Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.14, No.11, 2023

Conflict and Food Insecurity: The Man-made Famine in Tigrai-Northern Ethiopia

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ABSTRACT
This paper examines the effect of war on food insecurity in Tigrai using data of 2481 households. The calorie intake approach and the Integrated Food Insecurity Phase Classification (IPC) were applied to measure the level of food insecurity and classify the phases. The logistic regression model was applied to identify the factors affecting food insecurity in Tigrai. The empirical result revealed that 77.38 % of the households are food insecure with calorie deficiency gap of 33.68 % and 69.21 % of them are classified in crisis phase and above. The war has caused the level food insecurity and share of crisis phase and above to upsurge by 153.8 % and 49.7%, respectively. Food insecurity in Tigrai is determined by the recurrent conflict, price of commonly consumable cereals, and age of the head, family size, supports (aid) and access to electricity and financial services. During the war households mitigate the shortage of food by reducing the quality and quantity of food they consume, sell of livestock & assets, use their savings, food supports from family, NGOs and government, ate inedible green leaves, migrating to other neighboring villages and towns for search of food and participating in begging.
Keywords: Conflict, food insecurity, IPC, logistic regression, Tigrai, War
JEL: I30, I32, I38, P46
DOI: 10.7176/JESD/14-11-02
Publication date: June 30th 2023

I. INTRODUCTION

1.1. Background and justification

The world history tells us the occurrence of so many devastating wars in the various corners of the globe. Though there are variations in the nature, motivation and aims of the wars occurred, economic, political and social motived wars have dominated the wars arose in the world.

Theoretical literature on the impact of civil conflicts/wars on economic growth provides two conflicting views. The first view is backed by Benoit's popular hypothesis (Benoit, 1973; 1978) which states wars affect positively economic growth and development**.** War can increase GDP per capita by reducing unemployment and by shifting people from family formation and other non-market activities into wartime production. By contrast, significant numbers of studies argue that a war damages the economy through the destruction of resources and by reducing investment. Food insecurity and armed-conflicts are the two major problems that have aroused the attention of international institutions, political analysts, and governments in developing countries. Civil wars and conflicts have been associated with food insecurity in the developing world. Civil strife affects food security in developing countries due its detrimental effects on the agricultural sector and on the economy (Pierre, W.J. and Fred, H., 2006).

The armed-conflict in Yemen caused 8.4 million people to be classed as emergency and catastrophe and reduced the crop, livestock, and fish production and, as a result, their supply has been reduced to local markets (FAO, 2017). More than 85,000 childeren are died due to lack of food and hunger resulting from the long-lasting war in Yemen (Save the Children International, 2017). In Syria, the civil war resulted in severe food insecurity and all forms of malnutrition. Accordingly, about 12.4 million people are food insecure, of whom 1.3 million severely food insecure. Similarly, about 600,000 and 90,000 children are chronically and acutely malnourished, respectively. The overall food insecurity has grown from 42 to 71 % during 2020. The impact of the continued Syrian crisis during 2020 has led to a 21 % (13.4 million) increase in the number of people in need of humanitarian assistance (Humanitarian Programme Cycle, 2021).

In Somalia, rampant due to conflict and erratic weather, large numbers of people are facing high levels of

acute food insecurity. Between January to June 2021, about 1.6 million Somali people are experiencing high levels of acute food insecurity (IPC Phase 3 or above) and need sustained urgent action (IPC, 2021). In 2020, conflict, weather extremes, and economic shocks, including COVID-19 related economic effects again constituted the three primary drivers of acute food insecurity. However, the drivers are often interlinked and mutually reinforcing, rendering it difficult to specify a singular trigger of each food crisis. Conflict drove internal and cross-border displacement, deprived people of their livelihoods, disrupted markets, trade and crop production, prevented herders from accessing their pasturelands and contributed to high food prices. Conflict also constrained humanitarian access, leaving communities without essential assistance, and exposing aid workers to increased risks (FSIN and Global Network Against Food Crises, 2021).

Conflicts expressed in terms of large number of fatalities are correlated with a large estimated reduction in the national dietary energy supply of countries (Stijn V.W., 2018). Verwimp P. (2012) also stated that conflict affects the food security situation of the farm households via its effect on income sources, local food chain and political systems.

A study made in Afghanistan confirms the inverse relationship between conflict and food security. Households in provinces with higher levels of conflict experienced lower level of food security than provinces with lower level of conflict as there was staple food price increases in the provinces with lower levels of conflict (D'Souza, A. & Jolliffe, D., 2013). Further, conflict caused destruction of rural infrastructure, the loss of livestock, deforestation, the widespread use of land-mines and migration lead to long-term food security problems (Teodosijević, S., 2003).

After the bloody civil war ended in 1991, the Ethiopia government has carried out several economic reforms to improve the livelihood of people and securing inclusive development. Since the founding policy direction of the nation, ADLI strategy, till the GTP II, the country has introduced several policies and strategies which would help to achieve economic successes; recording an economic growth rate of averaging 10.6 % for successive 12 years (2005-2017), reduced the level of poverty to around 24.1 % and improve the provision of social services National Planning Commission (NPC) (2017).

Tigrai has also achieved several economic and social triumphs. In its second growth and transformation plan period (2016-2019), the GDP of the region was grown by 8.1 %. In this period, agriculture had the highest share in GDP (38.5%), followed by services (34.6%) and industry sectors (26.9%) Tigre Statistics Agency (TSA) (2020). Resulting from the successive economic growth in the region, the level of poverty was reduced from 61.4% in 1995/6 to 31.8 % in 2010/11 and 27% in 2015/16 and believed to further reduce to less than 24 % in 2020 (NPC,2020). IPC (2021) pointed out that the severe crisis of the acute food insecurity in Tigrai was mainly due to the recurrent conflict, large population displacements, movement and access restrictions, limited humanitarian access, loss of production, loss of livelihood assets, dysfunctional or non-existent markets, and loss of income. FAO (2021) stated that the outbreak of the war in the Tigrai results the destruction of livelihoods, internal displacement, and high levels of violence in the region. Furthermore, the armed-war has brought about the destruction of the social services providers which aggravate the incidence of food insecurity in the region.

These all points indicate that the war has a negative impact on food security and livelihood of the people but none of them test empirically the status of food insecurity, depth and its determinants and remained as researchable area in Tigrai. The paper is designed to assess the war time status of food insecurity & acute food insecurity phases, and determinants of food insecurity in Tigrai using the consumption approach and the first level-acute food insecurity phase classification. The study is important for humanitarian aid actors and governments to provide live saving supports in a coordinated manner, prioritizing demands & target groups and substantiating for rehabilitation works.

2. METHODOLOGY AND DATA SOURCES

2.1. Source, Nature and Sampling Technique

2.1.1. Description of the Study Area

Tigrai, in the Ethiopian history, is the base of ancient civilizations, the home of the Arc of covenant, an exemplary host and center to exercise various religions, especially the Christianity and Muslim, and historic grave place for invaders and a symbolic region of struggling for freedom, equality, and justice. Tigrai is one of the ten regions of Ethiopia. Its capital, Mekelle, is 781 kms far away from Addis Ababa, capital city of Ethiopia. The region has seven zones, namely, Western, Northwest, Central, Eastern, Mekelle, Southeast, and Southern. The zones are divided into 93 woredas and towns and 814 tabia[1], also referred to as kebele (OCHA, 2021).

In the year 2021, the population of the region is estimated at 5,685,598 (OCHA, 2021). With an average family size of 4.2 persons (2021 est.), 49 % of the population were male headed households and 50.7 % led by female. The age composition of the population is dominated by the young where 13 % were estimated to be less than five years old and 50 % were under the age of 18 years. Further, 30 % of the Tigrai's population is living in

[1] Tabia is lower government's administrative structure below the Woreda.

the urban areas (OCHA, 2021).

2.1.2. Research design & Data Source

This study employed a cross-sectional type of research design where the quantitative and qualitative types of data are used. It depends on the primary and secondary sources of information. The primary data was collected through semi-structured questionnaire, focus group discussion (FGD), key informant interview (KII), and participatory rural appraisal (PRA). One FGD and one PRA were organized in each study tabia and seven participants were selected from the associations, like women's association, youth association, farmers' association, religious leaders, and community leaders. Further, 34 KII were done with food security cluster experts and Relief Society of Tigray (REST) focal person in the woreda who have ample information about the livelihood and food security situation of the people. The secondary data was collected from annual reports, statistical bulletins, published and unpublished research works. The primary data was collected between May 4/2021 and June 4, 2021 in the selected woredas of the region. The data was collected from 34 woredas in the region; 17 rural woredas and 17 urban woredas.

2.1.3. Sampling Technique and sample size determination

The study used multi-stage sampling techniques to select participants of the study. First, zones were classified based on accessibility and security criteria, depending on the military and transportation information, into three namely, totally inaccessible & in secure[1], insecure but accessible and both accessible and secure. Second, based on the intensity of wars and physical destructions occurred[2], the relatively accessible and secure woredas were classified into three categories i.e., severely affected, moderately affected, and less affected. Two tabias from each woreda was randomly selected for the survey. Since the war has destroyed the registry of the households in the tabia, the representative households were selected using the directional sampling technique.

In determining the sample size, the Kothari (2004) equation was employed as it is appropriate when the population size is large (>10,000) and finite. The proportion here is that 72% of the woredas were severely affected and the rest 28% were affected moderately and/or less. A total sample was determined from the total household population (1,339,831) of the region (TSA, 2020).

$$n = \frac{NZ^2p(1-p)}{e^2(N-1)+Z^2p(1-p)}$$

$$n = \frac{1{,}339{,}831(2.58)^2 0.72(1-0.72)}{0.02^2(1{,}339{,}831-1)+(2.58)^2 0.72(1-0.72)} = 3346$$

n = sample size, N = pop size, p = population proportion, Z = confidence level, e = degree of error

Thus, by taking confidence interval of 99% (z = 2.58), margin/degree of error of 2%, proportion (P) = 72%, the initial sample size was 3346. By adding 20% contingency for none return, incomplete responses, data loss and other defects, the total sample size was determined to be 4016. Then, this was distributed to the zones, woredas and tabias based on proportional sample to population size. The sample was also disaggregated by urban-rural proportions (urban = 1354 & rural = 2662).

However, data was collected from 1,345 urban and 1,900 rural residents. About 764 (19.1%) of the sample was not included in the survey due to the accessibility challenges. Besides, 7 observations were dropped for their incomplete consumption data (refer to appendix table 1 for sample size distribution by gender).

2.2. Methods of Data Analysis

The study used both the qualitative and quantitative study. The status of food insecurity and its determinants and the integrated acute food insecurity phases are estimated using the quantitative approach and is strengthened using the qualitative data collected through the PRA, FDG and KII.

2.2.1. Measuring food security

Household level food in security was measured based on its calorie requirements and calorie intake. Using the 2200 kilo calorie per adult per day as the required calorie to lead a healthy and moderately active life, the food in security estimation was carried out Ministry of Finance and Economic Development (MoFED), 2012). A household was categorized to be food insecure, if its total calorie intake fell short of its calorie requirements; otherwise, it is food secured. Besides, the depth and severity of food insecurity was also computed at the household level.

Let Z be the required calorie per adult equivalent, Y_i is the actual calorie intake (adult equivalent) of individuals below the required level, N is number of households, q is the number of food insecure households normally those below the required threshold, $\boldsymbol{\alpha}$ is food in security aversion parameter (Ejigayhu, S. & Abdi-

[1] All woredas in the Western zone are insecure and inaccessible during the data collection. Representative data were collected from the Internally Displaced People (IDP) of the zone who are residing in Shire and Mekele city & treated as IDP in the analysis.
[2] Information is gathered form the Ethiopian defense force and the interim government of Tigray

Khalil E., 2013; R.S. Sidhua, Inderpreet, K. & Kamal V., 2008; World Bank Institute, 2005). The household food insecurity/food poverty level was computed using the Foster-Greer-Thorbecke (FGT) index:
Then, the FIS_i, which is the observed food insecurity status of the household:

$$FIS_i(Z,Y) = \frac{1}{N}\sum_{i=1}^{q}\left[\frac{Z - Y_i}{Z}\right]^{\alpha} \ldots\ldots\ldots\ldots\ldots\ldots\ldots [01]$$

Where α in this context assumes a value 0, 1 & 2; if the value of α=0, the FIS indicates the proportion/percentage/ of food insecure households in the total number of households and when α has value 1, FIS represents the food insecurity gap. Thus, the depth of food insecurity is the deficiency in calorie requirements (gap between required and actual intake of calories) as a proportion of total calorie requirements.

2.2.2. Integrated Acute Food Insecurity Phase Classification (IPC Phase)

The severity level of acute food insecurity was examined using the Integrated Acute Food Insecurity Phase Classification (IPC phase) using the computed food insecurity estimates. There are three IPC scales, namely, acute food insecurity, chronic food insecurity, and acute malnutrition (IPC , 2019). The IPC scale has become the global standard for the classification of acute food insecurity and is used mainly to inform decision-makers on allocating and programming resource worldwide and within countries. The IPC Phases are, namely Phase 1 (Minimal or none), Phase 2 (Stressed), Phase 3 (Crisis), Phase 4 (Emergency), and Phase 5 (Famine (areas) or Catastrophe (households) (IPC , 2019).

There are two food security outcomes, namely first-level outcomes include food consumption (Quantity and nutritional quality) and livelihood change (Assets and strategies) and second-level outcomes include nutritional status and mortality (IPC Global Partner, 2019). For this study purpose, the first-level[1] outcomes approach was employed.

2.2.3. Determinants of acute food insecurity

Econometrics models are very useful tools that enable to assess the relationship between the regressed and explanatory variables and determine their significance. Therefore, the accuracy and relevance of any policy implication or generally research results mainly depend on the proper specification of the model.

To determine the factors influencing food insecurity during the war time, we employed the logistic regression model, with the dependent variable being dichotomous variable[2]. If the dependent variables are categorical variable, a logit model is the appropriate one (Gujarati D., 2007; Madala G.S., 1992). In this study, household variables, community level factors, and economic and social variables were controlled and examined their effect on acute food insecurity.

Let the underlying response variable y^* is defined by the regression relationship as adopted by (Alemayehu G., Niek de Jong, Kimenyi M.S., Mwabu G., 2005; Teka A. Gabriel T. & Zeremariam F., 2018) is represented as follows:

$$y_i^* = \beta_i X_i + U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [02]$$

Where: y_i^* is the status of household i (food secure versus food insecure), β_i is set of coefficients, X_i is set of explanatory variables (determinants), U_i is the error term and, i represents the households that run from 1 to n.

Thus, as y^* is latent variable, what is observable is an event represented by a dummy variable y defined by:

$y = 1$ if $y^* > 0$, and
$y = 0$ otherwise …….. [03]

So, the response of the variable is a binary, taking two values, 1 if the household is food secure, and 0 otherwise. The probability of being poor depends on a set of variables X so that,

$$Prob(y_i = 1) = F(\beta X) \text{ and}$$
$$Prob(y_i = 0) = 1 - F(\beta X) \ldots\ldots\ldots\ldots\ldots\ldots [04]$$

Where: F is the cumulative distribution function for the error term U_i

The logit is the natural logarithmic value of the odds of the food secure and food insecure households.

[1] First-level outcomes refer to "characteristics of food consumption and livelihood change. Thresholds that correspond as closely as possible to the Phase description are included for each indicator. Although cut-offs are based on applied research and presented as global reference, correlation between indicators is often somewhat limited and findings need to be contextualized. The area is classified in the most severe Phase that affects at least 20% of the population" (IPC Global Partner, 2019).

[2] A logit model is applicable for qualitative binary variables that have two outcomes, i.e., $y = 1$ if the household is food secure and $y = 0$ if the household is food insecure.

Therefore, the estimable logit model after transformation is given as:

$$L_i = ln\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_n X_n \ldots\ldots\ldots\ldots [05]$$

Where: L_i is the natural log of the odds of households being food secure. $P_i$is the estimated probability of household being food secure evaluated at the mean. X_1, X_2, ….X_n are the explanatory variables. β_1, β_2, ….β_n are the estimated coefficients of the j^{th}explanatory variables.

Furthermore, the OLS regression was also applied to assess the determinants of food insecurity using the calorie per adult equivalent per day and the food consumption expenditure per capita.

III. RESULTS: THE EFFECT OF WAR ON FOOD INSECURITY IN TIGRAI

3.1. The war in Tigray

The war between the federal government of Ethiopia and the regional government of Tigray occurred in November 4/2021. It is, believed, an outcome of the political tensions, disagreements and violation of the constitutional order in the country. The conflict is differently stated and there is no agreement on the objectives of the war. The federal government of Ethiopia and its supporters has termed it as *"act of law enforcement"* and some Amhara regional government officials and their affiliated activists also termed as *"act of law enforcement and securing fief*". On the other hand, the regional government of Tigrai and its supporters stated that the federal government, allied with Eritrean government, has declared war against Tigrayan identity, cleansing Tigrayans, destroying the federal system in the country, and harming Tigrai economically, socially and politically. So, it was termed as *"a challenge against all round invasions"*. What so over the terminology, both the federal government, regional government of Tigrai, UN, international organizations and media have witnessed the involvement of many actors/countries and the deployment of full-flagged military forces; UAE's drones , air-force, mechanized army, hundreds of thousands of Ethiopian troops and paratroopers, Eritrean troops, Amhara special forces and fano/militia, Afar special forces and militia and others and caused unquantifiable death, destruction of wealth, starvation and displacement.

Though the war initiated to achieve a certain political game; with all measures, it was a devastating war and considered as "genocidal war". The World Peace Foundation (2021) explained that the Ethiopian and Eritrean governments, who are the main actors in the war in Tigrai, were intentionally, systematically, and prevalently starving the people of Tigrai and extensive risk of famine is shadowing badly. The regional government of Tigrai also accused of the Ethiopian government and its supporters for they started the war in Tigrai to extinct the people of Tigrai from the world by closing all the communication means like the telecom, electricity, banking, and transport services and encircled to totally vanish the people in a short period of time. They exercised all forms of genocide in the people of Tigrai; they used famine, rape, abduction and killing of innocent people as a weapon of war in the region.

OXFAM (2021) also stated that the people of Tigrai had lost their farm tools, seeds and livestock which made the livelihood of the people to be misery and made more than five million people to face extreme hunger. FEWS NET (2020) also criticized the acts of the Ethiopian government of its deliberate outage of connections, blockage of transport and aid convoys to cross to Tigrai and cautioned emergency Phase expected in parts of Tigrai in 2021 if the access constraint persists.

3.2. Household Features

In this study, regardless of the sample size and the number of woredas included, the data were collected from all zones, all social and economic status and type of settlement of the region.

The central zone accounts 26.35 % of the sample households followed by the IDP, mainly from Western zone, (17.16%), Eastern zone (15.62%), Northwestern (12.63%), Southeast (12.54%), Mekelle (11.68%) and Southern zone (10.76%). In addition, 64.28 % of the sample households were male headed and the remaining share (35.72%) were female headed households (see appendix table 2). The average age of the head of the households was 44.3 years and the mean family size was 4.5 persons.

The sample households had various level of educational status. The major share was the illiterate households (32.54%) followed by primary education (27.92%), secondary school (16.64%), religious education (5.33%), first degree (9.77%), diploma holders (6.1%), second degree (5.14%) and terminal degree holders (0.15%). The married heads of households in the sample had share of 74.79%, divorced (11.74%), widowed (10.08%), single (3.08%) and others (0.31%). Religion wise, orthodox accounted 93.13 %, Muslim (6.59%), catholic (0.15%) and protestant had share of 0.12% (refer appendix table 2).

3.3. The war & food insecurity

Tigrai was known for its efforts to tackle food insecurity and reduce the deep-rooted level of poverty. Due to the war in Tigrai, the level of food insecurity, malnutrition, and lack of access to basic social services are believed to

be at their highest level ever. The food security analysis result (table 1) indicates that 77.38 % of the sample households were food insecure, and they did not able to meet their essential food needs without engaging in atypical coping strategies. Only 22.62 % of the surveyed households were food secure.

The food insecurity gap is estimated at 33.68 % which indicates that the food insecure households need, at an average, 740.9 kilo calorie per adult equivalent a day to get the required calorie and lead healthy life. The severity in food insecurity / the energy deficiency severity/ in the households is estimated to be 18.5 %.

The level of food insecurity was higher in the rural areas than the urban counterpart which differs with the nature of the woreda. Accordingly, the proportion of households who had inadequate food calories consumption constitutes 81.17 % of the sample rural households. 75 % and 72.85 % of the households in the urban areas and small towns were food insecure, respectively. The result in table 1 also portrays that the food insecurity gap was higher in the rural areas (36.68%), followed by the small towns (33.02%) and the urban areas (30.35%).

According to the report by Tigrai Statistics Agency (TSA) and Mekelle University (MU) (2019), 41.28 % of the households in the region were mild, moderately, and severely food in secure. A study made by the World Food Program (2019) shows that 24.7 % of the households in Tigrai are food insecure. Another study made by Mekelle University and BoPF (2018), also stated that 75 % of urban residents and 54 % of the rural households had enough food for the 10-12 months of the year. The National planning Commission (2016) also indicates that level of food poverty in Tigrai was markedly declining overt time. On average, 1995/6-2015/6, the food poverty was reduced by more than 3.2 % per year. In the year 2015/18, 32.9 % of the households were food poor which is expected to be 29.7 in the year 2020/21.

Based on the above information, more importantly, the current magnitude of food insecurity in the selected woredas of the region was 213.3 % higher than the findings of the WFP (2019), 160.5 % higher than the regional food insecurity level reported by the National Planning Commission (2020) and 87.8 % higher than the study made by TSA and MU (2018). Moreover, at an average, the incidence of food insecurity is 153.8 % higher than the previous levels of food insecurity in the region. The war induced extremely high level, depth and severity of food insecurity in Tigrai was consistent with food insecurity level of countries while they enter to war like Yemen, South Sudan, Somalia, Syria and others.

Table 1: Intensity, depth and severity of food insecurity of households by zone and settlement type

Category		FIS_0	FIS_1	FIS_2
Zone	Eastern	72.38 (27.62)	30.62	17.0
	Central	85.39(14.61)	40.18	23.3
	Northwest	77.36(22.64)	32.16	17.7
	Mekelle	73.88(26.12)	29.6	14.9
	Southeast	69.52(30.48)	27.01	13.5
	Southern	68.39(31.61)	28.19	14.6
	Western*	69.82(30.18)	29.36	15.7
Settlement type	Rural	81.17(18.83)	36.68	19.2
	Urban	75.00(25.00)	30.35	15.9
	Small towns	72.85(27.15)	33.02	20.7
	population	77.38(22.62)	33.68	18.5

Source: Computed from the survey, 2021
Value in parenthesis is the % of food secure households.
* Data for the Western zone was collected from the IDPs as it was impossible to get an access to conduct the survey since it is fully under the control of the Eritrean & Amhara forces.

There is a variation in the magnitude and gap of food insecurity across the study zones of the region. The highest level of food insecurity was observed in the Central zone of Tigrai (85.39%) followed by Northwest zone (77.36%) and Mekelle zone (73.88%). The Eastern zone, South-east and Southern zone of Tigrai had food insecurity level of 72.38 %, 69.52 %, and 68.39 %, respectively. The highest calorie deficient zones are also featured by high level of food gap which ranges from 40.18 % in the Central zone to 27.01 % in the Southeast zone. The food insecure households in the Northwest zone had food gap of 32.62 % followed by Eastern zone which had food gap of 30.62 % and Mekelle zone (29.6%).

Even though there is no significant difference in the magnitude of food insecurity, based on nature of woreda understudy, 81.17 % of the sample households in the rural areas, 75 % in the urban areas and 72.85 % of the households in the small town setting were found food insecure households.

When we looked at the incidence of food insecurity at woreda level, from the surveyed woredas, 31.4 % of them had food insecurity level of above 80 %, 47.1 % of them also placed in the range of 70%-80% and the

remaining share (21.5%) had food insecurity level of 60%-70%. Adwa, Rama/ Aderbete, Laelay Maichew, Adwa town, 'Kifle ketema' Hawelti, Tahtay Koraro, Adigrat, Aksum, Ahferom, Endabaguna town were the woredas which had severe level food insecurity of above 80 % (Appendix table 3).

The food insecure households had higher average family size (4.89) than the food secure households (3.32). Thus, food insecure households are typically large families headed by unemployed head of household. Before the outbreak of the war, 4.49 % of the respondent households were unemployed. However, following the war in Tigrai, 48.32 % of the households are forced to lose their job and became unemployed. The remaining share perceived as if they are in their previous type of employment, but they are less productive and inefficient to generate income to support their families.

The FGD, KII and PRA result also supported the existence of extremely high level of food insecurity in the study areas. The awfully rise in the price of goods and services, particularly the commonly consumed cereals such as 'taff', wheat, maize, barely, beans, oil and others have significant impact on the reduction of food consumption at the household level. The deliberate, permanent and temporarily, closure of the banking services hampered households not to use their savings; lack of access to electricity, transport & market contributed for the food insecurity in the study areas. The market was not functioning properly; people were afraid to go to market and the Ethiopian government and its alliance forces were looting and destroying their wealth so that they fail to supply to the market and only few traders were dominating the system where the interim government's offices were collapsed to manage and regulate the market. As a result, the price of goods and services was sky rocketed that households could not afford to purchase. Very few humanitarian aid (food aid) distributions have been done to those who need immediate and continuous support. Though there were trials of food aid distribution, it was highly limited in its coverage, full-package[1], and continuity. In fact, Ethiopian government officials were repeatedly criticized foreign humanitarian aid distributed to rescue the 1985 famine as it was helping TPLF to be strong and able to win in the battlefields. Therefore, they used all the evil alternatives to oppress & terrorize the people to detach easily from TPLF. The quantitative and qualitative findings witnessed that the Ethiopian government was using famine as a weapon of war in Tigrai and the severe level of food insecurity was, basically, man-made.

3.4. War and Phases of Acute Food Insecurity

Generally, the armed-conflict took place in Tigrai affects the households' acute food insecurity with different level of severity among households, place of resident and demographic features.

An IPC severity of acute food insecurity (table 2) revealed that 22.62 % were in phase 1, 6.07 % of households were in Stressed phase, 7.24 % of the households were in Crisis Phase, and about 17.32 % of households were in Emergency Phase. In addition, 44.71 % of the households were placed in Catastrophe Phase in March, 2021. The share of households placed in the crisis phase and above in this study (69.27%) is similar with what the USAID assessed from October to December 2020 (70.2%). However, the share of the crisis phase and emergency phase in 2020 were moved to the next phase as the war in Tigrai worsens the food insecurity situation of the households. As a result, 62.03 % of the households were placed the emergency phase or above which verifies the "existence of disquieting famine" in the region.

This severe acute food insecurity might result from the cascading effects of the war, including high population displacements, movement restrictions, very limited humanitarian access, looting of cereals, livestock & livelihood assets by the Ethiopian and Eritrean troops and the Amhara Special Forces, militia and 'Fano', and the limited functions of markets in the region.

Table 2: Estimates of acute food insecurity at regional and zone levels (IPC phase), 2021

Zones	IPC- Phase 1	IPC- Phase 2	IPC-Phase 3	IPC- Phase 4	IPC- Phase 5
Central	107(14.6%)	41(5.12%)	48(5.99%)	140(17.48%)	455(56.8%)
Northwest	86(22.93%)	24(5.8%)	32(7.8%)	69(16.8%)	191(46.6%)
Eastern	127(27.2%)	31(6.1%)	42(8.3%)	92(18.2%)	204(40.24%)
Southern	101(31.5%)	16(4.6%)	26(7.5%)	73(20.92%)	124(35.5%)
Mekelle	91(26.1%)	29(7.7%)	26(6.9%)	68(17.94%)	157(41.42%)
Southeast	116(30.96%)	35(8.6%)	33(8.31%)	62(15.2%)	151(37.1%)
Western*	94(30.18%)	21(6.21%)	28(8.28%)	48(14.2%)	139(4.12%)
Total	**734(22.63)**	**197(6.07%)**	**235(7.24%)**	**562(17.32%)**	**1451(44.71%)**

Source: Computed from the survey, 2021; Note: Values in parenthesis is number
* Data was collected from the IDPs

Further, the IPC Phase area classification indicated that the magnitude of acute food insecurity was diverse across zone. Accordingly, the three zones with the highest number of households in phase 5 were the Central, Northwest and Mekelle.

[1] Providing food aid based on the family size and the required quantity of cereals, pulses and oil.

In the Central zone, table 2, 56.8 % of the households were classified in IPC Phase 5 followed by emergency (17.48 %). 5.99 % of the households in the Central zone were also in the crisis phase and the remaining 5.12 % and 14.6 % were in the crisis phase and phase 1 of food insecurity, respectively.

The Northwest zone of the region had the second highest number of households placed in phase 5 (46.6%), & 16.8 % of them were placed in the Emergency phase. Further, 7.8 % of the households were classified as crisis phase and stressed phase accounted 5.8 %. Mekelle zone was ranked third in terms of the number of people who are facing catastrophic conditions (41.42%). 17.94 % of the households were classified as Emergency phase, and the crisis phase and the stressed phase had share of 6.9% and 7.7%, respectively.

When we compared the findings with the October-December 2020 data, figure1, except the Mekelle and Western zone, the share of households in the catastrophe phase was 34.6 % higher than the October to December 2020. The October to December 2020 share of the emergency was 15.2 % higher than the March, 2021. Moreover, the share of households in the crisis phase in March was 31.8 % lower than that of the October to December 2020.

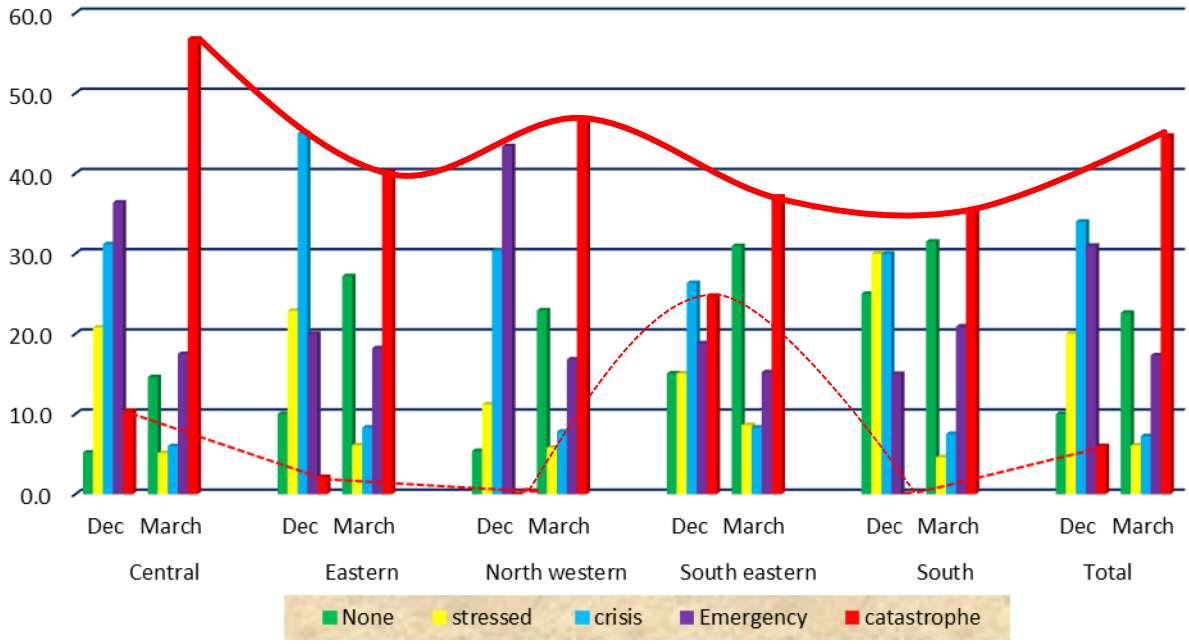

Figure 2: Food insecurity phase in December 2020 and March 2021
Source: computed from the survey, 2021 and USAID, 2020

As can be depicted from figure 2, further, the share of the stressed, crisis, emergency was higher in the October to December 2020 study than the March findings. The share of households in the stressed phase in March was 17.9 % lower than the October-December index. From the comparison and the status of IPC classification in Tigrai, the war has negative impact not only on the level of food insecurity but also the depth and severity of acute food insecurity.

Households in all the surveyed woredas (Appendix table 4), were placed in the emergency and catastrophe phase. Six woredas such as rural Adwa (64.09%), Adwa town (59.68%), Naeder (5.21%), Ahferom (58.02%), Tahtay Koraro (51.04%) and K/ketema Ayder (50.48%) were having more than 50 % of the households placed in phase 5. The higher number of households in phase 5 and phase 4 clearly justifies the presence of the critical shortage of food to eat which might be due to the food stock depletion, lack of humanitarian aid, selling of both productive and livestock assets of the households in the woredas. In fact, this study indicates that, November-March, 2021, 41.97 % of the households received humanitarian supports (aid) from the government, non-government organizations, and community. The households who received aid from the government and non-governmental organizations accounted 30.17 % and 11.8 % of them also received supports from their families, individuals & local community.

Furthermore, findings of this work show that the household members were facing different challenges associated with lack of food. On average 1.2 family members were exposed to one or more of the challenges/ human crises/ of food shortage. Similarly, on average, one family member loss weight due to lack of food and related diseases which might result in death and/ or repeated tiresomeness and stunting. In addition, due to lack of sufficient and nutritious food, the share of the family members who were reduced their weight and faced to repeated illnesses account 18.2% and 13.13%, respectively.

Moreover, 25.49 % of the households were getting the food supports only once, 9.18 % of them received

two times and 5.3 % responded as they got three times and more. Though a certain number of the households were beneficiaries of the food aid, the quantity of cereal, pulses and oil did not consider the family size they have, they received for less than 30 % of their family; not as per the intentional standard and the distribution was unfair. During the five months period (Nov-March), very small quantity, below the standard, of cereals, pulses and oil was distributed to the households. The average amount/ quantity of food items distributed to the households were 47.69 kgs. These issues were also be evidenced from the FGD and KII carried out in the selected woredas.

The FGD and KII result also substantiate the findings of food insecurity phase classification stated above which supports the existence of severe food insecurity and the prevalence of emergency phase and the catastrophe phase in the study woredas. As a result, there were situations, like in Adwa, where households are forced to eat green leaves (boiling 'moringa' and others like 'Birnihyo' and mixed with flour); normally it is not among the human feeds. Households were eating mainly once a day, reduce the quantity and quality of food they eat and use any kind of flour as a sauce" Tsebhi" as they could not get pulses, oilseeds and beans which basically serves as sauce /'Tsebhi'/ in Tigrai. Further, to a larger extent, there were households who used roasted and ground maize as sauce. They used flour soup/ 'Suwqo' to escape the shortage of food; this type of meal is mainly used during critical shortage of food.

Further, there were households who used "water and salt" as a sauce. More importantly, there were households who started begging cereals from their neighbors and community and lastly migrated to other areas. Moreover, the FGD result depicts the death of people and children, and mothers were malnutrition, like in Ahferom, Aksum, rural Adwa, Adwa, Naeder and Rama. These all cases or events are evidences for the presence of extremely large food gaps and severe food insecurity in the region. If immediate support is not continuously and regularly given to the people, more people will die in the coming few months.

3.4.1. Rural-urban variations in the phases of acute food insecurity

The IPC Phase analysis revealed that there are no significant variations in the severity of acute food insecurity. The severity of acute food insecurity was higher in rural areas than their urban counterparts. The IPC analysis in table 3 indicates that there were variations in the level of severity of acute food insecurity between rural and urban areas. The comparison, by place of resident, shows that rural had the highest share of acute food insecure households (47.69%) in the catastrophe followed by emergency (16.63%). Moreover, 66.96 % of the households were in the Crisis or worse.

Table 3: Rural- urban estimates of acute food insecurity (IPC phase), 2021

Zones	None	Stressed	Crisis	Emergency	Catastrophe/Famine
Rural	22.64	5.64	7.4	16.63	47.69
	(309)	(77)	(101)	(227)	(651)
Small towns	28.04	5.79	5.79	17.01	43.36
	(150)	(31)	(31)	(91)	(232)
Urban	25.35	6.62	7.66	18.14	42.23
	(341)	(89)	(103)	(244)	(568)

Source: Computed from the survey, 2021

Note: Values in parenthesis are the number of acute food insecure households in each IPC Phase

The small town form of settlement was the second category (43.36%) in terms of the share of catastrophe. 17.01 % of its households were classified as Emergency phase. Further, slightly lower than the small towns, 42.23 % of the households in the surveyed urban areas were in phase 5 which is characterized by extreme food gaps.

3.5. Determinants of households' acute food insecurity

To assess the factors affecting the food security in the region, the logistic regression model (mainly) and multiple regressions were employed. Seven separate regressions were carried out to examine the functional relationship between the dependent variable and the regressors. The calorie per adult equivalent per day, food expenditure per capita and food secure / insecure (dummy) were the dependent variables; and both conflict[1], household characteristics, community level variables, economic and social variables were used as regressors (see table 4.).

The status of food insecurity is measured by the calorie intake per adult equivalent a day or the food expenditure households incur to get the required calorie, commonly known as the food poverty. In panel 1of table 4, the link between food insecurity and conflict was assessed and the result supports for the inverse relationship. Further, the link was tested using the calorie intake (panel 2) and similar result was observed. However, the food insecurity situation of the households was not only influenced by the conflict, but also other factors have fundamental effects; price effect comes at the first place.

To examine the effect of price change on food security, the price of the commonly used food items were

[1] The monetary value of assets damaged in the war was used as a proxy variable to measure conflict.

considered. Price of taff (mixed and red), wheat, maize and barely were used in the regression. Besides, the change in price due to the conflict was also included in the regression using the interaction of conflict and price of the widely consumed cereal in the region. The results in panel 3 of table 3 depict the negative impact of the price on food security measured by the calorie per adult equivalent a day. Price of red 'taff', barley and wheat were statistically significant factors determining food security in Tigrai at 1% level of significance. Thus, a one percentage increase in price of red 'taff', barley and wheat reduced the kilo calorie per adult equivalent a day by 0.057, 0.094 and 0.115 percentage points, respectively.

Table 4: Determinants of food security

Regressors	Dependent variables: food security, log of food expenditure per capita (Food exp.), and calorie per adult equivalent (calorie)						
	Food exp. (1)	Calorie (2)	Calorie (3)	Calorie (4)	Calorie (5)	Security (6)	Food exp. (7)
Log of conflict	-0.056***	-0.004**	-0.006**	-0.006**	-0.008**	-0.027**	-0.099***
	(0.007)	(0.002)	(0.003)	(0.003)	(0.003)	(0.012)	(0.01)
Log of price of mixed 'taff'			-0.01	-0.001	-0.001	-0.057	-0.232***
			(0.009)	(0.007)	(0.007)	(0.036)	(0.022)
Log of price of red 'taff'			-0.057***	-0.037**	-0.032**	-0.26***	0.281***
			(0.016)	(0.015)	(0.015)	(0.071)	(0.024)
Log of price of barley			-0.094***	-0.091***	-0.092***	-0.373***	-0.127***
			(0.014)	(0.013)	(0.013)	(0.064)	(0.021)
Log of price of wheat			-0.115***	-0.124***	-0.126***	-0.368***	-0.077***
			(0.012)	(0.01)	(0.01)	(0.051)	(0.017)
Log conflict* log of price			-0.007*	-0.019**	-0.023***	-0.059*	-0.183***
			(0.003)	(0.007)	(0.006)	(0.031)	(0.016)
Sex of head (dummy)				0.023	0.014	0.033	0.022
				(0.028)	(0.028)	(0.129)	(0.071)
Log of family size				-0.946***	-0.955***	-3.27***	0.38***
				(0.036)	(0.035)	(0.163)	(0.084)
Education of head (dummy)				-0.031	-0.018	0.102	-0.019
				(0.023)	(0.026)	(0.115)	(0.064)
Marital status of head (dummy)				0.082**	0.077**	0.222	0.009
				(0.032)	(0.032)	(0.147)	(0.079)
Log of age of head square				-0.07***	-0.075***	-0.229***	-0.112**
				(0.019)	(0.019)	(0.086)	(0.048)
Log of income per capita					0.024***	0.11***	0.022***
					(0.003)	(0.016)	(0.006)
Category (dummy)					-0.016	0.041	-0.089
					(0.022)	(0.103)	(0.06)
Support (dummy)					0.078***	0.389***	0.047
					(0.021)	(0.098)	(0.052)
unemployment status(dummy)					-0.066***	-0.296***	-0.178***
					(0.023)	(0.106)	(0.048)
Access to electricity (dummy)					0.122***	0.409***	0.098*
					(0.024)	(0.104)	(0.056)
Access to finance (dummy)					0.057**	0.078**	0.002
					(0.024)	(0.03)	(0.055)
_cons	6.624***	7.333***	7.192***	8.131***	8.211***	2.243***	5.352***
	(0.024)	(0.016)	(0.038)	(0.145)	(0.147)	(0.683)	(0.386)
r2	0.034	0.001	0.07	0.287	0.3063		0.342
rmse	1.376	0.695	0.671	0.588	0.58044		1.271
N	3245	3245	3245	3245	3245	3245	3245

Source: Computed from the survey, 2021
Note: Values in parenthesis are robust standard errors.
* Significant at 10%, ** significant at 5% and *** significant at 1%

The effect of household level features was addressed and controlled in panel 4. Family size, marital status and age of the head are found significant to impact the calorie intake per adult equivalent a day. As a result, a one percentage increase in the family size of the household reduced the kilo calorie per adult equivalent a day by

0.946 percentages. Households led by married heads [1]consumed higher level of kilo calorie per adult equivalent a day than the unmarried heads, and a one percentage change in the age of the head reduced the kilo calorie per adult equivalent a day by 0.07 percentage points. Further, other community, economic and social variables were controlled in the regression (panel 5, 6 and 7). The regression results in panel 5, 6 and 7 also depict that conflict significantly reduced the food security situation of the households expressed in calorie per adult equivalent, food consumption expenditure and security (dummy).

The determinants of food security, using the logit model, were examined and presented in panel 6 of table 4. The figures indicate that conflict negatively and statistically significant variable to influence food security. The higher the level of conflict, the higher the likelihood of the household being food insecure as estimated. The prices of the commonly consumed cereals also affect the food security of the households. Price of red 'taff', barley and wheat reduced the probability of being food secure by 0.26, 0.373 and 0.368 at 1% level of significance. The war itself affects the price of goods and services across the zones and woredas. To control such incremental effect of price of consumable goods and services, it was interacted with the conflict variable, which had a negative effect on the level of food security of the households. As a result, the change in price of goods increases the likelihood of the households to be food insecure by 0.059 percentage points.

Controlling for socio-economic and demographic variables, household size increased the odds of falling into food insecurity by a factor of 3.27. This may mean that most of the household members are consumers rather than producers which resulted partly by the war. Thus, the larger the household size the more the pressure on the household for the scarce resources available and thus the higher the likelihood of falling into food insecurity. The age of the household head is a significant demographic variable which correlates to food insecurity. The higher the age of the household head the higher the likelihood of the household being food insecure by a factor of 0.229.

Income is believed to be among the factors affecting the food security of the households. A one percentage increase in the mean monthly income of the households increased the probability of being food secure by 0.11. The monthly income is determined by the current employment status of the households. Further, the unemployed heads of households had higher probability (0.296) of being food insecure than the employed counterparts. Access to electricity, financial services and aid supports (given by the family members, community, NGOs, and the government) also determine the level of food insecurity of the household. The household who had access to functioning electricity services had higher probability (0.409) of being food secured than those who did not have at 1 % level of significance. The households who got monetary and in kind supports from their families, NGOs, and government had lesser (0.296) probability of falling to food insecurity at 1% level of significance.

Moreover, during the war time, households were using savings to cover their expenses. As a result, access to financial services also affects the level of food security of the households. This study came with a positive relationship between access to financial services (banking service) and the level of food security. The regression result in table 4 depicts that households who had access to financial services had 0.078 higher probability of being food secured than those who do not have financial services at their localities due to the war. Moreover, the major finding of this research work, inverse relationship between food security and conflict, is consistent with research outputs carried out in other countries (Pierre, W.J. and Fred, H., 2006; Slobodanka B., and Teodosijević, 2003; D'Souza, A. & Jolliffe, D., 2013).

IV. CONCLUSION

The war in Tigray is a genocidal war and the Ethiopian government used famine as a weapon of war as it made 77.38 % of the households to become food insecure. The war also widens the food insecurity gap against the required calorie intake which accounted 33.68 %. The war caused 69.21% of the households to be classified in the crisis phase and above where the share of the catastrophe households was about 44.71 %.

The food insecurity in the Tigrai region was determined by the recurrent war, the price of basic goods and services, income of the household, age of the head, family size, access to electricity, access to financial services and unemployment of the head at different level of significance. Though there was no significance difference between the level of food insecurity based on the livelihood style, rural, urban and small town setting, higher percentage of good insecure households were observed in the rural areas followed by small towns and urban areas. Further, level of food insecurity and phases of food insecurity (crisis phase and above) varied across zones where the Central zone had the highest incidence followed by Northwest zone and Mekelle zones.

Acknowledgment

The authors would like to thank the Tigrai Institute of Policy studies (TIPS) for providing the data necessary for the study. We are also grateful for those who were participating in editing, reviewing and providing their genuine comments. All views raised in this paper are the opinion of the authors and do not reflect the interest of the TIPS.

[1] We treated marital status as married and unmarried (dummy). The single, divorced and widowed were considered as unmarried.

Conflict of Interest

There is no conflict of interest associated with this article.

Contribution of Authors

Teka Araya has initiated the research topic, developed the questionnaire and FGD, KII and PRA discussion points. He has also dealt with model specification and carrying out the analysis. Sung-Kyu Lee worked on the organization of the paper, editing, reviewing and proof reading. Besides, he has checked the appropriateness of the model used and the relevance of the topic for the rehabilitation of Tigrai.

BIBLIOGRAPHY

Africa Center for Strategic Studies. (2020). Food Insecurity Crisis Mounting in Africa, Informatics .

Alemayehu G., Niek de Jong, Kimenyi M.S., Mwabu G. (2005). Determinants of Poverty in Kenya: A Household Level Analysis.working paper 2005-44.

Barrett, C. (2002). Food Security and Food Assistance Programs, Handbook of Agricultural Economics. Elsevier Science.

Benoit, E. (1978). Growth and defense in developing countries. Economic Development and Cultural Change, 26(2):271–280.

BoPF (Bureau of Plan and Finance). (2018). Socio-economic Survey of hosueholds in Tigray. Mekelle.

Central Statistical Authority. (2008). Summary and Statistical Report of the 2007 Population and Housing Census. Addis Ababa.

D'Souza, A. & Jolliffe, D. (2013). Conflict, food price shocks, and food insecurity: The experience of Afghan households. Food Policy.

Ejigayhu, S. & Abdi-Khalil E. (2013). Determinants of Food Insecurity in Addis Ababa City, Ethiopia. Africa Association of Agricultural Economists held from Sep. 22-25 in Hammamet. Tunisia.

FAO, IFAD, UNICEF, WHO & WFP. (2017). The State of Food Security and Nutrition in the World 2017. Building Resilience for Peace and Food Security. Rome: FAO.

FEWS NET. (2020). Food security in Ethiopia: Emergency (IPC Phase 4) expected in parts of Tigray in 2021.

FSIN and Global Network Against Food Crises. (2021). Global Report on Food Crises 2021. Retrieved from http://https://www.fsinplatform.org/sites/default/files/resources/files/GRFC2021.pdf . Rome.

Global Network Against Food Crises (GNAFC). (2021). Global Report on Food Crises.

Gujarati D. (2007). Basic Econometrics . New York: Tata McGraw-Hill.

Humanitarian Programme Cycle. (2021). Humanitarian needs overview. Syrian Arab republic. Issued March 2021.

IPC . (2019). Integrated Food Security Phase Classification Technical Manual Version 3.0. Evidence and Standards for Better Food Security and Nutrition Decisions. Rome.

IPC. (2017). The republic of South Sudan: Acute Food Insecurity Situation for January 2017 and Projections for February - April 2017 and May - July 2017. Retrieved from http://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1026671/?iso3=SSD.

IPC. (2019). Integrated Food Security Phase Classification Technical Manual Version 3.0. Evidence and Standards for Better Food Security and Nutrition Decisions. Rome.

IPC. (2020). Ethiopia: IPC Acute Food Insecurity Analysis October 2020 – September 2021, Issued December 2020.

IPC. (2021). IPC acute food insecurity and acute malnutrition analysis in Somalia in January- June 2021.

Kothari, C.R. (2004) Research Methodology: Methods and Techniques. 2nd Edition, New Age International Publishers, New Delhi.

Madala G.S. (1992). Introduction to Econometrics, 2ed, University of Florida. New York: Macmilan publishing company.

Marc J. C. and Per Pinstrup-Andersen. (1999). Food Security and Conflict . Social Research , 375-416.

Ministry of Finance and Economic Development (MoFED). (2012). Ethiopia's Progress Towards Eradicating Poverty: An Interim report on Poverty study (2010/11). Addis Ababa: MoFED.

Mok, T.Y., Gan1, C., and Sanyal, A. (2007). The Determinants of Urban Household Poverty in Malaysia.

National Planning Commission (NPC). (2017). Ethiopia's Progress Towards Eradicating Poverty. An Interim Report on 2015/16 Poverty Analysis Study. Addis Ababa. Ethiopia. Addis Ababa.

OCHA. (2021). Humanitarian needs overview. Syrian Arab republic. Rretrieved from https://reliefweb.int/report/syrian-arab-republic/wfp-syria-situation-report-2-february-2021.

OXFAM. (2021). Conflicts and Dissaters-Ethiopia.

Pierre, W.J. and Fred, H. (2006). Analyzing the Effects of Conflicts on Food Security in Developing Countries: An Instrumental Variable Panel Data Approach.

R.S. Sidhua, Inderpreet, K. & Kamal V. (2008). Food and Nutritional Insecurity and its Determinants in Food

Surplus Areas: The Case Study of Punjab State. Agricultural Economics Research Review, 91-98.
Slobodanka B., and Teodosijević. (2003). Armed Conflicts and Food Security. Agricultural and Development Economics Division. The Food and Agriculture Organization of the United Nations. ESA Working Paper No. 03-11. FAO.
Stijn V.W. (2018). Food security and armed conflict: a cross-country analysis.FAO Agricultural Development Economics . Working Paper 18-3.
Teka A. Gabriel T. & Zeremariam F. (2018). Status and determinants of poverty and income inequality in pastoral and agro-pastoral communities: Household-based evidence from Afar Regional State, Ethiopia. https://doi.org/10.1016/j. World Development Perspectives.
Teodosijević, S. (2003). Armed Conflicts and Food Security. Food and Agriculture Organization.
TSA (Tigray Statistics Agency). (2020). Annual Macroeconomic Report of Tigray Regional State- Regional Gross Domestic Product (2008EFY-2011EFY). Mekelle.
UN News. (2020). Yemen: food insecurity a 'ticking timebomb', warn aid agencies. Retrieved from, https://news.un.org/en/story/2020/12/1079832.
Verwimp, P. (2012). Food Security, Violent Conflict and Human Development: Causes and consequences. Working Paper 2012-016.
WFP-Ethiopia. (2019). Comprehensive Food Security and Vulnerability Analysis (CFSVA). Ethiopia.
World Bank Institute. (2005). Introduction to poverty analaysis.
World Peace Foundation. (2021). Starving Tigray: Mass atrocity and humanitarian emergency in Ethiopia. World Peace Foundation.

APPENDICES

Table 1: Sample size by zone, woreda and sex

zone	woreda	Female	Male	Total	Share
	Adigrat_Town	47	30	77	2.4
	Ganta Afeshum	61	75	136	4.2
	Wukro_Town	28	24	52	1.6
	KilteAwlaelo	51	94	145	4.5
	Freweyni_Town	13	19	32	1.0
	Atsibi	14	11	25	0.8
Eastern		**235**	**272**	**507**	15.6
	Aksum_Town	31	73	104	3.2
	Adwa	62	158	220	6.8
	Naeder	18	58	76	2.3
	Laelay Maychew	16	88	104	3.2
	Tahitay Maychew	13	116	129	4.0
	Ahferom	23	58	81	2.5
	Adwa_town	31	31	62	1.9
	Rama/Aderbaete_Town	6	19	25	0.8
Central		**227**	**628**	**855**	26.3
	Shire_Town	76	80	156	4.8
	Tahtay Koraro	29	67	96	3.0
	Endabaguna_Town	6	38	44	1.4
Northwestern		**154**	**256**	**410**	12.6
	EmbaAlaje	8	16	24	0.7
	Endamekoni	30	64	94	2.9
	Maychew_Town	30	25	55	1.7
	Raya Azebo	47	82	129	4.0
	Mekoni_town	20	26	46	1.4
Southern		**135**	**214**	**349**	10.8

zone	woreda	Female	Male	Total	Share
	K/K/semien	20	37	57	1.8
	K/K/Adihaqi	17	21	38	1.2
	K/K/Kedamayweyane	17	27	44	1.4
	K/K/Quiha	18	22	40	1.2
	K/K/Hadnet	14	31	45	1.4
	K/K/Ayder	40	65	105	3.2
	K/K/Hawelti	9	41	50	1.5
Mekelle		**135**	**244**	**379**	11.7
	Degua Temben	31	47	78	2.4
	Enderta	58	73	131	4.0
	Hintalo	45	46	91	2.8
	HagereSelam	25	23	48	1.5
	Adigudom	26	23	49	1.5
Southeast		**185**	**222**	**407**	12.5
Western		**88**	**250**	**338**	10.4
	IDP (Western+)	179	378	557	17.2
	Total	1159	2,086	3,245	100.0

Source: Computed from the survey, 2021
Value in brackets is the share from the total sample

Table 2: Household features

Level of education			Marital status			Religion			Perceived economic status				
									before war			during war/now	
variable	*Freq.*	*%*	*variable*	*Freq.*	*%*	*variable*	*Freq.*	*%*	*variable*	*Freq.*	*%*	*Freq.*	*%*
Illiterate	1,056	32.54	Married	2427	74.79	Orthodox	3022	93.13	very poor	26	0.8	1022	31.53
Religious	173	5.33	Single	100	3.08	Muslim	214	6.59	poor	540	16.66	1556	48.01
primary (1-6)	906	27.92	Divorced	381	11.74	Catholic	5	0.15	Medium	2275	70.19	642	19.81
Secondary (7-12)	540	16.64	Widowed	327	10.08	Protestant	4	0.12	Rich	346	10.68	20	0.62
Diploma/TVET	198	6.1	Other	10	0.31				Very rich	54	1.67	1	0.03
First degree	317	9.77											
Masters	50	5.14											
Ph.D.	5	0.15											
Total	3245	100	Total	3245	100		3245	100		100.00		3245	100

Source: Computed from the survey, 2021

Table 3: Level and gap of food insecurity by woreda

Woreda	**FIS_0**	**FIS_1**
Adigrat_Town	0.82(0.04)	0.31(0.03)
Ganta Afeshum	0.79(0.04)	0.32(0.02)
Wukro_Town	0.71(0.06)	0.31(0.04)
KilteAwlaelo	0.63(0.04)	0.32(0.03)
Freweyni_Town	0.66(0.08)	0.23(0.04)
Atsibi	0.72(0.09)	0.22(0.04)
Aksum_Town	0.8(0.04)	0.37(0.02)
Adwa	0.92(0.02)	0.45(0.02)
Naeder	0.79(0.05)	0.39(0.03)
Laelay Maychew	0.9(0.03)	0.35(0.02)
Tahitay Maychew	0.8(0.04)	0.4(0.02)
Ahferom	0.8(0.04)	0.38(0.03)
Adwa_town	0.87(0.04)	0.41(0.03)
Rama/Aderbaete_Town	0.92(0.05)	0.39(0.04)
Shire_Town	0.74(0.03)	0.3(0.02)
Tahtay Koraro	0.81(0.04)	0.36(0.03)
Endabaguna_Town	0.8(0.06)	0.32(0.04)
EmbaAlaje	0.75(0.09)	0.29(0.05)
Endamekoni	0.71(0.05)	0.3(0.03)
Maychew_Town	0.69(0.06)	0.27(0.03)
Raya Azebo	0.64(0.04)	0.28(0.02)
Mekoni_town	0.7(0.07)	0.27(0.04)
K/K/semien	0.77(0.06)	0.26(0.03)
K/K/Adihaqi	0.71(0.07)	0.27(0.04)
K/K/Kedamayweyane	0.77(0.06)	0.29(0.03)
K/K/Quiha	0.6(0.08)	0.27(0.05)
K/K/Hadnet	0.71(0.07)	0.26(0.03)
K/K/Ayder	0.73(0.04)	0.33(0.03)
K/K/Hawelti	0.84(0.05)	0.33(0.03)
Degua Temben	0.79(0.05)	0.32(0.03)
Enderta	0.61(0.04)	0.26(0.02)
Hintalo	0.75(0.05)	0.28(0.03)
HagereSelam	0.73(0.06)	0.24(0.03)
Adigudom	0.63(0.07)	0.24(0.03)

Source: Computed from the survey, 2021
Values in brackets are standard errors.

Table 4: Food insecurity phases across woreda

Woreda	Phase				
	1	2	3	4	5
Adigrat_Town	14(18.18)	6(7.79)	6(7.79)	21(27.27)	30(38.96)
Ganta Afeshum	29(21.32)	9(6.62)	17(12.5)	24(17.65)	57(41.91)
Wukro_Town	15(28.85)	5(9.62)	2(3.85)	5(9.62)	25(48.08)
KilteAwlaelo	53(36.55)	3(2.07)	6(4.14)	22(15.17)	61(42.07)
Freweyni_Town	11(34.38)	3(9.38)	3(9.38)	6(18.75)	9(28.13)
Atsibi	7(28)	3(12)	2(8)	8(32)	5(20)
Aksum_Town	21(20.19)	1(0.96)	6(5.77)	25(24.04)	51(49.04)
Adwa	18(8.18)	14(6.36)	10(4.55)	37(16.82)	141(64.09)
Naeder	16(21.05)	4(5.26)	1(1.32)	10(13.16)	45(59.21)
Laelay Maychew	10(9.62)	11(10.58)	12(11.54)	23(22.12)	48(46.15)
Tahitay Maychew	26(20.16)	4(3.1)	6(4.65)	19(14.73)	74(57.36)
Ahferom	16(19.75)	2(2.47)	8(9.88)	8(9.88)	47(58.02)
Adwa_town	8(12.9)	4(6.45)	3(4.84)	10(16.13)	37(59.68)
Rama/Aderbaete_Town	2(8)	1(4)	2(8)	8(32)	12(48)
Shire_Town	40(25)	10(6.41)	16(10.26)	28(17.95)	62(39.74)
Tahtay Koraro	18(18.75)	7(7.29)	8(8.33)	14(14.58)	49(51.04)
Endabaguna_Town	9(20.45)	3(6.82)	3(6.82)	7(15.91)	22(50)
EmbaAlaje	6(25)	3(12.5)	1(4.17)	4(16.67)	10(41.67)
Endamekoni	27(28.72)	4(4.26)	7(7.45)	20(21.28)	36(38.3)
Maychew_Town	17(30.91)	2(3.64)	5(9.09)	11(20)	20(36.36)
Raya Azebo	46(35.66)	3(2.33)	9(6.98)	27(20.93)	44(34.11)
Mekoni_town	14(30.43)	4(8.7)	4(8.7)	11(23.91)	13(28.26)
K/K/semien	13(22.81)	8(14.04)	5(8.77)	9(15.79)	22(38.6)
K/K/Adihaqi	11(28.95)	2(5.26)	4(10.53)	5(13.16)	16(42.11)
K/K/Kedamayweyane	10(22.73)	2(4.55)	4(9.09)	14(31.82)	14(31.82)
K/K/Quiha	16(40)	2(5)	3(7.5)	5(12.5)	14(35)
K/K/Hadnet	13(28.89)	4(8.89)	2(4.44)	10(22.22)	16(35.56)
K/K/Ayder	28(26.67)	5(4.76)	7(6.67)	12(11.43)	53(50.48)
K/K/Hawelti	8(16)	6(12)	1(2)	13(26)	22(44)
Degua Temben	16(20.51)	5(6.41)	7(8.97)	17(21.79)	33(42.31)
Enderta	51(38.93)	7(5.34)	12(9.16)	16(12.21)	45(34.35)
Hintalo	23(25.27)	15(16.48)	4(4.4)	10(10.99)	39(42.86)
HagereSelam	13(27)	4(8.33)	7(14.58)	11(22.92)	13(27.08)
Adigudom	18(36.73)	3(6.12)	3(6.12)	8(16.33)	17(34.69)

Source: Computed from the survey, 2021
Values in brackets are %.