconomic variables in Addis Ababa, Ethiopia

	Minimum Dietary Diversity (≥ 4 Food Groups)
	AOR (95% CI)
Household Wealth	
Lowest	Ref
Middle	1.33 * (1.14–1.54)
Highest	1.67 * (1.42–1.96)
Mother's Education	
Never Attended/Less than First Grade	Ref
Grade 1–4	1.06 (0.82–1.37)
Grade 5–8	1.60 * (1.31–1.96)
Grade 9–12	2.25 * (1.82–7.78)
College	3.05 * (2.41–3.87)
Household Food Security	
Severely Insecure	Ref
Moderately Insecure	1.75*(1.38–2.22)
Mildly Insecure	2.12*(1.60–2.80)
Food Secure	3.13* (2.51–3.90)
Child Sex	
Female	Ref
Male	1.08 (0.97–1.21)

*Generalised estimating equations (GEE) with binomial family and exchangeable correlation structure; Abbreviations: AOR, Adjusted odds ratio; CI, confidence interval; Ref, reference group; * significance level of <0.05 . Adjusted for maternal and child age, wealth tertile, sex (child), maternal education, food security; clustering effect was controlled for all models.*

Perception of availability, affordability and consumption of family food and social stratification (Paper IV)

With the exception of fish, all other food groups were perceived to be available by 9 out of 10 individuals. Majority (80% or more) considered three food groups, namely cereals/white roots and tubers, other vegetables, and legumes/seeds and nuts, to be affordable. These three food groups were also the highest consumed food groups. Apart from the three, less than 50% of the participants consumed the other food groups. Vitamin-A-rich fruits and fish were the least consumed ($<10\%$) food groups, consumption of animal source and micronutrient-rich food such as vitamin-A-rich vegetables were also limited amongst our study population (Figure 6).

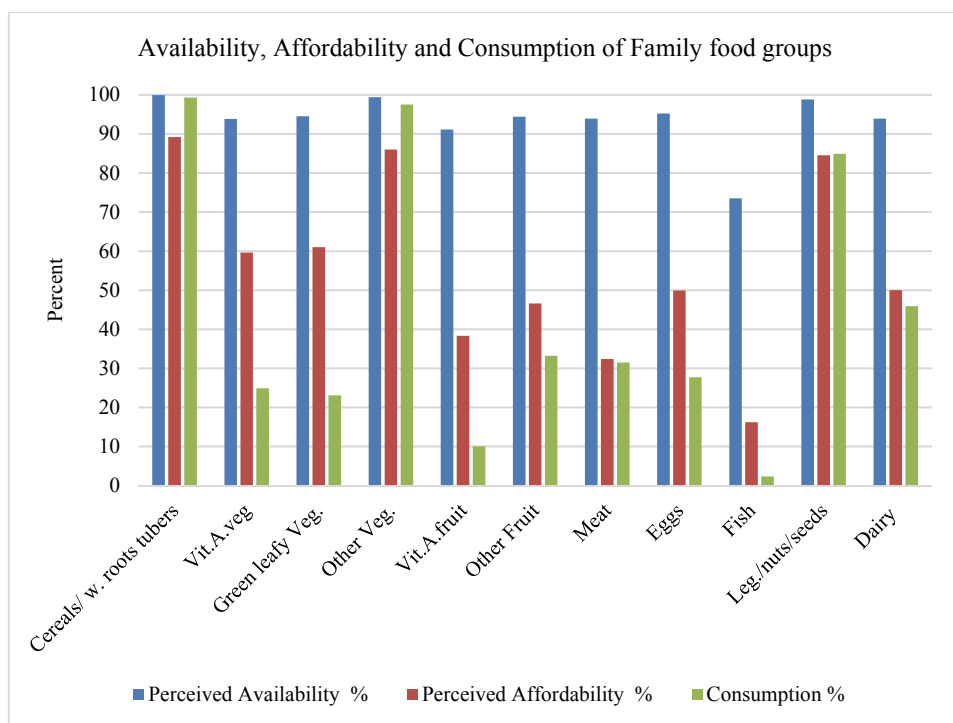


Figure 6. Proportion of households based on perceived availability, affordability and consumption of family food groups

When stratified by wealth, perception of affordability showed clear differences between the lowest and the highest categories. The highest difference in perceived affordability among the lowest and highest wealth quintile was observed in fish (3.9-fold), followed by meat (3.4-fold) and vitamin-A-rich fruits (3-fold) (Figure 7).

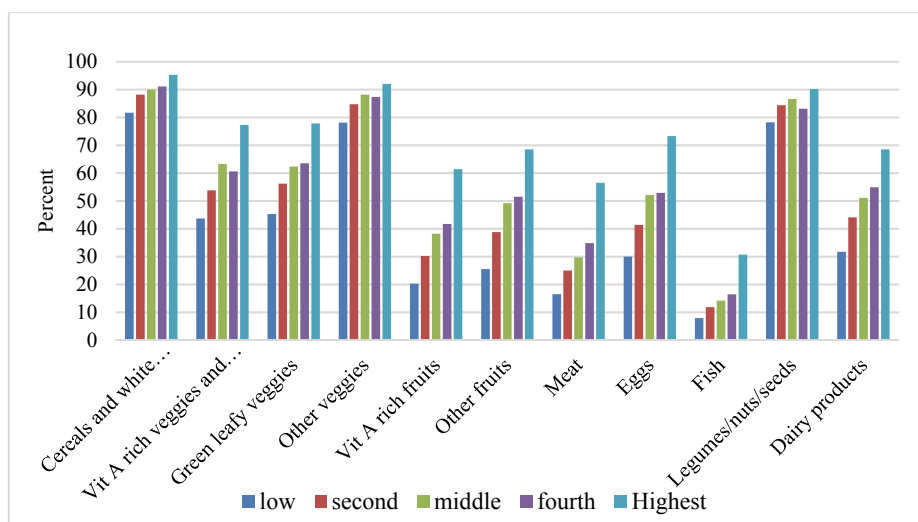


Figure 7. Proportion of households who perceive they can afford of family food by household wealth

Consumption of cereals, white roots and tubers, and other vegetables was high for all wealth groups (>80%). Apart from the food group legumes/nuts and seeds, which showed an inverse relation with wealth for the other food groups, consumption increased as the wealth strata increased. Similarly to the perception of affordability, the difference in consumption among the lowest and highest wealth quintiles was higher in fish (7.9-fold), vitamin-A-rich fruits (3.6-fold), and meat (3.1-fold) (Figure 8).

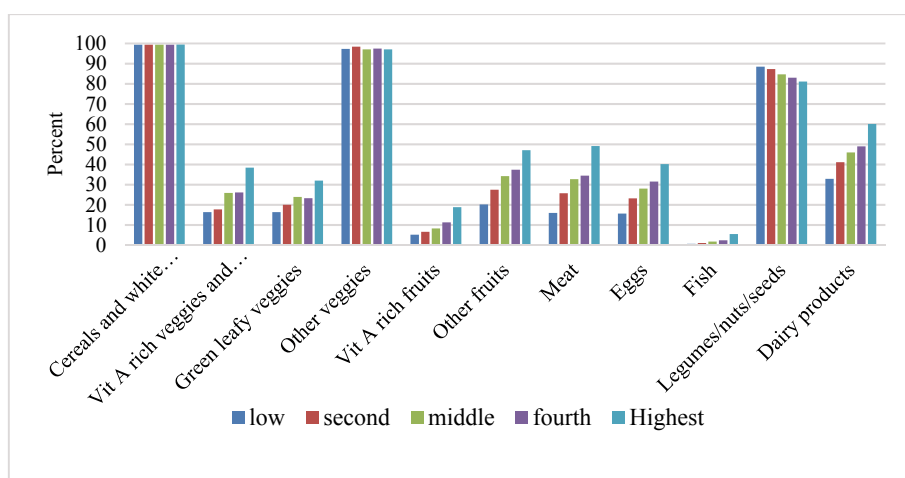


Figure 8. Proportion of households with intake of family food by household wealth

When comparing affordability and consumption by education level, the largest difference between the no education versus college-educated women was observed in fish, meat and vitamin A-rich fruits. The food group legumes/nuts and seeds were the exception, as consumption was reduced in the highest educated groups (Figure 9).

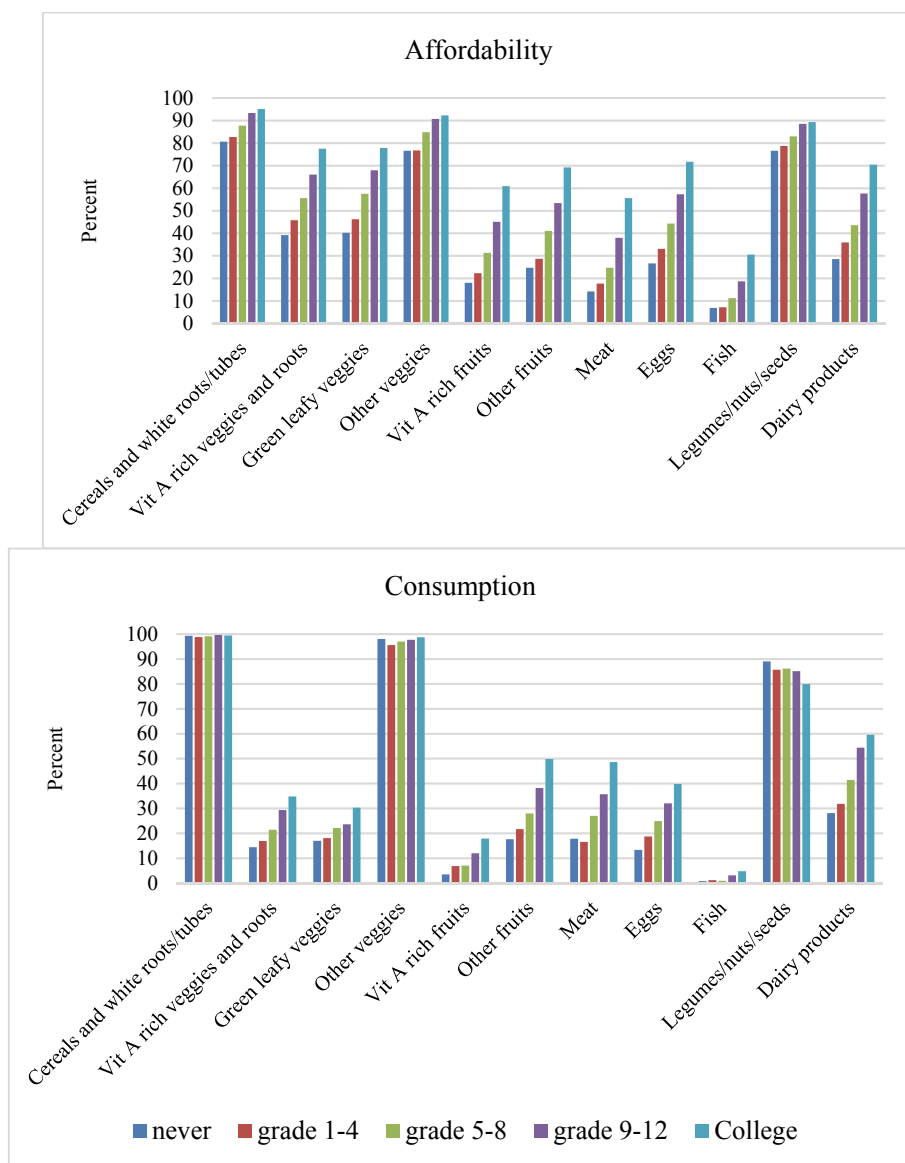


Figure 9. Proportion of households who perceive they can afford and consume family food by mother's education level

When evaluating the independent effect of affordability, wealth and education, all three were significantly associated with consumption of the different food groups. Affordability was significantly associated with consumption of all the selected foods except for vitamin-A-rich vegetables; households that perceived the food groups to be affordable had higher consumption as compared to those households that perceived they could not afford the food groups (Table 6).

Household wealth status was also associated with consumption; households in the highest wealth quintile were more likely to consume micronutrient-rich foods (vitamin-A-rich fruits and vegetables, green leafy vegetables, and other fruits) and animal-source protein foods (meat, dairy, and eggs) as compared to household in the lowest wealth quintile (Table 6).

Having a college-educated mother in the household was positively associated with consumption of micronutrient-rich foods, with the highest variation observed in consumption of vitamin-A-rich fruits (AOR: 3.20; 95%CI: 2.06–4.98). The odds of consuming animal-source protein foods; meat (AOR: 2.29; 95%CI: 1.79–2.93), eggs (AOR: 2.44; 95%CI: 1.87–3.17) and dairy (AOR: 1.79; 95%CI: 1.43–2.26) was also higher in households with college-educated mothers compared to household with mothers who never attended/finished a grade (Table 6).

Table 6: Association between selected family food groups and household perception of affordability– wealth and education in Addis Ababa, Ethiopia

		Vit.A.Fruit	Vit.A.Veg.	Green Leaf Veg.	Other Fruits	meat	egg	Dairy
		AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)
Affordability	Yes	3.10 (2.52–3.81)	2.83 (0.73–1.16)	2.76 (2.35–3.23)	3.61 (3.16–4.13)	3.06 (2.67–3.51)	3.01 (2.61–3.46)	6.74 (5.94–7.66)
	No	ref	ref	ref	ref	ref	ref	ref
	highest	2.18 (1.56–3.03)	2.01 (1.62–2.49)	1.73 (1.38–2.15)	1.79 (1.45–2.22)	2.90 (2.32–3.62)	2.08 (1.67–2.61)	1.52 (1.24–1.86)
	forth	1.54 (1.09–2.17)	1.36 (1.09–1.70)	1.27 (1.01–1.58)	1.55 (1.25–1.91)	2.05 (1.64–2.56)	1.80 (1.44–2.26)	1.23 (1.00–1.50)
	middle	1.16 (0.81–1.65)	1.32 (1.07–1.66)	1.33 (1.06–1.65)	1.40 (1.13–1.72)	2.08 (1.66–2.59)	1.52 (1.22–1.90)	1.17 (0.96–1.43)
Wealth	second	1.04 (0.73–1.51)	0.92 (0.73–1.16)	1.13 (0.90–1.42)	1.20 (0.97–1.48)	1.61 (1.28–2.02)	1.37 (1.09–1.72)	1.12 (0.92–1.36)
	Lowest	Ref	Ref	Ref	Ref	Ref	Ref	Ref
	College	3.20 (2.06–4.98)	1.86 (1.44–2.40)	1.33 (1.04–1.70)	2.49 (1.95–3.17)	2.29 (1.79–2.93)	2.44 (1.87–3.17)	1.79 (1.43–2.26)
	Grade 9-12	2.53 (1.64–3.91)	1.78 (1.37–2.23)	1.06 (0.83–1.35)	1.97 (1.56–2.48)	1.73 (1.37–2.19)	2.10 (1.63–2.71)	1.93 (1.56–2.40)
	Grade 5-8	1.72 (1.10–2.68)	1.35 (1.05–1.72)	1.12 (0.89–1.42)	1.45 (1.15–1.83)	1.43 (1.14–1.80)	1.78 (1.38–2.29)	1.43 (1.16–1.76)
Education	Grade 1-4	1.97 (1.16–3.36)	1.12 (0.81–1.54)	1.00 (0.73–1.36)	1.23 (0.91–1.66)	0.87 (0.63–1.19)	1.43 (1.04–1.98)	1.03 (0.78–1.36)
	Never attended	Ref	Ref	Ref	Ref	Ref	Ref	Ref

Abbreviation: CI, confidence interval; Ref, reference group; AOR, adjusted odds ratios; In the adjusted model, we controlled for perception of affordability, wealth, and maternal education; clustering effect

Discussion

This study found that mothers as primary caregivers face serious challenges in adequately feeding and caring for their children. Rapidly changing economic and social dynamics in urban settings; evolving children's food preferences, expanding food markets and advertisement influences, and safety concerns are all part of the complex equation and challenges.

Additionally, our findings bring to attention evidence that both over- and under-nutrition are co-existing; with the high prevalence of overweight/obesity and moderate level of stunting. The diet quality was also limited, with 40% of children not receiving an adequately diverse diet. Our findings also highlight that household wealth, food security status and maternal education levels, each associate differently with stunting and overweight. All were, however, associated with the diet diversity of the children.

With regards to family diet, we found that, generally, there is a limited consumption of micronutrient-rich and animal source foods. The consumption of micronutrient-rich and animal source foods was better in the highest wealth group, in households with educated mothers and those who perceive that they can afford it.

Mothers experience of child care and feeding

Our findings highlight that mothers who are the primary caretakers of children are overwhelmed by their multiple roles, especially in a context of fading social support. Due to financial strains and the rising cost of living, the traditional roles of mothers – household chores, child care and family food provision – are evolving to include work outside the home to support their families (32). Adjusting to the evolving dual role of becoming a working mom, while still shouldering the household responsibilities, leaves mothers stressed (102). In contrast, other studies have shown that mothers' multiple duties/roles are not associated with stress; rather, that this is associated with increased levels of satisfaction and greater access to resources, especially in the presence of support (103,104).

Adding to the mothers' stress was the city's frequent reconstruction, which forces families to move away from their familiar surroundings, fragmenting social support systems. Earlier studies have attested to the high social cost associated with the extensive renewal of urban areas in Addis Ababa (91,105).

The social support system used to be part of the traditional child caring practice, and is very important to ensure continuity of feeding in the absence of mothers/caregivers for a short spell. Its presence has been shown to improve child feeding practices, while its absence is associated with poor diet and nutritional outcomes (37–39,106). The presence of social support alleviates the time pressure, giving mothers time to take care of their children and themselves (36). Additionally, having social support also means that mothers have the opportunity to work and earn extra income (107), enabling them to purchase diverse and healthy food. Supporting this, other previous studies have shown that those who have social support are more likely to follow dietary recommendations, consume animal source food, and eat home-cooked meals (37,106,108). On the contrary, for those with low levels of social support, the time limitation may impel them to resort to ultra-processed foods which are less time consuming and cheaper (38), but are implicated with increased risk of malnutrition (39).

Selection of food for children

Our findings show that the food selection process is complex and there are many aspects that mothers deliberate on before making food choices for their children. One of the influences is the child's preferences; busy mothers may opt to simply comply with their child's preference, as they may not have the time nor the energy to cook food that children would later reject (108,109). This also relates to the state of exhaustion mentioned earlier, where mothers give in to the child's preferences as they are exhausted.

Another important driver for food choice was access to financial resources. Our findings showed that mothers with access to financial resources were able to have a planned diet. Studies have also shown that people purchase and consume food they prefer if they can afford (110), however, when there are financial limitations, they resort to foods that are less desirable, compromising on quality and/or quantity (110,111). The importance of having access to adequate financial resources for an improved diet was further supported by the analysis in Paper VI, where we observed an association between both affordability and wealth with the consumption of the different food groups.

Although mothers were aware of the nutritional recommendations, including the importance of exclusive breastfeeding, initiation of complementary foods and a balanced diet, there were gaps in their practice and understanding of what constituted a balanced diet. The confusion on what constitutes a healthy food has been observed in other settings as well (112). Having nutrition-related awareness may not always translate to the desired behavior (113). Partly, this is because food choices are based on a complex set of factors that vary across individuals, cultures, and contexts (114). As mentioned earlier, the cost of food, and the maternal state of being, also influence the decision-

making process; another important element that the mothers in our study raised is the concerns they had about the safety of the food.

Mothers' concerns about food safety influence the type of food they give their child. Their concerns are substantiated by earlier studies from different parts of Ethiopia which indicated the presence of contaminants in some of the fresh produce as well as in the ready-to-eat foods (115,116). Food safety issues are severe in many low-income countries where regulatory mechanisms and institutions are weak.

Nutritional status of children

Our results show the co-existence of under- and over-nutrition among children in Addis Ababa. Except for the prevalence of wasting, which was low, the stunting and overweight/obesity rates reported here are within the moderate and high threshold levels, respectively (117). The persistent level of stunting is consistent with other reports from Africa, which have shown that stunting is at a slow decline (6). When we compared the overweight/obesity level in our study with that reported in the 2016 Ethiopian demographic and health survey (EDHS), we found that there was a 5 percentage point difference (89). This difference could be because of the inaccurate representation of the city in EDHS, where the sample size drawn to represent the city was very low ($n=216$) (89), our study used a larger sample size and produced a more stable estimate. Our results could also be an indication that childhood overweight is on the rise in Addis Ababa as it is in other parts of Africa (6). This rise could be in part reflective of the cumulative changes that the city has experienced over the years, including the expansion in food retail options, leading to a gradual shift to more processed foods and a reduction of open spaces contributing to a sedentary lifestyle (67,118,119).

Dietary Intake

In our study, the proportion of children who received the recommended number of foods, four of the seven child food groups, were only 60%. Although one might consider this figure low, it is much better than the national average, which was 20% in 2016 (89). The national commitment to end child undernutrition by 2030 has stated 100% access to adequate food all year round as one of its key strategies (120). However, the low proportion observed in this study, highlights the need to maximize efforts to improve diet diversity. Our results indicate both the household and child diet is mainly composed of cereal (83% for children and 99% for households), a finding that is consistent with the national consumption survey, which also showed that cereals/roots and tubers constitute the major portion of the Ethiopian diet (121).

Consumption of micronutrient-rich and animal source food was particularly very low; less than 46% of the households and children consumed these food groups. Animal source food, although it is a high-value food among the population, is expensive and deemed to be occasional or holiday food. The high price of animal source food within the community has also been documented by earlier studies (122). One possible explanation for the limited consumption of micronutrient-rich food sources among the study population could be its high price (122), particularly for the vitamin-A-rich foods. Perhaps another explanation to the limited consumption of vegetables, especially green leafy vegetables, among younger children, is due to a common belief that they cannot digest these foods (123).

Socioeconomic positions

Maternal Education

Both children and households with college-educated mothers had better diets compared to those who had mothers who never attended/finished any level of education. The association between higher maternal education and improved diet diversity has been documented in earlier studies (41,124). Maternal education level has also been associated with improved nutritional knowledge (125), which further leads to improved diet quality.

Children who had mothers with higher education levels had lower odds of stunting. Several studies have reported similar findings (42,43,54,126), and one potential pathway to explain this association is: educated mothers make use of family planning, antenatal care services, have better health-seeking behaviours and better knowledge of child nutrition (42,89,125,127). Besides, educated mothers would have financial independence and autonomy to make diet choices, which has been shown to improve dietary and nutrition outcomes for children (128,129). On the contrary, having a college-educated mother was found to increase the risk of overweight/obesity. As most college-educated mothers would also be working or have careers, the conflicting time pressures that mothers experience could be influencing them to go for more convenient and ready-to-eat foods (130). Mothers with careers may also feel guilty for not personally caring for their children, hence may provide more treats, sugary drinks and sweets to their children (32).

Household wealth

Household wealth status has also been shown to be independently associated with the diet of the household and children. Households in the higher wealth groups had higher consumption of both micronutrient and animal source foods. The consumption of these food groups among the higher wealth group was as anticipated, as the price food is consistently increasing and could be difficult for the poor to afford (122). Consistent with this, children from the

highest wealth group had a higher likelihood of obtaining an adequately diverse diet (41).

In our study, children from the highest wealth households also had higher risk of being overweight. This could be because wealthy households can afford to buy all the desirable products in a relatively large quantity without regard to their nutritional value. Another possible explanation could be, that, in the wealthier households, they have access to private cars, electronic gadgets such as TV, which limits the physical activity levels of children (131,132).

Food security

Severely food insecure households have limited diet diversity and show a high prevalence of stunting. Chronic food insecurity, in the long run, manifests in the form of severe stunting (62,64). Households with severely limited access to food would barely be able to consume a decent meal, let alone a diverse diet (62,63) that consists of fruits and vegetables (133,134).

Affordability

Food groups that were perceived to be affordable were more likely to be consumed by families. This finding is consistent with studies that have found that household consumption and selection of diet are influenced by their ability to purchase/afford food (68). The consumption of healthy food, for example, fruits and vegetables, has been associated with household perception of affordability (133,134). When evaluating the price pattern in Ethiopia, Bachewe et al. (122) found that the price of most food groups, especially that of animal source food and vitamin-A- rich foods, is on the rise. This could be one reason for the poor consumption of these food groups within our study households, suggesting that cost is a strong determinant for their diets (71,135).

Methodological considerations

This thesis used a mixed-method design, a combination of both qualitative and quantitative research designs, which is one of the strengths of the study. While the qualitative studies helped to explore and understand the lived experiences of mothers, the quantitative component was necessary to quantify the dietary diversity and nutritional outcomes. A short account of the strength of each component is given below.

Qualitative Method

This part of the study makes an important contribution to the understanding of the setting and the lived experiences of the mothers. To ensure the trustworthiness of the studies, several efforts were made: the research team spends considerable time in the field to create a rapport with the mothers and facilitate

prolonged engagements with potential participants. To ensure transferability, sample selection was made based on our theoretical knowledge about the dietary requirements of children whose mothers had children in three different age categories were sampled purposively. We also considered mothers' work status (working/not working), parity (primiparous/multiparous), and their community involvement as additional criteria in the purposive sampling procedure. Thick description of the setting was recorded, along with detailed field notes. The analysis was finalized after several discussions among the multidisciplinary research team, with each member contributing a different perspective. There were also additional forums for peer scrutiny by presenting the findings to both local and international expertise in the field. Audit trails were kept at each stage of the process to ensure the reliability of the research. A possible limitation of the study is social desirability bias; for mothers to admit that they are unable to provide food for their children is difficult, so they may not have disclosed the conditions fully. However, we tried to minimize this bias by having well-trained research assistants who were sensitive to the mothers' concerns and capable of encouraging mothers to feel comfortable to express their experiences and challenges.

Quantitative Method

Generalizability

The quantitative study was conducted in two rounds to capture seasonal variations in the availability of food. The study samples in both rounds were drawn from all woredas (districts) of the city administration. Thus, the findings are generalizable to the city and other large towns in Ethiopia. Generalizability to other urban areas in low-income settings is also plausible by taking into consideration the prevailing sociocultural contexts.

Internal validity and reliability

The study had a large sample size and the fieldwork followed standard procedures. The research assistants who collected the data have extensive field research experience and had received intensive training before conducting both of the surveys on the questionnaire modules, interview techniques and taking anthropometric measurements. Standardization sessions for the anthropometric measurements were carried out, and all measurements were done using recommended measuring boards and weight scales. Most sections of the questionnaire used standard tools that have already been tested in the study context; for others, the tools were pretested and any necessary adjustments were made including the dropping of some sections after pretest. The data collection process was closely supervised by field supervisors as well as part of the research team to make sure that everything progressed according to the protocol.

Selection bias

As there were no updated listing of clusters to serve as a sampling frame, we used cluster sampling to identify households. In the selected households, all mother-child pairs were invited to participate in the study, and we observed a very low refusal rate (about 1%). The inability to find respondent mothers at home after three visits was another reason for not enrolling a household, but these numbers were also very low, at only 194 out of the 14,018 households visited. Hence, these potential sources of selection bias are unlikely to affect our results. The weighting of prevalence estimates was not done, although Addis Ababa is presumed to have a similar population size across its districts, there is still a possibility of modest variations in population size leading to over/under sampling of certain population groups. It was not possible to obtain accurate population size estimations of the districts, as the last census was conducted in 2007 and the plan to conduct a new census has been postponed several times due to various reasons.

Information bias

The data collection used a standardized questionnaire, and calibrated instruments. Maximum efforts were made to make sure all interviews were carried out in a private location where the mother could comfortably answer all questions. Mothers were asked to recall what the child ate in the past 24 hours; in following this process, although efforts were made to minimize recall bias by asking mothers to recall the foods they gave to their child from early morning, step-by-step and probing for snacks as well aided by a photo gallery, we cannot rule out the chance that the mothers may have simply forgotten some food items. Additionally, social desirability bias might have slightly inflated our diet diversity measures, as some mothers, especially those who are aware of what constitutes a nutritious diet, might have included food not consumed by the children and/or family. To limit the chance that mothers just said 'yes' to all food groups, we started with a free recall of food consumed by the child. Another issue that could even out the inflation in the study context is that if the mother considered that there might be aid opportunities, she may also have under-reported the child's and/or household's dietary consumption.

Confounding

This thesis accounted for selected potential confounders by using multivariable regression models. Potential confounders that were identified through a review of the literature and that were deemed relevant to our conceptual framework were included in the model. We used the generalized estimating equation (GEE) and mixed-effect logistic regression to estimate the independent effect of socioeconomic positions with child diet and nutritional outcomes, as well as family food consumption, while accounting for clustering effects. However, unmeasured/residual confounding cannot be completely ruled out.

Conclusions

Based on the finding of this thesis, the key conclusions are:

- Mothers who play the critical role of ensuring that a child gets an adequate diet and nutrition are under a lot of stress and devoid of support systems in rapidly growing urban centers.
- Decisions about what to feed children are heavily influenced by the children's food preferences, food safety issues, and price.
- Despite stunting still being the highest form of malnutrition, a considerable proportion of children have overweight/obesity in Addis Ababa.
- Children generally have limited diet diversity, but more so in the poorest segment of the population.
- Malnutrition, both stunting, and obesity, was present in all socio-economic strata, with the highest variability observed when stratified by maternal education. While higher education protects from stunting, it also increases the risk of overweight/obesity.
- Although no serious limitation on the availability of food groups on the market was reported, a household's consumption is limited to only certain food groups. The affordability and consumption of vitamin-A-rich and animal source foods are very low, especially among the poorest segment of the population.

Considering that mothers are the linchpin that holds together efforts to promote child diet and improve nutritional outcomes; measures to alleviate their stress are acutely needed. One approach could be testing interventions that could improve mothers' support systems, and which might counteract the effects of diminishing support. Exploring different avenues would be valuable, such as testing the effectiveness of subsidized day-care systems that are affordable for the vulnerable population. This would enable mothers to work and have time to carry out social obligations with reduced stress. Additionally, studies that explore the lived experiences of fathers with regards to child care and feeding would be invaluable.

The findings of this thesis also highlight the importance of child food preferences, which are highly influenced by marketing campaigns, therefore, marketing regulations may be needed to promote healthier diet choices and curb

the increasing challenge of overnutrition. Strategies to create an appeal towards healthy foods by using innovative promotion strategies could also be an alternative. The findings from this thesis also highlight that food safety is a concern among the mothers; therefore, a broader food safety assessment is needed to verify these concerns. If founded, stronger regulatory measures need to be put into place; if not, public awareness campaigns must be initiated to reassure families.

Improving maternal education levels provides an opportunity for a cost-effective intervention that should be prioritized as it could have the potential to improve the quality of the diet for children and the family as well as to tackle both the over- and under-nutrition challenge. Tailor-made information packages for the mothers that are suited to their level of understanding, and possibly even preparing menu-based guides, could be a cost-effective strategy for improving child diet and nutrition.

Although the malnutrition agenda for the country is still focused on under-nutrition, this study raises awareness of the rising problem of overweight children. This could also be the case nationwide, therefore, similar large-scale studies in other cities in Ethiopia are needed to understand the shift in the burden of malnutrition and the determinants to mitigate the problem at an early stage. Further, interventions that work to reduce undernutrition need to be careful to not inadvertently promote an increase in overnutrition. My study has also identified the higher-risk sub-groups for both stunting and obesity in this setting, and, therefore, tailored intervention strategies that target the various segments of the population could be developed. Thus, there might be a need for additional nutrition-sensitive interventions that target this vulnerable population, such as poverty alleviation efforts.

Accordingly, encouraging decision-makers to prioritize the implementation of nutrition-sensitive interventions could improve the situation of mothers who are the key players in promoting healthy nutrition; the returns of this investment on mothers would be reflected in many forms, including improvement in diet and nutrition of households and child health as a whole.

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