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Food Insecurity and Coping Strategies in War-Affected Urban Settings of Tigray, Ethiopia

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Abstract: Armed conflict remains a significant global issue, with several studies highlighting its detrimental impact on the affected communities, making it a critical area of research. This study aimed to examine the effects of prolonged armed conflict on food security among urban households in Tigray, Ethiopia, and to examine their coping mechanisms. Primary data were collected from 740 urban households between May and June 2024. The Food Insecurity Access Scale (FIAS), Food Insecurity Experience Scale (FIES), and Food Consumption Score (FCS) were employed to assess the levels of food security, while the Livelihood Coping Strategy Index (LCSI) was used to identify coping strategies. The findings revealed that female-headed households were more affected by food insecurity than male-headed households. FIAS (FIES) scores indicated that 17% (2%) of households were food-secure, with 20% (25%) mildly, 35% (32%) moderately, and 29% (30%) severely food-insecure. The FCS analysis showed that 52% of households had poor food consumption, 33% were borderline, and 16% were acceptable. The findings show that 39% of urban households experienced hunger in the post-conflict period. Stress-level strategies are the most widely adopted coping mechanisms. These findings underscore the urgent need for targeted policy interventions that address the specific vulnerabilities of female-headed households and ensure the development of sustainable coping strategies to mitigate the long-term effects of food insecurity in war-affected urban settings. This study offers novel insights into the urban dimensions of food insecurity and coping strategies in post-conflict settings.

Keywords: conflict-induced crises; coping strategies; food insecurity; hunger; urban households

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1. Introduction

The global rise in food insecurity is increasingly tied to food crises, which are often worsened by armed conflict. These conflicts disrupt food systems, destroy agricultural land, and damage essential infrastructure, leading to severe consequences for food security. War-induced displacement and famine have long-lasting impacts on households, compounding the struggle for food security (Martin-Shields & Stojetz, 2019). Consequently, food insecurity has emerged as a crucial area of study across disciplines because of its significant effects on livelihoods (Jones et al., 2013). According to the FAO, food security exists when "all people at all times have consistent physical, social, and economic access to sufficient, safe,

and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Thus, food insecurity arises when any of the four pillars—access, availability, stability, or utilization —are compromised (Jones et al., 2013).

Food insecurity remains a global challenge, particularly in regions affected by conflict (Martin-Shields & Stojetz, 2019). Armed conflicts have a profound impact on food security, destabilizing food systems, displacing populations, and reducing resilience to food shocks. These conflicts also limit access to essential goods and services, exacerbating existing vulnerabilities (FAO & WFP, 2020). Many studies have established a clear link between conflict and food crises (Hendrix & Brinkman, 2013; FAO et al., 2017; Koren & Bagozzi, 2017; Diawoł-Sitko, 2020). In 2021, 72% of the 193 million people facing acute food insecurity were in conflict-affected countries, illustrating the severity of the situation (FSIN, 2022). Conflict-affected populations are three times more likely to suffer from food insecurity than those in peaceful areas (FSIN & GNAFC, 2021).

The relationship between conflict and food insecurity has also been demonstrated in various empirical studies. Muriuki et al. (2023), for example, documented a 16.13% reduction in Food Consumption Scores (FCSs) in Ethiopia and Malawi as a result of conflicts in 2019. This trend is mirrored in countries such as Syria, Yemen, and Sudan, where ongoing conflicts have led to severe food crises (WFP, 2023; World Bank Group, 2023; OCHA, 2024). Conflicts not only limit access to food but also trigger broader economic disruptions, including job losses, inflation, and declining social services, which together weaken community resilience (FAO & WFP, 2020).

A recent conflict in the Tigray region of Ethiopia is a stark example of these dynamics. On 4 November 2020, the conflict led to widespread infrastructure damage, disrupted agriculture, and significant displacement, resulting in acute food insecurity (Clark, 2021; Weldegiargis et al., 2023; Geremedhn & Gebrihet, 2024). Although the intensity of fighting has decreased, its long-lasting impact on food security persists, affecting food access, stability, and distribution (Clark, 2021; Gebregziabher et al., 2023; Araya & Lee, 2024; Geremedhn & Gebrihet, 2024). Tigray, which had been relatively food-secure before the war, faced emergency-level food insecurity by March 2021 due to the conflict's economic and social tolls (Clark, 2021). Furthermore, the impact of conflict on food security is gendered, with distinct consequences for both men and women (Clark, 2021).

While existing research has highlighted the effects of conflict on food security, gaps remain, particularly concerning the situation of urban households after conflict. Much of the previous research has centered on rural or non-war-affected contexts, often overlooking the complexities faced by urban populations in conflict zones. Some studies, such as those by Gebregziabher et al. (2023) and Weldegiargis et al. (2023), have explored the impact of sieges on urban livelihoods and the prolonged effect of conflict on food security. However, limited research exists on the coping mechanisms employed by urban households in post-war Tigray.

This study addresses these gaps by examining two main questions: (a) What is the current food security status among urban households in Tigray? (b) What coping strategies are urban households using to manage conflict-related food insecurity? Insights from this study aim to inform policymakers, researchers, and humanitarian agencies to support the development of sustainable strategies to aid urban households during post-conflict recovery.

The paper is organized as follows: Section 2 provides a literature review to contextualize the study; Section 3 details the data sources and methodologies; Section 4 presents the findings; Section 5 discusses the implications of the results; and Section 6 concludes with key insights and recommendations for future action.

2. Literature

2.1. Conceptual Framework

War significantly affects development, particularly food security, creating stark disparities between war-affected and peaceful regions. In conflict zones, food insecurity becomes both a cause and consequence of protracted crises. Armed conflicts disrupt agricultural activities, damage infrastructure, and hinder food production, leading to reduced availability and limited market access (FAO et al., 2017). In addition, conflicts have gender-specific consequences, with female-headed households frequently experiencing more severe declines in food security than male-headed households during crises (Agidew & Singh, 2018). Despite the seriousness of war-induced food insecurity, research gaps persist, particularly in Tigray, Ethiopia.

The study's conceptual framework (Figure 1) examined the link between armed conflict, food insecurity, and coping mechanisms in Tigray. It explores how conflict influences food security and how households respond to it. Conflicts disrupt food availability and access by interrupting agricultural production and damaging supply chains (Muriuki et al., 2023). For instance, Gates et al. (2012) find that medium-intensity conflicts cause a 3.3% increase in undernourishment. These studies underscore the connection between war and food insecurity, with significant impacts on urban households that prompt the adoption of diverse coping mechanisms (Van Weezel, 2018). Armed conflicts intensify food insecurity by limiting resource access, disrupting production, and forcing households to rely on lower-quality food (Sassi, 2021; Kuo Lin et al., 2022; Araya & Lee, 2024).

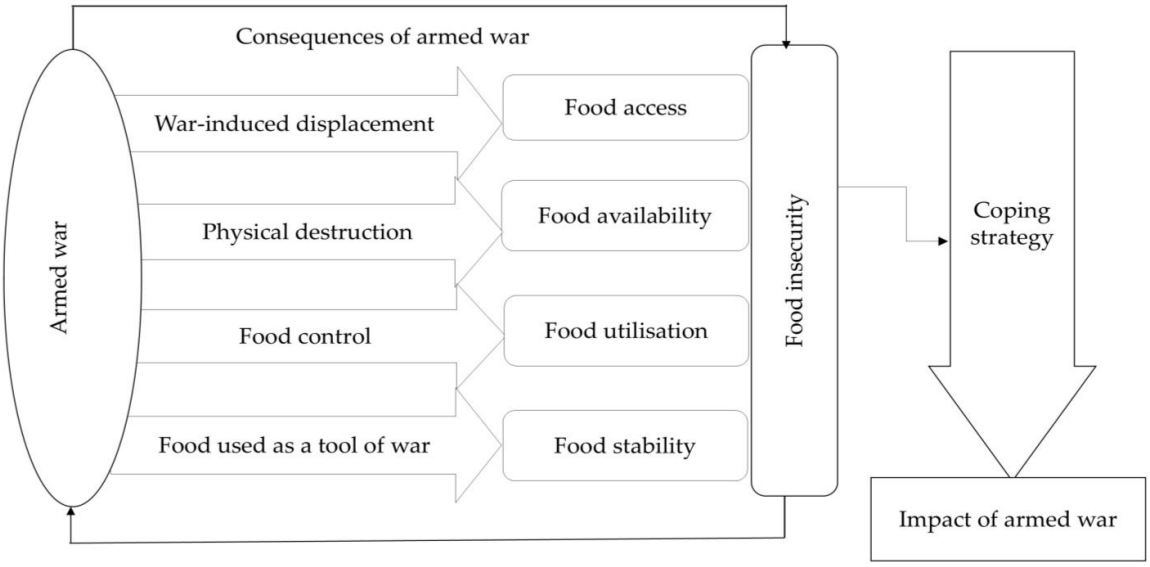

Figure 1. Conceptual framework: interplay among war, food insecurity, and coping strategies. Source: Authors' compilation.

In the face of such challenges, households have developed a range of coping strategies to mitigate the impact of conflict on their livelihoods. A coping strategy encompasses a set of short-term actions aimed at minimizing the immediate effects of crises, such as armed conflicts, and stabilizing consumption to ensure survival (Morduch, 1995; Alemayehu & Bewket, 2017). Conflicts affect all aspects of food security—access, availability, utilization, and stability—by causing displacement, destroying assets, controlling food supplies, and even weaponizing food. These factors exacerbate food insecurity in urban households (Figure 1), leading to hunger and declining food security in conflict-affected communities (Kemmerling et al., 2022). Consequently, people in such areas often adopt various coping mechanisms to address the challenges of prolonged conflict.

This study focuses on the effects of armed conflict on food security among urban households in Tigray, and the coping strategies employed to manage food insecurity during and after the conflict. These findings aim to fill an important gap in the literature on war-induced food insecurity, particularly in the underexplored urban context of Tigray. Figure 1 shows the interaction between war, food insecurity, and coping strategies.

2.2. Review of Empirical Studies

Conflict and war have significantly hindered global development, with severe consequences for food security. These challenges manifest as heightened levels of malnutrition, hunger, poverty, and livelihood loss in war-affected households. Disruptions in food supply chains cause price inflation and food shortages, making food less accessible to vulnerable populations (Dlamini et al., 2023; Fotakis et al., 2024; Munialo & Mellor, 2024). Such disruptions frequently force households into food insecurity because of the loss of income and diminished capacity to purchase food (Dahal, 2017). Understanding the extent of food insecurity in war-affected areas is essential to inform policies and interventions by governments, development practitioners, and humanitarian agencies.

War-affected regions, especially in sub-Saharan Africa, demonstrate high levels of food insecurity as conflicts exacerbate existing vulnerabilities related to food, poverty, and political instability. A prime example is the Tigray region of Ethiopia, where armed conflict intensifies food insecurity, particularly in urban settings. This review explores food insecurity and coping strategies in conflict-affected regions with a focus on Tigray's urban households.

Empirical studies have underscored the adverse effects of conflict on household food security. For instance, Ibrahim et al. (2024) analyzed food security in Syria's war zones by measuring factors such as the Food Consumption Score (FCS), Dietary Diversity Score (DDS), and Reduced Coping Strategy Index (RCSI). The study highlighted that female-headed households faced greater food insecurity than male-headed households, while being more proactive in dietary diversity. Similarly, Araya and Lee (2024) assessed the 2021 Tigray conflict, revealing that 77% of households were food-insecure, with 34% in crisis and 69% facing emergency levels, according to the Integrated Food Insecurity Phase Classification (IPC). Influential factors include household size, conflict, inflation, and access to humanitarian aid and financial services.

Further research should emphasize the impact of prolonged conflicts on food security. Weldegiargis et al. (2023) studied households in Tigray with children under one year of age using data from mid-2021. Their analysis showed that 85% of households experienced food insecurity, with 14.4% facing severe food insecurity. Local strategies to manage food shortages involve meal reduction, limited food variety, and, in extreme cases, skipping meals entirely.

Other studies have corroborated these findings. Muriuki et al. (2023) examined Ethiopia and Malawi, showing a 6.8-unit (16%) reduction in FCS for conflict-affected households. In Ethiopia, 12% of households have reduced food consumption due to exposure to conflict. In Palestinian territories, Kuo Lin et al. (2022) noted a one-point FCS drop in the Gaza Strip, particularly in areas near conflict zones. These studies consistently demonstrate that conflict reduces food security, necessitating coping strategies to handle food shortages and economic hardship.

Households in conflict areas often adapt to mitigate the impact of food insecurity through various coping mechanisms. These strategies, rooted in local knowledge and practices, include reducing meal sizes, limiting food diversity, and relying on aid (Sassi, 2021; Kuo Lin et al., 2022). In South Sudan's conflict-affected Western Bahr el Ghazal region,

households coped by selling assets, borrowing food or money, and engaging in small-scale farming (Sassi, 2021).

In extreme situations, individuals tend to resort to desperate measures. For example, some communities may depend on scavenging, begging, or consuming wild foods—strategies that highlight the gravity of food crises in conflict zones (Dlamini et al., 2023). Farzana et al. (2017) found that severely food-insecure households in Bangladesh often resort to both food compromises and financial strategies, including reducing meal portions, borrowing, and selling possessions.

These empirical findings emphasize the widespread impact of conflict on food security and demonstrate the varied coping mechanisms adopted by the affected populations. Evidence indicates that food insecurity in conflict settings results not only from direct disruptions, but also from long-term economic and social instability (Kuo Lin et al., 2022; Weldegiargis et al., 2023; Ibrahim et al., 2024). Such instability often forces communities to rely on survival strategies that may have negative effects on their well-being, economic stability, and resilience.

Before the outbreak of the armed conflict in November 2020, Tigray was among Ethiopia's most food-secure regions, benefiting from advances in agricultural productivity and diverse livelihood opportunities. However, war drastically reversed this progress, leading to severe food insecurity across the region. Despite its significance, research on how urban households in Tigray cope with food insecurity during and after the conflict is limited (Gebregziabher et al., 2023; Weldegiargis et al., 2023; Araya & Lee, 2024; Geremedhn & Gebrihet, 2024). This study seeks to address this gap by assessing urban households' food security status in Tigray, as well as the strategies they adopted to cope with food-related challenges in the post-war period.

3. Methodology

3.1. Description of Variables

The household survey was conducted in seven urban Woredas (districts) within the war-affected settings of Tigray, Ethiopia. Tigray is situated geographically between latitudes 14°08′11.67″ N and longitudes 38°18′33.57″ E. Tigray borders Sudan to the west, Eritrea to the north, Afar National Regional State of Ethiopia to the east and Amhara National Regional State to the south (Figure 2). The region is divided into seven zones: Southern, Southeastern, Mekelle, Eastern, Central, Northwestern, and Western zones.

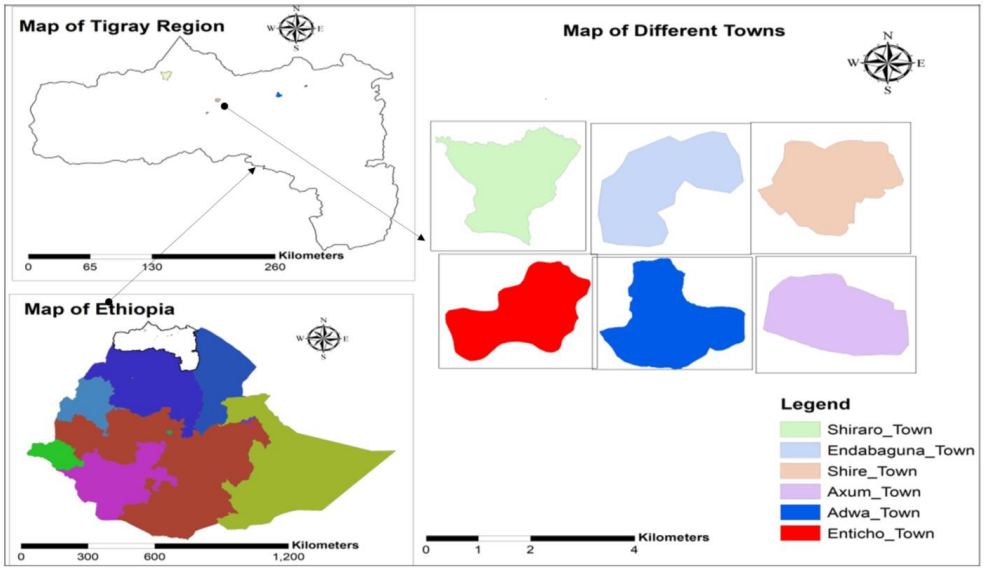

Figure 2. Map of the study area. Source: Authors' development using ArcGIS 10.8.

This research focused on two zonal towns owing to resource limitations. This study employed primary data collected in May and June 2024 from a sample of 740 urban households.

3.2. Data Collection and Sampling Technique

In this study, a cross-sectional household survey research approach was adopted. The survey was conducted from May to June 2024 with heads of urban households in Tigray, Ethiopia. A multi-stage sampling technique was used in this study. First, the two zones were purposively selected. Second, six towns, Enticho, Adwa, Axum, Shire, Endaba-Guna, and Shiraro, were purposively selected. Purposive sampling was employed to ensure the selection of zones, towns, and administrative units (Tabias) that experienced the highest intensity and severity of armed conflict, thereby enabling the study to focus on households most affected by the war and to address the research objectives effectively. These towns were occupied twice by Ethiopian and Eritrean forces in 2020 and 2022, respectively. Third, three "Tabias" (the smallest administrative unit) from each selected town were randomly selected using the lottery method. Finally, 740 sample household heads were randomly selected from the "Tabias" using a systematic sampling technique.

Using Yamane's (1967) sample-size determination formula, the sample size was computed as follows:

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

where e is the marginal error (equal to 0.05), n is the required sample household size, N is the target finite household population, and 1 is a constant.

A structured questionnaire was used to collect data, analyze households' food security status, and identify their coping strategies. Furthermore, to augment the quantitative data, a qualitative survey was conducted with a total of 10 focus group discussions (FGDs), each with eight members considering the age, education, economic status, and gender diversity of the participants. Moreover, ten key informant interviews (KIIs) from each selected town were held with district officers and food security experts.

3.3. Methods of Measuring Food Insecurity

Food security assessments rely on a range of methods that are broadly classified into subjective and objective techniques. Objective measures, commonly used in earlier studies, focus on consumption patterns or food expenditure data to evaluate food security levels (Gebresilassie & Nyatanga, 2023; Weldegiargis et al., 2023; Araya & Lee, 2024). Recently, subjective measures have gained popularity among economists, offering an alternative and often complementary approach to understanding food security dynamics (Gebresilassie, 2020; Gebresilassie & Nyatanga, 2023; Weldegiargis et al., 2023). Subjective assessments capture individuals' perceptions and experiences of food insecurity and provide deeper insights into food access challenges.

This study employs subjective food security measurement techniques to evaluate household-level food security, specifically using four well-established scales: the Food Insecurity Access Scale (FIAS), Food Insecurity Experience Scale (FIES), Food Consumption Score (FCS), and Household Hunger Scale (HHS) (Maxwell et al., 2003; WFP, 2007).

These methods were chosen to address the specific objectives effectively and within the constraints of the conflict-affected setting. A cross-sectional household survey was employed to collect data from a large sample of 740 households within a limited time frame and resource availability. This method allowed for the application of well-established tools, such as the Food Insecurity Access Scale (FIAS), Food Insecurity Experience Scale (FIES), and Food Consumption Score (FCS), which provide robust quantitative measures of

food insecurity levels and coping strategies. Additionally, qualitative methods including focus group discussions and key informant interviews were incorporated to capture the contextual and nuanced experiences of urban households in Tigray. These methods complemented the quantitative data by offering insights into the lived realities and adaptive mechanisms of households in war-affected settings. The combination of quantitative and qualitative approaches was purposeful, ensuring a comprehensive understanding of the issues, while balancing statistical analysis with narrative depth. This mixed-methods design was particularly suited to the study's aim of investigating the multidimensional impacts of conflict on food insecurity and the diverse coping strategies adopted by the affected populations.

3.3.1. Food Insecurity Access Scale (FIAS)

The FIAS was designed to measure the severity of food insecurity experienced by households over the 30-day period preceding the survey. This tool focuses on assessing food insecurity at the household level, particularly in terms of access to food (Coates et al., 2007). The scale consists of nine questions addressing the "occurrence" of food insecurity-related conditions and the "frequency of occurrence" to identify food-secure and food-insecure households.

Households were initially asked if specific conditions had occurred within the past 30 days ("yes" or "no"). For affirmative responses, a follow-up question gauged the frequency of the condition: rarely (once or twice), sometimes (three to ten times), or often (more than ten times) within the 30-day window. The FIAS score, ranging from 0 to 27, was calculated by summing the scores of the frequency responses, with higher scores indicating more severe food access insecurity (Maxwell et al., 2003; Coates et al., 2007). This method enables a comprehensive assessment of food security, including access, availability, and stability dimensions, by considering both the presence and frequency of food-related challenges (see Tables 1 and A1).

Table 1. Measures of food insecurity and their threshold values.

Measures of Food Security	Category Values	Category Labels	Thresholds
FIAS	1	Food-secure[1]	[0, 1]
	2	Mildly food-secure[2]	[2, 13]
	3	Moderately food-secure[3]	[14, 16]
	4	Severely food-secure[4]	[17, 27]
FIES	1	Food-secure	[0]
	2	Mildly food-secure	[1, 3]
	3	Moderately food-secure	[4, 6]
	4	Severely food-secure	[7, 8]
FCS	1	Acceptable	($\geq$35)
	3	Borderline	[21.5, 35)
	4	Poor	[0, 21.5)
HHS	1	No hunger (or little hunger)	[0, 1]
	3	Moderate hunger	[2, 3]
	4	Severe hunger	[2, 4]
LCSI	1	No coping strategies	
	2	Used stress-level strategies	
	3	Used crisis-level strategies	
	4	Used emergency-level strategies	

Source: Authors' compilation.

The sum of the "frequency-of-occurrence" over the past 30 days for the nine-food insecurity-related occurrence of conditions is computed as follows:

$$FIAS\ scores_{\ [0,\ \ 27]} = \sum_{i=1}^{9}(Q_{1,a} + Q_{2,a} + Q_{3,a} \ldots,\ Q_{9,a}) \quad (2)$$

$$Average\ FIAS\ score,\ x_i = \frac{sum\ of\ FIAS\ scores\ in\ the\ sample}{Number\ of\ FIAS\ scores\ (households)\ in\ the\ sample} \quad (3)$$

where $Q_{1,a}$_$Q_{9,a}$ refer to the "frequency-of-occurrence" question (once or twice, sometimes, or often) and x_i refers to the i^t sample household.

3.3.2. Food Insecurity Experience Scale (FIES) Measures

The Food Insecurity Experience Scale (FIES) is an experience-based measure of food insecurity. To assess individuals' access to sufficient food, it employs a set of eight occurrence questions (yes or no) excluding the "frequency-of-occurrence" question over the past 30 days. This metric relies on participants' direct responses to gauge their level of food security (Maxwell et al., 2003; WFP, 2007; FAO et al., 2023). The FIES scores range from zero to eight. The higher the FIES score, the higher the food insecurity level experienced by the households (Tables 1 and A2).

The sum of the "frequency-of-occurrence" over the past 30 days for the eight-food insecurity relations occurrence of conditions is computed as follows:

$$FIES\ scores_{\ [0,\ \ 8]} = \sum_{i=1}^{8}(Q_{1,a} + Q_{2,a} + Q_{3,a} \ldots,\ Q_{8,a}) \quad (4)$$

3.3.3. Food Consumption Score (FCS) Measures

The FCS is a composite score that considers households' dietary diversity, food consumption frequency, and relative nutritional value of different food groups. It measures household food consumption, which is a proxy for household food utilization components of food security. The FCS was computed based on the food consumption frequency of eight different food groups in the sample households a week before the survey, and each group was then multiplied by its weight. The FCS is calculated by aggregating data on the household's consumption of eight basic food items over the seven days before the survey, with any food item score exceeding seven being truncated (Table 1) (WFP, 2008). The various food group categories are presented in Tables A1 and A2.

Based on Subedi and Kent (2018), FCS is computed as follows:

$$FCS_{\ [0,\ \ \geq 35)} = \sum_{1}^{n}(fFG_1 xwFG_1) + (fFG_2 xwFG_2) + \cdots + (fFG_n xwFG_n) \quad (5)$$

where fFG refers to the "frequency-of-occurrence" for food consumption or frequency of food group used (7-days recall), wFG refers to the weight assigned to the different food groups ("staples = 2, vegetables = 1, fruits = 1, meat and fish = 4, pulses = 3, milk = 4, oils = 0.5, sugar = 0.5 and condiments = 0"), and $1 \ldots n$ is the number of food groups.

3.3.4. Household Hunger Scale (HHS) Measures

The HHS was computed using the last three of the nine FIAS questions (Q_7, Q_8 and Q_9). To estimate the level of hunger for the households under study, the "frequency-of-occurrence questions" were used. The HHS score ranges from zero to six and the higher the score, the more severe the condition (Tables 1 and A1).

3.3.5. Local Coping Strategy Index (LCSI)

The LCSI is a tool used to assess the various strategies households adopt in response to food insecurity, particularly in areas affected by crises or conflicts. The index provides a

quantitative measure of household resilience and vulnerability by evaluating how households cope with food insecurity. It assesses household livelihoods based on questions about asset depletion and livelihood stress over the past 30 days. Before conducting the survey, common local coping strategies employed by urban households to address food insecurity were identified through key informants and focus group discussions with war-affected communities. The LCSI is organized into three coping strategies (Yohannes et al., 2023):

i. Stress coping strategies: these include selling household assets (such as furniture, radio, jewelry, chair, table, television, etc.), reducing the size and frequency of meals, eating less-preferred and cheap foods, borrowing money to cover food needs, spending savings, moving children to less expensive schools, petty trading, engaging as daily laborers, sending a member of the household to eat elsewhere, and consuming wild foods.
ii. Crisis-level coping strategies include selling productive assets, reducing non-food expenses on health, and withdrawing children from school.
iii. Emergency level coping strategies: these include selling or mortgaging a house; begging for money or food; engaging in exploitative, dangerous, or life-threatening employment (such as prostitution, smuggling, and thievery); and migration.

Weights were then assigned to each identified coping strategy and computed by summing these weights. Households are categorized based on their LCSI scores: "no coping strategies–1", "use of stress-level coping strategies–2", "use of crisis-level coping strategies–3", or "use of emergency-level coping strategies–4." Hence, a household that uses a "crisis-level coping strategy" receives a 3, while a household that uses an "emergency-level coping strategy" receives a 4. Table 1 presents summary measures of food security (FIAS, FIES, FCS, and LCSI) and their threshold values.

Based on Subedi and Kent (2018), LCSI was computed as follows:

$$LCSI = \sum_{1}^{n}(fLCS_1 xwLCS_1) + (fFG_2 xwLCS_2) + \cdots + (fLCS_n xwLCS_n) \quad (6)$$

where $fLCS$ refers to the frequency of local coping strategies used, $wLCS$ refers to the weight of local coping strategies, and $1 \ldots n$ is the number of local coping strategies used.

3.4. Data Processing and Analysis

The quantitative data collected from the sample households were entered into Microsoft Excel by the data collectors and exported to Stata version 17 for analysis. The data were analyzed using quantitative and descriptive statistics, and are presented in tables and figures.

4. Results

This section is organized into four parts to provide a clear understanding of the prevalence of food insecurity and coping strategies among urban households in Tigray. It begins with an overview of the sociodemographic characteristics of the sample households, followed by an analysis of the prevalence of food insecurity as measured by the Food Insecurity Access Scale (FIAS), Food Insecurity Experience Scale (FIES), and Food Consumption Score (FCS). The prevalence of hunger is then discussed along with the coping strategies employed by households, highlighting variations by town and gender. Both quantitative and qualitative findings were integrated to provide a well-rounded perspective on the challenges faced by these households.

4.1. Sociodemographic Statistics of Households

All the sample households completed the questionnaires, achieving a 100% response rate. The mean age of the patients was 52.3 years. Table 2 shows that 27% of the households are female-headed, while 73% are male-headed. Most households were married (75.6%) and 10.4% were widowed. Regarding education, 51.3% had completed primary school and 25.4% had completed secondary school. The majority of respondents (97.4%) were Christian, with the remaining 2.6% being Muslim. The average family size was four persons per household. Unemployment was 42.2% overall, with significant variations across towns, and the highest in Shire (52.4) and Enticho (47.7).

Table 2. Sociodemographic statistics of the sample households.

Variables	Enticho	Adwa	Axum	Shire	Shiraro	Mean	χ^2
Age (years)	45	48	57	52	58	52.3	38.24 ***
Gender (%)							
Female	14.3	24.2	21.4	24.3	31.8	27.4	4.27 ***
Male	85.7	77.8	78.6	75.7	68.2	72.6	
Marital status (%)							
Single	7.2	0.0	2.6	8.4	0.9	8.1	2.78 ***
Married	70.3	66.8	73.4	78.6	81.6	75.6	
Divorced	8.5	6.2	0.0	0.7	3.5	6.4	
Widowed	10.7	22.1	19.7	7.3	9.2	10.4	
Family size	3.3	4.9	4.3	5.0	5.8	3.5	
Education (%)							
Illiterate	12.5	8.2	14.9	16.7	27.8	15.6	11.36 ***
Primary (Grades 1–8)	66.5	55.8	66.1	48.3	53.2	51.3	
Secondary (Grades 9–12)	15.7	28.7	18.6	31.6	17.4	25.4	
Tertiary and above	5.3	7.3	0.4	3.4	1.6	7.7	
Religion (%)							
Christian	97.4	96.3	99.1	89.8	88.7	97.4	5.23 ***
Muslim	2.6	3.7	0.9	10.2	11.3	2.6	
Employment status (%)							
Employed	52.3	53.5	58.9	47.6	60.7	57.8	6.43 ***
Unemployed	47.7	46.5	41.1	52.4	39.3	42.2	
Total	11.49	22.30	23.78	29.59	12.84		

Source: Authors' computation. *** $p < 0.00$.

4.2. Households' Food Insecurity Status and Indicators

Tigray's war-induced crises have affected people's livelihoods, causing widespread food insecurity. Table 3 compares household food insecurity in the post-war period (2024) and during the ongoing armed conflict (2022), using the FIAS score. Urban household food insecurity changed minimally from the ongoing war to the post-war period. During the ongoing war, 93.51% of households were food-insecure, with 66.35% headed by males. In the post-war period, 83.51% of the households remained food-insecure, with 59.05% being male-headed. Shire (28.11%) and Axum (22.7%) had the highest food insecurity rates during the ongoing war, and these towns still had the highest rates in the post-war period at 29.59% and 23.78%, respectively.

Furthermore, Table 4 presents household categorization based on household Food Insecurity (Access) Scale scores during post-war.

Only 3.7% of households were food-secure during the post-war period, indicating minimal concern about food provision. In contrast, 18.52%, 29.69%, and 48.15% of households experienced mild, moderate, and severe food insecurity, respectively. This implies that nearly half of the sample households (48.15%) were severely food-insecure (access) and frequently worried about adequate food provision during the post-war period.

Table 3. Food security during the ongoing war and post-war period in Tigray using FIAS scores, n (%).

Variables	During Armed War (2022)		Post-War (2024)		
	Food-Secure	Food-Insecure	Food-Secure	Food-Insecure	Total
Gender					
Male	20 (2.71)	491 (66.35)	74 (10.00)	437 (59.05)	507 (69.05)
Female	28 (3.78)	201 (27.16)	48 (6.49)	181 (24.46)	229 (30.95)
Sub-total	48 (5.49)	692 (93.51)	122 (16.49)	618 (83.51)	740 (100)
Towns					
Enticho	7 (0.95)	78 (10.54)	23 (3.11)	62 (8.38)	85 (11.49)
Adwa	10 (1.35)	155 (20.95)	20 (2.71)	145 (19.59)	165 (22.30)
Axum	8 (1.08)	168 (22.70)	27 (3.65)	149 (20.14)	176 (23.78)
Shire	11 (1.49)	208 (28.11)	33 (4.46)	186 (25.13)	219 (29.59)
Shiraro	12 (1.62)	83 (11.22)	19 (2.57)	76 (10.27)	95 (12.84)
Total	48 (5.49)	692 (93.51)	122 (16.49)	618 (83.51)	740 (100)

Source: Authors' computation.

Table 4. Prevalence of households' food insecurity level using FIAS (May 2024).

Occurrence	Frequency-of-Occurrence		
	Rarely [1]	Sometimes [2]	Often [3]
$Q_{1,a}$			
$Q_{2,a}$			
$Q_{3,a}$			
$Q_{4,a}$			
$Q_{5,a}$			
$Q_{6,a}$			
$Q_{7,a}$			
$Q_{8,a}$			
$Q_{9,a}$			

Note: Food-secure Moderately food-insecure Mildly food-insecure Severely food-insecure.
Source: Authors' computation. Note: The percentage of "severely food insecure (access) households" is equal to the number of households in the FIAS category (4) divided by the total number of households in the FIAS category and multiplied by 100.

4.2.1. Analysis of Households' FIAS-Related Condition

Table 5 presents estimate of household food insecurity during the war and post-war periods. During the ongoing war, 98.38% of households worried about food provision, decreasing to 96.35% in the post-war period (a 2.03% reduction, $p < 0.001$). During the ongoing war, 87.16% consumed less-preferred foods, while 74.19% of households ate a limited variety. In the post-war period, these figures have reduced to 88.51% and 91.62%, respectively, indicating significant reductions ($p < 0.001$) but continued preference limitations. During the ongoing war, 95.68% of households ate undesirable food, 90.41% ate less than needed, 77.84% had fewer meals, 70.27% had no food at home, 71.35% felt hungry at bedtime, and 20% did not eat from morning to morning. Although there are changes between the two periods (ongoing war and post-war) in terms of anxiety, the changes are minuscule.

Table 6 shows the FIAS, FIES, and FCS estimates for the post-war sample households. The FIAS results revealed that 35% of households were moderately food-insecure (9% in Adwa and 8% in Axum). Severe food insecurity affected 28.51% of the participants (9% in Shire and 7% in Axum). Mild food insecurity affected 20% of the population (6% in Shire and 5% each in Adwa and Axum). Only 16.49% were food-secure, indicating significant variation in food insecurity across towns. The FIAS results showed that most households were food-insecure, with notable variations across towns.

Table 5. Estimates of household food insecurity-related conditions during the armed war (2022) and post-war periods (2024), n (%).

Occurrence Questions	During the Ongoing War (2022), n (%)	Post-War Period (2024), n (%)	% Points Difference	χ^2
Worried about food	728 (98.38)	713 (96.35)	−2.03	0.001
Unable to eat preferred foods	645 (87.16)	655 (88.51)	1.35	0.001
Eat a limited variety of foods	549 (74.19)	678 (91.62)	17.43	0.001
Eat foods that do not want to eat	708 (95.68)	586 (79.19)	−16.49	0.001
Eat a small amount of meal	576 (77.84)	583 (78.78)	0.94	0.001
Eat small amounts of meal per day	669 (90.41)	613 (82.84)	−7.57	0.001
No food of any kind in the household	520 (70.27)	184 (24.87)	−45.40	0.001
Go to sleep at night hungry	528 (71.35)	122 (16.49)	−54.86	0.001
Go a whole day and night without eating	148 (20.00)	23 (3.11)	−16.89	0.001

Source: Authors' computation.

Table 6. Household food (in)security status estimates, n (%), May 2024.

Household Food Insecurity (Access) Scale Scores–FIAS					
Towns	**Food-Secure**	**Mildly Food-Insecure**	**Moderately Food-Insecure**	**Severely Food-Insecure**	χ^2
Enticho	23(3.11)	20(2.70)	22(2.97)	20(2.70)	
Adwa	20(2.71)	35(4.73)	65(8.78)	45(6.08)	
Axum	27(3.65)	39(5.27)	59(7.97)	51(6.89)	
Shire	33(4.46)	46(6.22)	75(10.14)	65(8.78)	
Shiraro	19(2.57)	11(1.49)	35(4.73)	30(4.05)	
Mean	122(16.49)	151(20.41)	256(34.59)	211(28.51)	3.69 ***
Food Insecurity (Experience) Scale Scores—FIES					
Enticho	21(2.84)	22(2.97)	20(2.70)	22(2.97)	
Adwa	18(2.43)	43(5.81)	51(6.89)	53(7.16)	
Axum	23(3.11)	47(6.35)	54(7.30)	52(7.03)	
Shire	23(3.11)	63(8.51)	72(9.73)	61(8.24)	
Shiraro	15(2.03)	10(1.35)	37(5.00)	33(4.46)	
Mean	100(13.51)	185(25.00)	234(31.62)	221(29.87)	8.34 ***
Household Food Consumption Score—FCS					
Towns	Poor, n (%)		Borderline, n (%)	Acceptable, n (%)	
Enticho	42(5.68)		21(2.84)	22(2.97)	
Adwa	98(13.38)		48(6.49)	19(2.57)	
Axum	101(13.65)		49(6.62)	26(3.51)	
Shire	105(14.19)		83(11.22)	31(4.19)	
Shiraro	35(4.73)		42(4.68)	18(2.43)	
Mean	381(51.49)		243(32.84)	116(15.67)	4.58 ***

Source: Authors' computation. *** $p < 0.00$.

4.2.2. Analysis of Households' FIES

The FIES results indicate that most households are food-insecure, with varying severity. On average, 31.62% of the households were moderately food-insecure. Shire had the highest level of severe food insecurity (9.73%), followed by Axum (7.3%). Nearly 30% of households were severely food-insecure (7.16% in Adwa and 7.03% in Axum). Mild food insecurity affected 25% of the population (8.51% in Shire, 6.35% in Axum, and 5.81% in Adwa). Approximately 14% of households are food-secure, including 3.11% in Axum and Shire.

4.2.3. Analysis of Households' FCS

Most of the sample households experienced severe food insecurity post-war. The FCS results showed that 51.49% of households had poor FCS [0–27.5), with 14.19% in Shire and 13.65% in Axum, which had the lowest scores. Approximately 33% of households had borderline FCS [21.5–35), with 7% in Adwa and Axum having the lowest scores.

Approximately 16% of the households had an acceptable FCS (≥35), with 3.5% in Axum having the highest acceptable scores. Overall, most households had poor or low food consumption (Table 6).

4.3. Analysis of Households' Hunger Scale

Figure 3 shows the prevalence of urban household hunger based on the Household Hunger Scale. Accordingly, approximately 61.43% of the sample households had little or no hunger. By contrast, approximately 25% and 14% of the sample households faced moderate and severe hunger, respectively, in the post-war period. This implies that a large proportion of households (39%) faced hunger during the post-war period because of war-induced food insecurity-related crises.

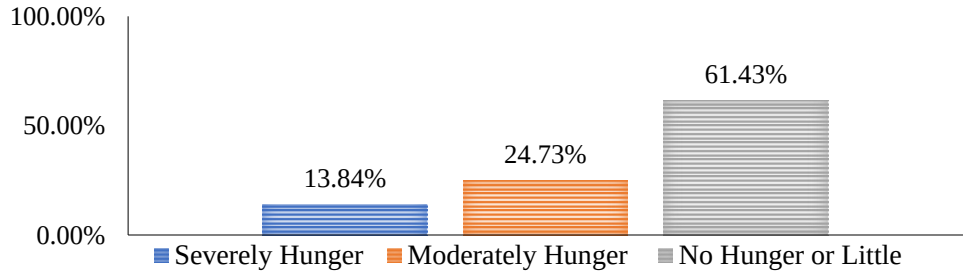

Figure 3. The proportion of households relying on local coping strategies. Source: Authors' computation.

4.4. Analysis of Coping Strategies for Food Insecurity

Urban households in war-torn Tigray have employed various coping strategies to address food insecurity due to armed war-induced crises. Figure 4 illustrates the aggregate coping strategies (under stress-, crisis-, and emergency-level strategies) adopted by households. Accordingly, the results indicate that 48% of households, including 49% female-headed and 43% male-headed households, use at least one stress-level coping strategy to mitigate food insecurity-related crises. The crisis-level strategy was the second most common strategy adopted by 24% of households, with 27% of male-headed and 30% of female-headed households employing them. Furthermore, 15% of the households, with comparable proportions between male- and female-headed households, resorted to at least one emergency coping strategy.

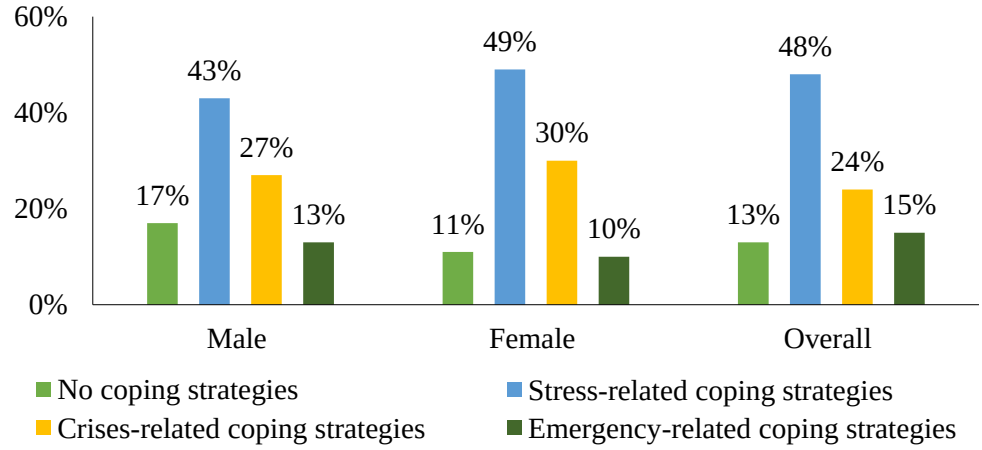

Figure 4. The proportion of households relying on local coping strategies by gender. Source: Authors' computation.

Figure 5 shows the strategies employed by individual households to cope with war-induced crises related to food insecurity. The most commonly adopted stress-level strategies include selling household assets (41% of all households), reducing meal size, consuming

less-preferred food (35%), borrowing money to cover food needs (27%), and spending savings (23%). Importantly, it was uncommon for an urban resident household to participate in daily labor work in Tigray, Ethiopia. However, due to the severity of their food insecurity levels, they have been forced to engage in daily labor activities. Accordingly, about 21% of urban households participated in daily labor work as a coping strategy to mitigate food insecurity-related crises. Conversely, the least adopted stress-level strategy was to move the children to less-expensive schools (12%). This implies that most mildly, moderately, and severely food-insecure households employ stress-level strategies to mitigate severe food insecurity crises. Furthermore, a significant proportion of households (22%) sold productive assets to cope with food insecurity and the potential long-term effects on long-term livelihoods. Additionally, 17% reduced healthcare expenses and 16% withdrew children from school. Emergency strategies included migration (13%), selling or mortgaging houses (12%), and engaging in exploitative or dangerous work (11%), whereas begging (8%) was the least common emergency strategy. Food-insecure households in war-affected areas often adopt multiple strategies (Figure 5).

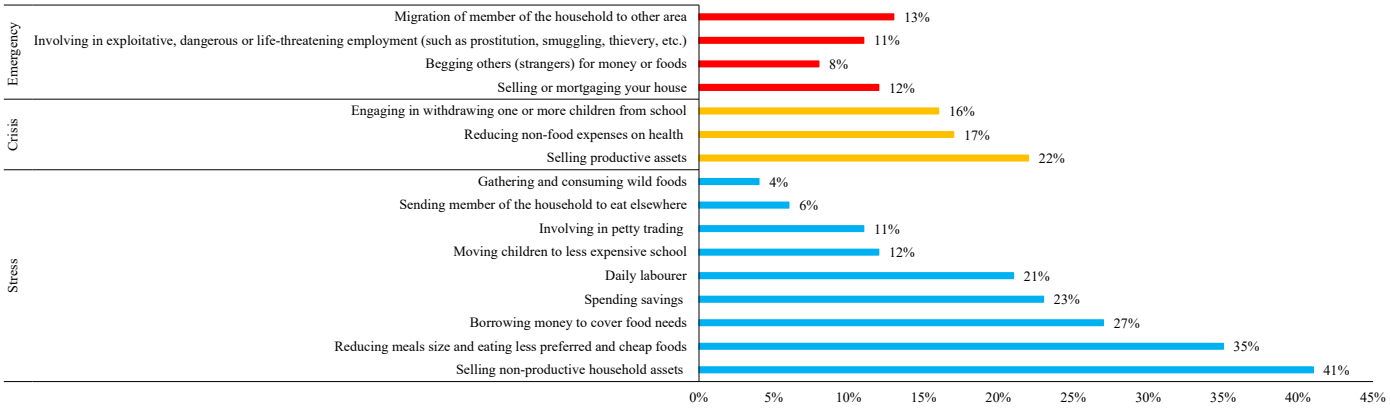

Figure 5. The proportion of households who adopted coping strategies (with multiple responses). Source: Authors' computation.

Most of the focus group discussants and key interviewees stated that urban households were forced to employ new coping strategies. This is new to us because, in the earlier periods of food shortages, none of the urban households used such strategies. These were doing one's activities at home, replacing daily workers, being employed as daily workers, cash for work, and migration to rural areas by their families, which were the most unusual strategies, in addition to the most commonly adopted strategies, that have been employed by urban households due to war-induced livelihood crises.

A focus group participant described the current food insecurity:

> *…."Our household of six lost its primary breadwinner, my eldest son, during the 2013 genocide in Axum, Tigray, where he was killed by Eritrean forces. Uncommonly for our urban community, we resorted to daily labor for income. After extensive family discussions, we agreed on this work, and two members now engage in daily labor, allowing us to sustain ourselves." The participant added: …"This daily wage work is a new, atypical strategy supplementing our usual coping mechanisms, such as consuming cheaper food, reducing portion sizes, limiting meals to twice daily with priority for children, and forgoing clothing expenditures, relying instead on garments bought during peacetime."* (Female participants aged 46 years)

Another male respondent, severely affected by the ongoing food insecurity crisis, recounted his family's experiences and coping mechanisms:

> "*As a mathematics instructor at a secondary school for nearly 18 years, I once enjoyed a comfortable lifestyle. During peaceful times, my family never experienced any food insecurity or hunger, and we consumed diverse, high-quality foods. My income sufficed for our monthly expenses, allowing for savings in banks for future needs. However, the genocidal war in Tigray has devastated everything. We have endured unprecedented hardships in Tigray's history. In 2021/2022, amidst the armed war, we resorted to borrowing money and food from acquaintances, intending to repay with future wages. Regrettably, the Ethiopian federal government has failed to disburse our salaries for almost 17 months. Consequently, we've been compelled to use our current wages to settle our debts. Consider this: my monthly net salary is 9000 Ethiopian Birr, yet one quintal of 'Teff' (a cereal) costs 15,000 Ethiopian Birr, and my rented accommodation expenses 3000 Ethiopian Birr monthly. Life has become incredibly challenging, and words fail to convey the misery we're enduring due to the genocidal war in Tigray. This dire situation persists. To sustain my family, I've resorted to tutoring 25 students from primary and secondary levels, each paying 300 Ethiopian Birr monthly. This supplementary income serves as a coping strategy, helping to marginally alleviate the food insecurity we face due to the war-induced crisis*." (Male participant aged 43 years)

In sum, all individuals who participated in the focus group discussions (FGDs) and key informant interviews (KIIs) indicated that the majority of urban households used multiple stress-, crisis-, and emergency-level strategies, supporting the findings of the sample households.

As depicted in Figure 6, 88% of severely and 76% of moderately food-insecure households employed various coping strategies.

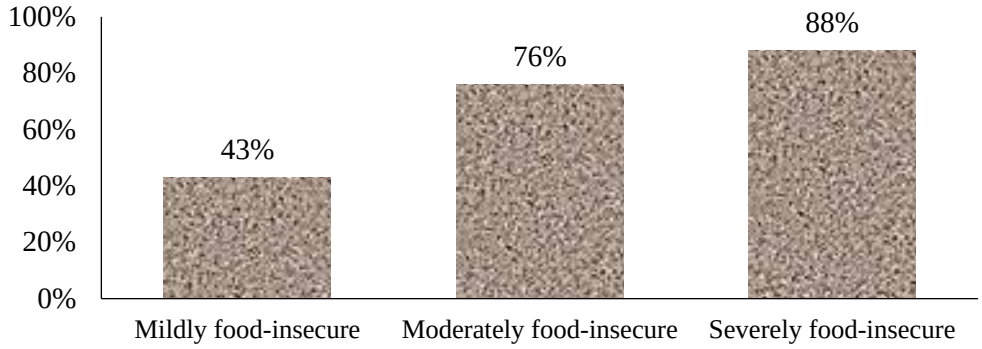

Figure 6. The proportion of households who adopted coping strategies by level of food insecurity. Source: Authors' computation.

5. Discussion

5.1. Urban Households' Food Insecurity Status

Food insecurity remains a critical global challenge, particularly in war-affected regions. Civilians bear the brunt of armed conflict, facing heightened levels of food insecurity, malnutrition, and starvation due to disruptions in access to essential food items. This study examines and compares the levels of food insecurity in urban households affected by armed conflict, focusing on aspects such as food access, consumption scores, and household hunger scales. Additionally, it identifies the coping strategies used by urban households in Tigray, Ethiopia to address food insecurity in the aftermath of the conflict.

Tigray was among Ethiopia's most food-secure regions before the outbreak of the war on 4 November 2020, largely due to increased agricultural productivity and diverse livelihood options (Clark, 2021). However, this conflict disrupted this progress, exacerbating food insecurity throughout the region. According to the Food Insecurity Analysis (FIA), 83.5% of households in the study were food-insecure, while 16.5% were food-secure.

Interestingly, female-headed households showed a slight advantage over their male-headed counterparts in terms of maintaining food security. These findings suggest that post-conflict recovery should consider household characteristics with targeted support for the most vulnerable groups to foster sustainable livelihoods and mitigate food insecurity.

Using the Food Insecurity Experience Scale (FIES) estimation, 86.5% of the sample households were food-insecure, while 13.5% remained food-secure. These figures align closely with those of Weldegiargis et al. (2023), who reported 85% food insecurity in Tigray during a conflict. In contrast, Araya and Lee (2024) reported a slightly lower figure of 77% for food insecurity in the region. According to the Integrated Food Insecurity Phase Classification (IPC), 34% of households in Tigray are in crisis, with 69% experiencing emergency levels of food insecurity in 2021. The disparities in food insecurity levels across studies may stem from differences in data collection periods and the evolving impact of conflict on the region. Conducting multiple surveys in different seasons can yield more comprehensive insights.

Food insecurity (FI) remains a persistent global challenge. In 2022, 29.6% (2.4 billion) of the world's population faced moderate or severe food insecurity. This marked a slight decline from 11.7% in 2021 to 11.3% in 2022, translating to 27 million fewer food-insecure individuals. However, these individuals often exhausted their food supplies, and some went without food for a day or longer (FAO et al., 2023). Africa, the continent most affected by food insecurity, saw an increase to 60.9% by 2022, driven mainly by a rise in moderate food insecurity. Severe food insecurity affected nearly a quarter of Africa's population, with intense conflict in Tigray contributing to both regional and global food insecurity figures.

The study's findings reveal a grim situation for urban food insecurity in Tigray, where most households experience severe hunger. In the sample, 15.7% of households had acceptable food consumption scores, 32.8% were borderline, and 51.6% had poor food consumption. The Hunger Scale (HHS) revealed that while 61% of households experienced little or no hunger, 39% faced significant hunger, with 25% in the moderate category and 14% in the severe hunger post-conflict category. These results align with those of Weldegiargis et al. (2023), who reported that 35.9% (21.5% moderate and 14.14% severe) of households in Tigray faced hunger during the 2021 conflict.

The global hunger rate has increased from 7.9% in 2019 to 9.2% in 2022. In Africa, the hunger rate rose from 19.4% in 2021 to 19.7% in 2022, resulting in 11 million more people facing hunger compared to the previous year and an overall increase of 57 million since 2019 (FAO et al., 2023). Africa's hunger rate remains notably higher than that of other regions, affecting nearly 20% of the population, compared to 8.5% in Asia, 6.5% in Latin America and the Caribbean, and 7% in Oceania. Since 2010, hunger in Africa has seen a steady rise, with a significant increase in 2020, and continued growth through 2022. In particular, hunger in sub-Saharan Africa rose from 22.2% to 22.5% between 2021 and 2022, bringing an additional nine million people into food insecurity (FAO et al., 2023).

5.2. Households Coping Strategies

Households experiencing food insecurity employ diverse coping mechanisms that reflect their level of vulnerability (Kyaw, 2009; Adebo & Falowo, 2015; Sani & Kemaw, 2019; Melese et al., 2021; Yohannes et al., 2023; Araya & Lee, 2024). These strategies encompass food-based approaches, non-food-based approaches, or a combination of both to meet basic needs (Yohannes et al., 2023). Evidence indicates that households in war-affected areas often resort to various measures to address food insecurity (Clark, 2021; Weldegiargis et al., 2023; Yohannes et al., 2023; Araya & Lee, 2024). In the Tigray region of Ethiopia, prolonged armed conflict severely damages urban livelihoods, heightens vulnerability, and

exacerbates food insecurity among affected communities. Consequently, households have adopted various strategies to cope with food shortage.

The findings reveal that households in war-affected communities employ a range of coping mechanisms to mitigate food insecurity. Nearly half (48%) of the sample households resorted to stress-level strategies, with the most common being the sale of non-productive household assets, while collecting and consuming wild food was the least frequent. This finding highlights the reliance on stress-level strategies among urban households facing food insecurity. Notably, engaging in daily labor was traditionally rare in Tigray's urban areas, yet approximately 21% of households turned to this practice due to the severity of food insecurity. This trend aligns with previous research indicating a significant shift in coping behaviors.

In addition, approximately 24% of the sampled households adopted crisis-related strategies, such as selling productive assets, cutting non-food expenses, particularly on healthcare, and withdrawing children from school. A smaller segment (15%) of households engaged in emergency-level strategies, including selling or mortgaging homes, begging, and migrating. These findings are consistent with those of Adebo and Falowo (2015), Sani and Kemaw (2019), Melese et al. (2021), Dlamini et al. (2023), Yohannes et al. (2023), and Araya and Lee (2024), which show that households struggling with food shortages often resort to similar stress-coping strategies. Among the severely food-insecure households in this study, 88% employed a range of strategies, while 76% of moderately food-insecure households did the same.

This study highlights the complex and multifaceted coping strategies adopted by urban households in the war-affected areas of Tigray, Ethiopia to counter the severe impacts of food insecurity. These findings underscore the intricate survival mechanisms at play amidst prolonged conflict, where disruptions in economic activities, restricted market access, and limited humanitarian aid create formidable challenges. This discussion provides an in-depth look at key coping strategies and their implications for household well-being, community resilience, and policy interventions. A comprehensive understanding of these strategies is crucial for developing effective short- and long-term responses that support vulnerable households and protect at-risk populations during crises.

A comparison with other conflict-affected areas reveals notable similarities and differences in the patterns of food insecurity and coping strategies. For instance, studies from Yemen and Syria, regions that have also experienced prolonged armed conflict, indicate that households resort to similar stress-level and crisis-level coping mechanisms, such as selling assets, reducing food portions, and withdrawing children from school (Kuo Lin et al., 2022; Ibrahim et al., 2024). However, unlike in Tigray, where daily labor has become a significant coping mechanism for urban households, households in Yemen and Syria often depend heavily on external humanitarian aid due to limited access to labor markets. These comparisons underscore the importance of tailoring food security interventions to the specific socio-economic and cultural contexts of conflict-affected areas, while also recognizing the universal challenges posed by armed conflict to food systems and household resilience.

The long-term impacts of food insecurity and the coping mechanisms employed by urban households in Tigray are far-reaching, shaping both individual livelihoods and broader socio-economic dynamics. Prolonged exposure to food insecurity erodes household resilience, forcing families to deplete productive assets, withdraw children from education, and forgo essential healthcare services, which compromises future generations' well-being and potential for upward mobility. Over time, these coping strategies perpetuate cycles of poverty, reduce human capital, and undermine social cohesion. Moreover, reliance on emergency-level strategies, such as migration and the mortgaging of homes, contributes to destabilization at both community and regional levels. The consequences of these mecha-

nisms extend beyond the immediate crisis, as rebuilding livelihoods and fostering economic recovery become increasingly difficult. The sustained pressure on urban households highlights the critical need for targeted, long-term interventions that strengthen food systems, promote diversified income-generating opportunities, and enhance access to education and healthcare to break the cycle of vulnerability and foster sustainable development in post-conflict regions.

6. Conclusions and Policy Implications

This study addresses research questions regarding the prevalence of armed conflict-induced food insecurity and coping strategies used by urban households in Tigray. It explores the current food security status among urban households in the region and examines the various coping strategies they use to manage armed conflict-induced food insecurity. This study explored the extent of food insecurity and coping mechanisms among urban households in Tigray, Ethiopia, following a protracted armed conflict. These findings underscore the severe impact of war on food security in urban areas.

The Food Insecurity Assessment Scale (FIAS) revealed that 35% of households were moderately food-insecure and 29% were severely food-insecure, with variations observed across different towns within the region. The Food Insecurity Experience Scale (FIES) showed similar trends, with 32% of households moderately food-insecure and 30% severely food-insecure. Furthermore, the Food Consumption Score (FCS) highlighted that 52% of households had poor food consumption, while 33% fell within the borderline category. In contrast, food security remains limited; only 17% of households are food-secure according to FIAS, 2% according to FIES, and 16% according to FCS.

During the post-war period, about 25% of households experienced moderate hunger and 14% faced severe hunger. The crisis prompted urban households to employ a range of coping strategies that relied heavily on indigenous knowledge and practices. Most food-insecure households adopted stress-level strategies, followed by crisis- and emergency-level tactics. While necessary for immediate survival, these strategies often undermine long-term resilience and productivity.

This study contributes to literature by focusing on urban households in post-conflict Tigray, an often-overlooked group in food insecurity research. The findings offer valuable insights into the ongoing challenges faced by these households, highlighting the significant effects of conflict on food access, and the diverse approaches taken to cope with these hardships. The situation in Tigray's urban areas calls for immediate and targeted interventions to alleviate food insecurity. Policymakers must prioritize enhancing food accessibility and availability, focusing on the most vulnerable groups to restore livelihoods and build resilience. Future research should aim to refine strategies that improve food security in post-conflict settings and ensure solutions that address both short- and long-term needs.

The following policy implications are outlined to address war-induced food insecurity crises:

- Urgent and scaled-up humanitarian aid is needed to enhance access to food and protect the limited livelihoods of vulnerable and war-affected communities in Tigray, Ethiopia.
- Poor households lacking resources are likely to require stop-gap support, with a focus on temporary assistance (including income generation) during crises. Governments (both federal and regional), development practitioners, and humanitarian organizations need long-term food security strategies to guide their interventions to ensure sustainable development goals.
- To save lives and livelihoods, understanding the local coping strategies that households use is essential for designing effective interventions that can address both immediate food needs and long-term livelihood recovery of war-affected households.

Given the protracted nature of armed war in Tigray, Ethiopia, sustained humanitarian efforts and a focus on building resilience are crucial for mitigating the war-induced impact of food insecurity-related crises.

7. Limitations and Future Studies

7.1. Study Limitations

This study offers valuable insights into food insecurity and coping strategies in war-affected communities in Tigray, Ethiopia using both quantitative and qualitative approaches with a relatively large sample size. However, there are limitations to be considered when interpreting these results.

- The research was limited to specific towns in Tigray because of limited resources, making the findings non-generalizable to other regions of Ethiopia where war occurred. Variations in local cultures, economic conditions, and the nature of the war can lead to different coping strategies and experiences.
- Self-reported data for both quantitative and qualitative methods may introduce recall bias, as respondents might inaccurately remember their experiences, particularly regarding past food consumption and coping strategies, thereby affecting data reliability.
- The household-level focus may miss community-level dynamics and the impact of external factors, such as government policies and humanitarian organizations, on food security. Including broader community perspectives could provide a more comprehensive understanding of food insecurity in the context of wars.
- To address food insecurity crises, governments should prioritize research and development (R&D) for long-term sustainability and resilience. Evidence shows that R&D funding improves efficiency and well-being, while reducing poverty.

7.2. Future Research Directions

- Future research encompassing both rural and urban areas in Tigray is essential to comprehensively understand the extent of food insecurity that stems from war-induced crises. This comprehensive perspective could provide a more precise picture of the situation (war-induced food insecurity-related crises).
- War-induced food insecurity has a gender-based effect. Future studies should investigate intra-household gender and rural–urban disparities in food insecurity levels.
- The local coping strategies observed included altering consumption habits and selling household assets. The strengthening of the local resilience response to food insecurity can be further supported by government-led income-generating initiatives. Therefore, further research should explore integrating contemporary and local coping mechanisms for sustainable solutions in war-affected households.

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Hospital (CHSSRH), Aksum University, Tigray, Ethiopia (IRB Number: 054/2024). Verbal consent was secured from each participant before interaction.

Data Availability Statement: The data used for this study can be provided upon request.

Conflicts of Interest: The authors declare that they have no conflict of interest.

Appendix A

Table A1. The food security measurement tool over the past thirty days before the survey.

Questions	Occurrence Questions	Response Options	Codes
	"Did you worry that your household would not have enough food?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Did you or any household member have to eat a limited variety of foods due to a lack of resources?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Did you or any household member have to eat fewer meals in a day because there was not enough food?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Was there ever no food to eat of any kind in your household because of lack of resources to get food?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...

Table A1. *Cont.*

Questions	Occurrence Questions	Response Options	Codes
	"Did you or any household member go to sleep at night hungry because there was not enough food?"	1 = Yes 0 = No (skip to)	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...
	"Did you or any household member go a whole day and night without eating anything because there was not enough food?"	1 = Yes 0 = No	. . ...
	"How often did this happen?"	1 = Rarely (1 or 2 times in the past 30 days) 2 = Sometimes (110 times over the past thirty days) 3 = Often (>10 times over the past thirty days)	. . ...

Source: Adapted from Coates et al. (2007).

Table A2. Households' Food Consumption Score (food groups).

Sr.No.	Food Groups	Weight (W)	Days Eaten Over the Past 7 Days (D)	Score (=W * D)
1	Meat and fish	4.0		
2	Dairy products (chees, milk and others)	4.0		
3	Pulses (lentils, peas, beans and peanuts)	3.0		
4	Staples or cereals (maize, barley, rice and bread)	2.0		
5	Vegetables	1.0		
6	Fruits	1.0		
7	Honey and sugar	0.5		
8	Fat, oil and butter	0.5		

Source: Adapted from WFP (2007).

Notes

1 "Able to meet essential food and non-food needs without engaging in atypical coping strategies" (WFP, 2015).

2 "Has minimally adequate food consumption without engaging in irreversible coping strategies; unable to afford some essential non-food expenditures" (WFP, 2015).

3 "Has significant food consumption gaps, or marginally able to meet minimum food needs only with irreversible coping strategies" (WFP, 2015).

4 "Has extreme food consumption gaps or has extreme loss of livelihood assets will lead to food consumption gaps, or worse" (WFP, 2015).

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