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Household food-security strategies and migration in Tigray, Northern Ethiopia

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ABSTRACT

Food security has continued to be a global concern despite progress in the international agenda to reduce food insecurity over the last decades. A considerable number of populations are facing difficulties in dealing with hunger globally. Ethiopia is among the countries that face persistent challenges to achieving food security. However, the subjective dimension of food security has not received much attention in the food-security literature. This study, therefore, aims to assess food security in Ethiopia's Tigray region, using self-reported parameters to apply a household food-insecurity access scale (HFIAS) score, and also recording people's coping behaviors in the context of migration. We assessed how different livelihoods contribute to household food security where migration is assessed as adaptive livelihood and short term means of coping strategy during food insufficiency. Since food security is an outcome of livelihood, the paper further examines the need to integrate livelihood-based approaches to assessing food security. A qualitative research approach was used for the study, with Participatory Research Approach (PRA) methods and household interviews being employed to acquire the data. Data transcription, cleaning, coding, and restructuring were performed on the datasets while descriptive statistics, including frequency and cross-tabulation, were used in the analyses. HFIAS results show that the reversible coping strategies applied when food crisis persists include consumption of foods of the same variety or cheaper or less-preferred foods, remittance, reduction of food portion size, selling of assets, daily labor and borrowing money or grain. The livelihoods of the households perused mainly included agriculture, migration, and off-farm and non-farm activities. The results further revealed that all the households engaged in agriculture, with 67% of them owning an average of 0.5 ha of land. The major finding reveals that households with diversified livelihoods including remittance income were found to be more food-secure; therefore, we concluded that the overall livelihood has to be addressed to ascertain rural households' food security.

Introduction

Food security is a high priority on the international development agenda. It was part of the Millennium Development Goals (Goal 1 Eradicate extreme poverty and hunger) [1,2] and continues to play a prominent role as one of the 17 Sustainable Development Goals (Goal 2: Zero Hunger). While we have witnessed a continuous decline in the number of undernourished people between 2000 and 2015, from 900 to 777 million, this trend has reversed in recent years and numbers have risen again to 921 million [3] due to conflicts,

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climate variability and extremes, economic downturn and unaffordable healthy diets [4]. This trend sends a clear warning that achieving the Zero Hunger target by 2030 is in serious jeopardy [5]. Some scholars even predict that food insecurity may remain a worldwide problem for the coming 50 years and beyond [6–8]. The majority of the food-insecure population is located in rural areas of the Global South – particularly in Sub-Saharan Africa and South Asia ([9,10], Thomas-Hope, [11]). The situation in Eastern Africa is particularly severe, with 34% of the population undernourished [5]. Over the past decades, livelihoods of people living in rural areas worldwide have undergone significant changes including increasing diversification into non-farm activities as well as increasing use of migration [12–14]. Against this backdrop, studies across different places suggested that the extension of the diversity of rural livelihoods to include off-farm, non-farm local activities and migration in addition to agriculture is becoming more central to rural households' efforts to ensure livelihood and food security [15–17].

Despite scientific evidence regarding food security in the Horn of Africa, especially in Ethiopia, there are few studies on households' food-security adaptation and coping strategies associated with livelihood diversification and migration in the region. The majority of these previous studies looked into food-security situations [16,18,19], dimensions of income diversification and food-security situations [20], and the determinants of food security [21–23] in Ethiopia. Some recent empirical studies have also contributed evidence on migration and food security [24–26]. For example, a study by Asefaw [26] focused mainly on seasonal migration associated with food insecurity, while [24] addressed the impact of remittance on household food security.

Thus, this study is intended to fill the gap in the literature relating to household food security in the context of livelihood diversification and migration in the Tigray region of Ethiopia. The study also addresses the role of migration in securing household food security in circumstances of food insufficiency. This study mainly focuses on exploring households' food-security adaptation and coping strategies as they link to livelihood diversification and migration in the Tigray region of Ethiopia. Ethiopia is among the most food-insecure countries in the horn of Africa despite the progress made in recent decades to reduce hunger. It has long been one of the most food-insecure countries in the world that experience severe food security problems and is highly dependent on food aid [20,27,28]. Ethiopia in general and Tigray in particular have experienced dynamic population movements, mainly of adult males and females aged between 15 and 50 years [29]. Migration in the region remains part of the livelihoods of migrants, families and their origin communities [30] and the region has experienced serious food insecurity and significant migration, both internal and international, throughout its history.

This study is designed to achieve three major objectives: a) to explore household food and livelihood strategies; b) to understand the short- and long-term implications of household strategies to household food security and well-being, and c) to understand the role of migration in response to food insufficiencies. The study concentrates on who is adopting what kinds of strategies, and what implication those strategies have for household food security: essentially, what people do when faced with food insufficiency needs to be examined carefully, since strategies are context-specific. Hence, this study seeks to emphasize the range of strategies that households employ to adapt to and cope with food insecurity, and to understand how migration contributes to food security and what roles does it play in responding to circumstance of food insufficiency.

State of the art: food security, rural livelihood, and migration

Concept of food security

The concept emerged as a central issue for the global development agenda in the wake of the world food crisis of 1972–74 and at the 1974 World Food Conference [31–33]. During that period the definition of food security focused on the supply side of food at the global and national levels [34]. Food security was defined as the availability of adequate world supplies of basic foodstuff at all times to sustain a steady expansion of food consumption [35]. The main aim was to prevent food-supply shortage at the aggregate level. However, in the 1980s, the attention to food security shifted from the global and national levels to household and individual levels [32]. Furthermore, a stronger emphasis began to be placed on access to food. The broad recognition of the questions of access goes back to the seminal work of the Nobel Prize winner Amartya Sen, Poverty and Famine: An Essay on Entitlement and Deprivation [36]. Access to food is determined by the ability of people to convert resources into food whether by production (e.g. farming), exchange (e.g. purchase of food in the market), or transfer (e.g. food aid). In 1986 the World Bank [37] defined food security as "access by all people at all times to enough food for an active and healthy life".

Since the 1990s the meaning of food security expanded to include the questions of nutritional value and food preference [38]. [5] Further stated that food security exists when "all people, at all times, have physical and economic access to sufficient, safe nutritious food to meet their dietary needs and food preferences for an active and healthy life". The notion of food security includes the following dimensions: food availability, food accessibility, food utilization, and food stability [31,39], while food availability refers to the quantitative amount of food people have at their disposal for consumption and the type and quality of food. Food availability is linked to the production, distribution, and exchange of food. Food accessibility refers to the ability of individuals and households to gain access to appropriate and nutritious food. Accessibility is linked to affordability, allocation, and preference. Food utilization refers to the ability of the household to consume and benefit from food. Food utilization is linked to the nutritional value of food, the social value of food, and questions related to food safety. Food stability addresses the temporal dimension of food security. With respect to the time dimension of food security, people can face either chronic or transitory food insecurity. The distinction is made between chronic food insecurity and transitory food insecurity [40]. In the situation of chronic food insecurity individuals and households continuously lack the capacity to meet minimum food needs. Transitory food insecurity refers to the temporal decline of food security due to crop failure and price hikes, among other factors.

There are remarkable scientific reports in the literature regarding the determinants of food insecurity in different countries. A study

by Bashir and Schilizzi [41] on the determinants of household food security in rural areas of Africa and Asia highlighted that technology adoption, land quality, education, and input availability were the most-studied determinants. Furthermore, the reviewed studies address other variable factors influencing availability and access to food. For physical and economic access to food, the most important determinants are off-farm income, livestock assets, and access to credit [41,42]. One aspect of food security that has not been critically underscored in the literature is its socio-cultural and subjective dimension. Noack and Pouw [43] argue that the availability and accessibility of "sufficient culturally adapted food" are crucial for achieving food security. Maxwell [32] also stressed that people are food-secure if they have removed their anxiety about the existence of enough food to eat. Therefore, the authors point to the need to understand not only what culturally adapted food is, but also the kind of social environment in which it is utilized and the accompanying consumption behaviors [32,43]. Noack and Pouw (ibid.) therefore propose the adoption of an approach that addresses the sociocultural dynamics of food security.

Rural livelihoods, migration, and its impact on food security in the place of origin of migrants

The vast majority of the population that suffers from hunger lives in rural areas of developing countries. The livelihoods of millions of rural families engaged in small-scale farming, pastoral and agro-pastoral, depend on rainfall, meaning that above-normal and below-normal rainfall as well as drought are often hazardous [5]. Those environmental hazards, particularly rainfall-related events and trends, lead to crop damage, animal loss, soil erosion, and flooding that affect the food and livelihood security of communities. Over the past decades, the livelihoods of people living in rural areas worldwide have undergone significant changes to improve livelihoods and reduce risks to life and living [44–46]. Changes related to the diversification of livelihood strategies have become more common as means to reduce vulnerability to shocks, improve food security, and increase income and the overall well-being of the people. Vast empirical evidence from rural areas in developing countries highlights that in the context of agricultural change migration has become a defining feature of rural livelihoods [47–49], and rural livelihoods become more diversified with the growing importance of non-farm activities [50]. Income earned from non-farm activities and remittances received from migrant members can be helpful for purchasing agricultural inputs and food items for households in the places of origin [51–54].

Migration can also be part of coping strategies that households apply in times of food stress [55,56]. Migration as a reaction to food insecurity must be understood in the context of vulnerable households' livelihoods, where households apply multiple strategies to deal with stress [57]. Household strategies can be categorized in different ways; Davies [58] makes the distinction between coping and adaptation strategies: coping strategies are mechanisms to deal with immediate and short-term insufficiency of food, whereas an adaptive strategy refers to more permanent changes in ways to acquire sufficient food. Coping strategies at the early stage of food insufficiency include for example short-term dietary changes, like altering the overall household consumption; rationing of food or shifting to less-preferred foods, and the increased use of credits for consumption purposes [32,59,60]. Not all households are prepared to talk about their means of coping with food insufficiency; however, Maxwell [61] has emphasized the importance of the subjective judgments of food insufficiency to deal with food security, which is one focus of this study.

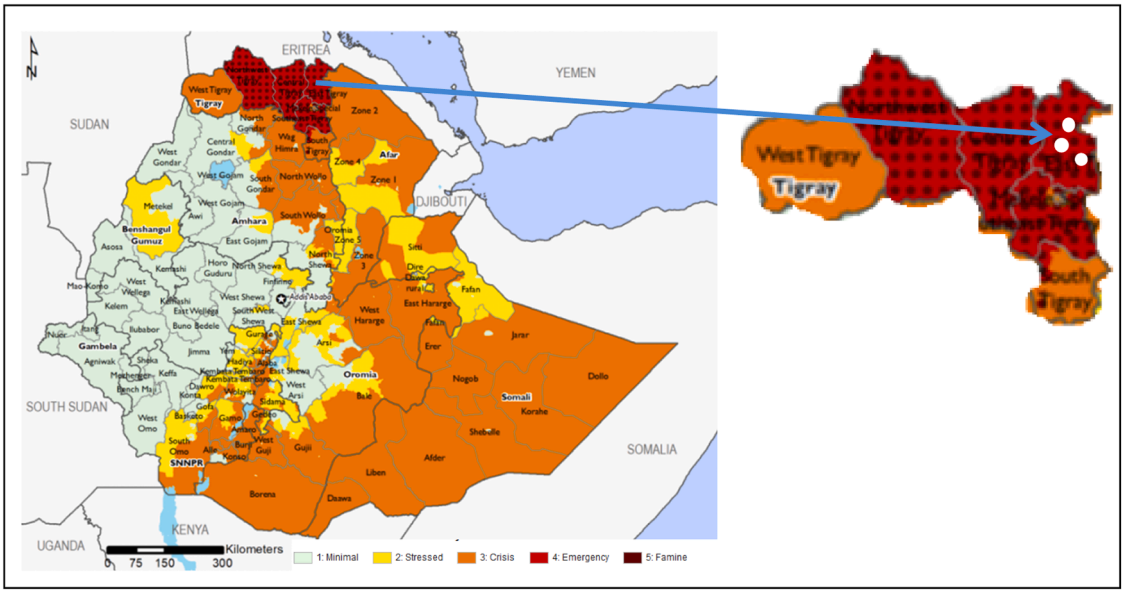

Fig. 1. The study location; modified from WFP.FEWS-NET [56] food-security update.

Methodology

Study area and site selection

The study location is Tigray region, the northernmost part of Ethiopia (Fig. 1). Tigray region is one of the 9 regional states of the Federal Republic of Ethiopia, which has long been severely affected by recurrent drought, other extreme weather events, and war. This region is characterized by food insecurity and harsh living conditions caused by the decline in rainfall, extreme increases in temperature, degradation, and fragmentation of arable land, and other natural calamities such as pests, desert locusts, and insects [62]. High levels of poverty and low crop yields are among the longstanding factors that contributed to chronic food insecurity. The study was conducted based on data collected in the Tigray region of Ethiopia between 2018 and 2019 before the outbreak of Covid-19. The impact of the COVID-19 pandemic and a plague of desert locusts in September 2020 during the pre-harvest season are recent examples that have amplified the economic difficulties in the region [63]. Besides, the current conflict, which has been ongoing in the region since November 2020, is one cause that has resulted in a notable decline in food security among displaced, urban and rural poor households, due to significant disruption to market functions, trade flows, aid delivery, local earnings and livelihoods throughout the region [56]. The rural livelihoods in Tigray are also characterized by migration, both internal and international, particularly to the Middle East [30]. Tigray is a place of origin, destination, and transit for migrants.

The Eastern zone of Tigray has been selected purposively based on the severity of food insecurity and high migration flow. Among the seven districts in the Eastern zone, Saesie Tsaedaemba district has been characterized by high migration, drought-prone, eroded farmland, high population, and chronic food insecurity [64]. According to the information obtained from the woreda's food-security expert, the district is among the most food-insecure areas in Tigray, where about 50% of the population rely on safety-net support and food early-warning systems. This is because the main livelihood of the people in the area is subsistence-based agriculture characterized by mixed farming (cropping and livestock production), and this has been highly affected by several factors, including natural calamities, for many years. The districts have 2 urban and 25 rural kebeles. Among the rural kebeles of the district, three villages, namely Gueguna, Mueguma, and Takot (Table 1), have been deliberately selected based on accessibility to transportation and migration profile of the villages after discussions with the district's local experts. Both Takot and Mueguma are located in the plains, whereas Gueguna village is in a place characterized by hills and valleys and rocky topography, which is inconvenient for farming.

Data acquisition and analysis

This empirical study was carried out using qualitative mixed-methods research design combining Participatory Research Approach (PRA) with semi-structured household and expert interviews. Six expert interviews were held with different authorities working at different governmental and non-governmental organizations (NGOs) from the regional to the local level. Several PRA tools were used to obtain an overview of the study area, including a) transect walks and observation; b) wealth ranking; c) problem ranking; and d) creating a seasonal calendar. These sets of Participatory Rural Appraisal (PRA) techniques were employed [65–67] to gain a thorough understanding of the community's social and physical structures. Social maps and wealth rankings were used in a subjective measure to gain insights into the community's socioeconomic structure from the perspective of the community. Knowledge of the village's physical layout and resource base was acquired through transect walks and observations. Understanding how locals prioritize their difficulties and the problems they experience was made with the help of problem ranking. The temporal dynamics (long-term and intra-annual) of events and the occurrence of activities and phenomena within the research site were shown by the seasonal calendar. To gain a more comprehensive knowledge of food security, livelihoods, and migration at the community and household levels, a mixed-methods approach that includes both sets of PRA methodologies and interviews was used.

The composition of participants involved in the PRA group included people of different socioeconomic statuses, genders, and age groups. The purposive sampling method was applied to select households for the semi-structured interviews. All in all, 42 households were interviewed using a semi-structured questionnaire that had been translated into the local language. The interview included information on food security, the coping mechanisms used in times of food insufficiencies, and means of food acquisition, as well as the livelihoods the interviewees pursued and their implications. Hence, not less than 11 households were purposively selected from each community, and these households were verified and interviewed after the community-based discussions (Table 1).

The household food-security level was assessed using household food-insecurity access scale (HFIAS) scores based on self-reported parameters (See Table 2). Their food-security status was categorized as either food-secure, mildly food-insecure, moderately food-insecure, and severely food-insecure based on the scored values. Based on the commonly agreed assessment measure established by Coates et al. [68], households who are food-secure were scored between 0 and 1, those mildly food-insecure between 2 and 7, moderately food-insecure between 8 and 11, and severely food-insecure 12–27.

Table 1
Sample households in the three villages.

Villages	No. of households	Sampled households
Gueguna	680	18
Mueguma	615	13
Takot	585	11
Total	1880	42

Table 2
Household food-insecurity access scale questions.

Item number	Question
Q1	Did you worry that your household would not have enough food due to a lack of resources?
Q2	Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
Q3	Did you or any household member have to eat a limited variety of foods due to a lack of resources?
Q4	Did you or any household member have to eat some foods that you did not want to eat because of a lack of resources to obtain other types of food?
Q5	Did you or any household member eat a smaller meal than you felt you needed because there was not enough food?
Q6	Did you or any household member eat fewer meals in a day because there was not enough food?
Q7	Was there ever no food at all in your household because there were no resources to get more?
Q8	Did you or any household member go to sleep at night hungry because there was not enough food?
Q9	Did you or any household member go a whole day without eating because there was not enough food?

The data collected from the PRA are noted and discussed then transcribed and summarized. The data obtained from household interviews were collected through handwritten note-taking during the interview and minutes after the interview, then transcribed and transferred into Word document files. The PRA and household records were transcribed from the local language (Tigrigna) used during the fieldwork into an English version. Data cleaning, coding, and restructuring were done for effective analysis. The quantifiable information in the semi-structured interviews was analyzed with descriptive statistics.

Results and discussion

Household characteristics and migration experience of households

Out of 42 households interviewed, 4 of whom were female-headed households. The age of the interviewees ranged from 38 to 80 years of age with an average of 60.8 years and the average family size was 5 (Table 3). The interviewed households owned an average of 0.55 hectares of farmland. Concerning educational level, 31 of the households did not attend formal schooling, 9 of them could read and write, and 2 interviewees had attended elementary level. The household sample covers a wide range of migration patterns: out of all 12 households had both internal and international migrants, 9 households had international migrants, 6 had international migrants, 5 households had members who had internal migrants only, 6 had no migration experience, and 4 had members with failed migration experiences (Table 3). In Takot and Mueguma for example, internal migration was not well reported in household surveys (Table 3). This result implies that the majority of people in the area are being reported to be migrants, both internal and international, but an international migration is reported to be much more common. Some studies have revealed similar findings in other parts of the world, including Nigeria [69,70], Somalia [71], India [72,73], and other countries in Latin America [74].

Livelihoods profile

A wide range of income-generating activities takes place in the studied area. Households pursue their livelihoods using a single strategy or a combination thereof. Agriculture (crop-livestock mixed farming), off-farm and non-farm activities such as dairy, poultry, beekeeping, daily labor earnings, minor trading, handicrafts, rent from assets, and retirement benefits as well as migration are

Table 3
Characteristics of sample households (HH).

Households characteristics	Villages			Total
	Gueguna	Takot	Mueguma	
Households interviewed	18	13	11	42
Female interview	8	2	3	13
Average household family size	5.	5.	5	5
Average farm size	0.6	0.5	0.57	0.55
Marital status				
Married	15	10	12	37
Widowed	3	1	1	5
Average schooling				
no formal schooling	10	11	10	31
Read and write	8	1	–	9
6–9	–	1	1	2
Migration experience of households				
Returnee International migration	–	4	2	6
International migration	2	4	3	9
Internal and international migration	6	3	3	12
Internal migration	5	–	–	5
No migration	4	1	1	6
Failed migration	1	1	2	4

Source: own survey (2018).

commonly used strategies (Table 4).

The results of the household interviews and the discussions with community members suggest that farming is the primary source of income in the study region. However, land is extremely scarce in the community, and the majority of the surveyed households (67%) owned an average of 0.5 hectares of land, while 21.4% of them owned 0.75 hectares, 9.5% of the households owned 1 hectare, and the remaining 2.4% of the households owned 0.25 hectares (Table 4). This data makes it clear that land ownership among the locals is practically limited across the villages. Farmers in the area cultivate mainly cereal crops such as wheat, barley, maize, and sorghum, which are the main staple-food crops. They also produce a variety of animals, including small ruminants (sheep, goats), poultry, and cattle for use in farming, trade, and domestic use. Participants stated that regardless of the size of the farm plot, agriculture is the primary source of livelihood in the study society, having both direct and indirect effects on the households' incomes.

All of the households that took part in the survey were engaged in agriculture, and they all cited agricultural production as the main source of livelihood, particularly for self-consumption and nutritional well-being, producing seed for the upcoming season, and selling and exchanging non-processed crops in the market, depending on the needs of the household. In addition, cereal crops are commonly used in various social activities like wedding parties, religious events, memorial ceremonies, and other occasions. In 8 households, farming is the only source of revenue to sustain their well-being. Four of the households had experienced failed attempts at migration, three had no migrants, and one had four internal migrants who made no contributions to the family back home due to poor living conditions following migration.

While farming is the main source of livelihood, people in the study area are also engaged in several off-farm and non-farm activities. For instance, petty trading is one of the local non-farm income sources, and 10 households pursue this activity, of which one family has no migration experience. From Table 3, it is noticeable that small-scale dairy and beekeeping were used by 3 households each for both cash generation and consumption. Urban house rent was a source of income for 4 households, while daily labor was another means of earning in 4 households, 2 of which had with migration, one households each had failed and no migration. Besides these activities, retirement allowance, poultry-keeping, selling handicrafts, and collecting rent from the hiring-out of a car were reported by single households as ways they earned an income. This shows that migrant-sending households are more likely to engage in non-farm local activities than non-migrant-sending households or those with failed migration experience, because of the remittance flow back home [75,76].

Apart from farming activities and local non-farm activities, migration and remittance is one source of income for the villagers. Based on the PRA on migration, both internal and international migration are widespread phenomena. People are migrating throughout the year and the number of migrants is increasing over time. Results from the PRA discussions and interviews show how migration is an important feature of households' livelihood strategies for households. The households viewed migration as one way of diversifying their livelihood strategies, mainly to reduce financial risk and maximize income through the flow of remittances. The majority of the households (27 out of the 42 interviewed households) with migratory family members acknowledged remittances as one source of income, regardless of the amount, and used them for a variety of purposes based on household needs including consumption. Nearly all households that received remittances used their money primarily for direct purchases of consumable items. Remittances play a great role in helping people to access food until the next harvest, especially in circumstances of environmental stress like drought in which crop and livestock production fall. Furthermore, results from the households revealed how migration affects investments and products through direct and indirect income-decision effects. Ten households were able to implement alternative economic strategies by diversifying their sources of income, and other households confirmed the significance of remittances in supplying inputs to local agricultural production in the form of better seeds, fertilizers, pesticides, and oxen. Households who used remittances to buy oxen remarked how helpful it is to coordinate plowing, which boosts agricultural output and improves household food security.

Moreover, households said they used their remittances on things like stationery, education, medicine, and health insurance that help improve human capital and treat the sicknesses of their family members. As a result, migration through the flow of remittances is a critical coping and adaptive-livelihood strategy in the region, having both short- and long-term effects. The majority of migrant-

Table 4
Households source of livelihood.

Source of livelihood		Households with migration	Households w/o migration	Households with failed migration	Total
Agriculture	Farming	32	6	4	42
Local off-farm and non-farm activities	Petty trading	9	1		10
	Daily labor Wage	2	1	1	4
	Beekeeping	3			3
	Dairy	5			5
	Poultry	1			1
	House rent Income	4			4
	Retirement Allowance	1			1
	Handicrafts	1			1
	Car rent income	1			1
Remittance		27			27

Source: own survey (2018); $n = 42$ households.

sending households use remittances to purchase consumable goods in the short term, especially when livelihoods are lost and crops fail due to drought or other associated causes. Remittances in this situation are not a choice but rather the last resort for some households to address food emergencies. Migration and remittances, on the other hand, are seen as adaptive tools with long-term implications in that they assist households in diversifying their sources of income and enhancing their general well-being. Previous studies have reported similar findings that migration and remittance are among the main means of livelihood in Tigray [24,77,78], in Thailand [79, 80], in India [51,73] and other parts of the globe [53,81].

Households' food security, coping strategies, and food acquisition

The results from PRA, particularly the seasonal calendar, show that food availability has been and continues to be a longstanding issue of concern in the community. Ethiopia has four seasons each year, and low availability of staple food crops was reported from late spring to early autumn. The months of greatest food inadequacy was reported from May to September, corresponding to the pre-harvest season almost every year in the region. The majority of households were unable to grow enough produce to feed the family for the entire year, especially for those which owned less land, were female-headed, or had no access to oxen or manpower. During the dry season, cactus fruit has played a vital role both for consumption and for cash. In times of food scarcity, the villagers have had to apply various coping strategies, including adjusting consumption patterns (e.g. portion size reduction, consumption of less-preferred food), selling assets, earning a daily labor wage, and receiving remittance (Table 5).

Households were assessed regarding their food-security status based on self-reported parameters by being asked whether they experienced inadequacy or unavailability of food, and whether they felt anxious if they had run out of certain food items earlier during the data-collection period. Food security of the households was assessed using HFIAS and characterized into four categories; food-secure, mildly food-insecure, moderately food-insecure, and severely food-insecure. The food security of the households is highly associated with access to assets such as land, livestock and plants; access to credit; access to irrigation; type and diversity of livelihood strategies employed; access to income; family size and number of active family members; age and gender of the household's head, and social capital. Those factors determine households' individual production abilities, which affect their livelihood outcomes, including food security.

As the score from the HFIAS in Fig. 2 shows, the food-security situation of the majority of households (27) was moderate to severe, whereas 15 households were mild to food secure. These severe foods in secure households are those who own low asset endowment, female-headed households or no/less capable personnel, large family sizes with more dependent members, no additional income other than farming, or confined to low-income activities. With regard to migration experience; the figure shows households with failed migration and no migration experience were more likely to be less food secured. Similar results have been reported [24] that households with access to remittance have lower HFIAS scores than households with no remittance income which shows a positive effect of remittance on household food security. The current result shows an average HFIAS score 9.1 which means moderately food insecure and the time when the data was collected was during hunger season which is similar result as reported in Vaitla et al. [82], which showed an average food insecurity status from mild to moderate. The result further shows households that characterized by better resource base, diversified livelihoods, better socioeconomic status, male and younger aged active head, access to additional income or remittance are tend to be more food-secure; mildly food-insecure and food-secure. Whereas those who are landless and land-scarce tend to be more vulnerable to food insecurity. Food insecurity varied by land size, as a greater proportion of landless households faced food insecurity compared with households with more farmland [51].

The sample households adopted a diversity of coping strategies in response to food insecurity, categorizing consumption coping strategies in two steps: in the initial stage of food insufficiency, and during serious or extended periods of food shortage. The range of

Table 5
Coping strategies applied by households that do not have enough food or money to buy food.

Coping strategies	All households		Households with migrants		Households with failed migration		Households w/o migrants	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
First-phase								
Shift to less-preferred/cheaper foods	23	54.8	19	59.4			4	66.7
Consumption of the same variety of food	25	59.5	25	78.1			–	
Reducing portion size of food	6	14.3	2	6.3	3	75	1	16.7
Asking for remittance to purchase food	9	21.4	9	28.1			–	–
Selling assets to buy food	2	4.8	1	3.1	1	25	–	–
Working daily labor	2	4.8	1	3.1			1	16.7
Borrowing money or grain from neighbors / relatives	1	2.4	–	0			1	16.7
Second-phase								
Reducing food portion size	5	11.9	1	3.1			4	66.7
Priority for children	1	2.4	–				1	16.7
Borrow money, grain, */injera* from relatives	6	14.3	4	12.5			2	33.3
Reduce frequency of eating/merging meals	3	7.1	1	3.1			2	33.3
Technical reduction of food portion size (changing the consistency of food)	3	7.1	3	9.4			–	–
Asking for remittance	15	35.7	15	46.9			–	–
Maternal buffering	1	2.4	1	3.1			–	-

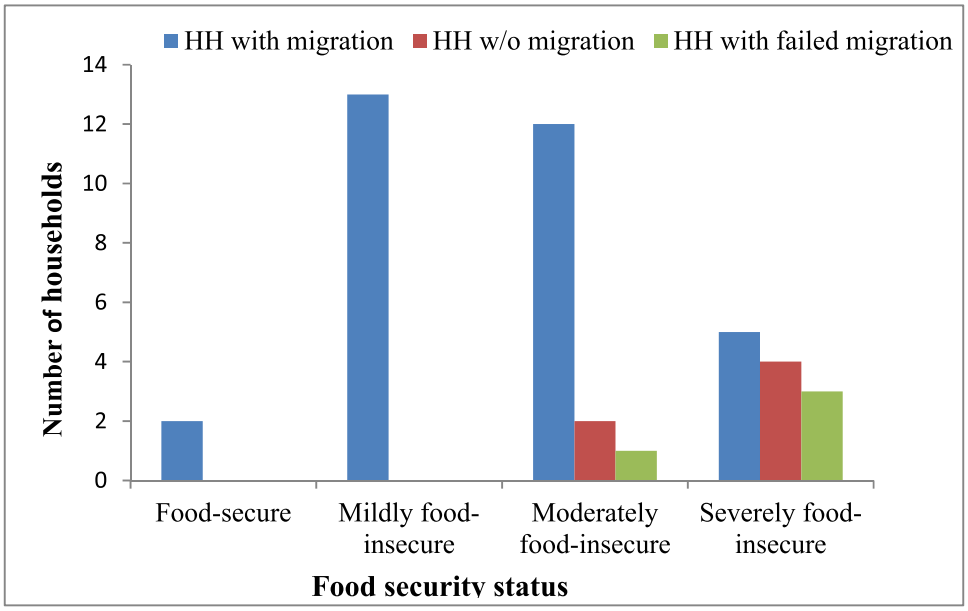

Fig. 2. Food-security status of sample households.

strategies applied by sample households to cope with food stress is presented in Table 5.

Households use one strategy or a combination to cope with food stress. During the first stage of food insufficiency, they applied adjustable coping strategies. Among these consumptions of the same variety of food is the most commonly used 25 (59.5% followed by shifting to less-preferred food /eating cheaper foods 23 (54.8%). Asking family members for remittance to purchase food and reducing the portion size of food are the third 9 (21.4%) and fourth 6 (14.3%) strategies applied by the households respectively. Selling assets and engaging in daily wage labor was applied by 2 households, and borrowing money or grain from others was mentioned by one household (Table 5). However, when the food-crisis period becomes extended, coping choices are exhausted and food insecurity worsens. Reducing food portion size was witnessed in 5 (11.9%) of all households where majority of them are households with no migrants. Asking for remittance was witnessed common strategy in households with migrants 15 (46.9%)), borrowing money, grain or *injera* – a common food in Ethiopia was used in 6 (14.3%) of all households while merging meal time, technical reduction of food portion size (changing the consistency of food, i.e. making portions more thinner) and mother buffering were also applied in few households when the first stage of coping mechanisms became inadequate or unsustainable. Households reported the second phase of coping mechanisms influences the food intake quantitatively, and stated that such strategies were not a choice but the last option that the households have to ensure their survival. These results further indicate that households with no migrants had likely limited choices to access required food; consumed less in terms of quantity, and/or consumed food of poorer quality, less-preferred food, and a more limited variety of food than normal compared to households with migrants who use remittance as alternatives. Therefore, their food-security level can be considered severe. The severity of food insecurity can be judged as acute food insecurity when the population applied marginal or unsustainable strategies to deal with food insecurity that are unhealthy for life [60]. "Coping" means acting to survive within the existing rule systems [83], while coping behaviors are applied during food stress as it influences food security status in addition to the food type adopted [32].

Besides these, there are some other coping strategies and means of food acquisition that women used in the study areas. For example, one old woman during a group discussion said that many years ago, "mothers occasionally used to intentionally provide foods with more salt to their family members to make them feel thirsty, to make them want to drink more water after consumption and stay with a full stomach for the remaining hours". Similarly, providing roasted barley, wheat, or maize for snacks during evenings was mentioned as another technique to make family members drink more water so their stomachs feel full, which helps to reduce the feeling of hunger and the desire to consume more food. Adding a greater proportion of water to milk to distribute it to all members of the family was another way mothers deal with reduced access to food. All these strategies have been used during bad seasons to suppress appetite by taking up space in the stomach. Households that pursued diversified income sources were less likely to experience the second stage of coping strategies, but these were commonly used means in vulnerable households. One successful returnee migrant, who is currently experiencing better living conditions, explained his feelings about how hard the past times were: "We sold all of our stocks and left nothing, for the sake of purchasing food. Seeing children while starving was the worst; borrowing money or *enjera* from neighbors was not easy; it is also bad to skip the time of meal while we want to eat." He further stated, "I still remember that I had skipped many meals but we used to use all those mechanisms as the last choice for existence during that hard time". This food-security analysis was done before the breakout of COVID-19 and war in the study region, both of which have had a detrimental effect on the nation's overall food security. Through the interruptions in the food-supply chain and the general inability of social-security programming to address the losses caused by the epidemic, particularly to those in vulnerable regions and groups, with Tigray among the

most impacted regions [84]. Besides, the current conflict, which is framed as a purposeful attempt to starve the entire population and is aimed at destroying Tigray's economic foundation in particular, the state of the agricultural sector affects the food-security situation [63,85]. Thus, food supply-chain interruptions, local production losses, and restrictions on non-farm livelihood activities are among the causes of the conflict that has decreased households' access to food [86]. As a result, 83% of Tigray's population experiences food insecurity, with over 40% experiencing a severe food shortage [87].

Households reported different means of food acquisition (Fig. 3) where agriculture is the main source of food production for the majority of the participants. The result shows almost all households (42 households; 62% of the total) obtained most of their foodstuffs from their production and through purchases from the market. Additionally, safety-net assistance and food remittance are among the means of food acquisition for 29% and 9% of the households respectively (Fig. 3). The majority of the safety-net recipients are households who have no or failed migration experience, are female-headed, solely depend on farming (in most cases, sharecropping), have no or reduced asset base, have scarce land holding, and have a large number of family members. A few households who have migrant members in nearby places confirmed that they were receiving remittances in various forms, such as flour, sugar, coffee, oil, and other food and non-food items. This reveals how food remittances are supportive of the food-security situation of their households. Food-remittance-recipient households mentioned that beyond the food remittances and material transfers, personal visits and interactions with the migrant members also play a vital role in strengthening strong linkage and ties between the household members. On the other hand, a greater number of households with limited livelihoods obtained their food from safety-net assistance.

Food security and migration/remittance

In Tigray, farmers mostly depend on a single annual crop season called the Kiremt season, and rarely on the Belg season, which has erratic rainfall patterns and has a significant impact on farm output. For the vast number of villagers, especially vulnerable households who solely depend on the fragmented farmland for their livelihoods, food insecurity is very high, especially during the dry season. Consequently, it is difficult for many houses to provide food for their families. For many of the villagers, migration and remittance are essential components of livelihood and food-security strategies.

The results from this study show that remittance is useful for addressing both short- and long-term issues with food security. Households employ remittances in the short term to address food insufficiencies, medical needs, and other urgent household priorities. For instance, from interview results, 15 of the 26 households that verified using remittances to buy consumable items used this strategy as a last resort to deal with severe food shortages and meet their consumption needs until the following harvest season. This show that remittance is one mechanism households used to deal with food insufficiency. Purchasing food is a significant use of remittances in both rural and urban migrant-sending households in the Global South [88]. Similar statements regarding the significance of remittances on the food security of families at home were made in cases from Nepal [89], Nigeria [90], and Upper Ghana [91]. A few households have reported receiving food remittances from migrant family members, particularly internal migrants who moved to nearby locations, as another type of migration input to the household's food security. This demonstrates that internal migrants are likely to make regular visits and send money home in the form of food and non-food products. Besides, the reduction of the number of family members was also mentioned as another positive output of migration with regard to household food insufficiencies. Seven households reported that the reduction in family size through migration helped them to decrease the number of mouths to feed, which helped them to consume diets of greater quantity and better quality. A case study from Nigeria by Mbah et al. [92] found that a reduction in the number of mouths to feed is a major effect of rural-urban migration among farm families. Grace et al. [93] came to a similar conclusion, arguing that it is important to take advantage of every opportunity to externalize the cost of consumption during a food crisis so that there are fewer mouths to feed.

Beyond the short-term strategies used to deal with food inaccessibility, remittance was found to have crucial implications for household food security in the long run. The importance of migration extends beyond the short-term implications of food consumption. Households who are able to invest remittances in diversified means of income and promote local food production through accessing farm-related inputs reported the positive impact of remittance on their food security in the long term. This implies that the utilization of remittances to enhance income and boost food production likely contributes to a better food supply than those who use it for immediate consumption. As Akçay and Karasoy [94] found, the flow of remittances can increase the ability of the household to deal with stress and reduce its vulnerability to food insecurity. Some studies have further shown that the role of remittances for food

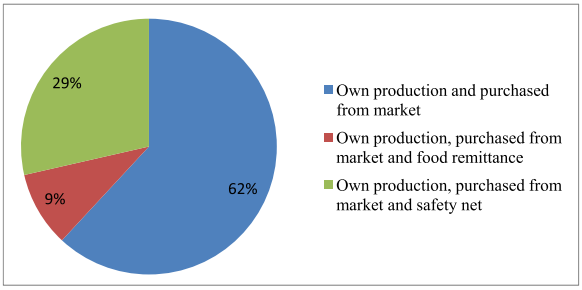

Fig. 3. Household food acquisition.

security is particularly significant during food-price shocks [24,53,95,96]. Choithani [51] comes to a similar conclusion from a case study from rural North India, where remittances are linked to a higher level of household food security. These pieces of evidence have revealed a positive relationship between remittance and the well-being of migrant-sending households in rural households of developing countries [52,97].

Conclusion

This study assessed household food security qualitatively using self-reported parameters that address the inadequacy, insufficiency, and anxiety/worries about inaccessibility of food by ascription of HFIAS scores and identification of coping behaviors during periods of food stress, arguing that the subjective dimension of food security has not previously received much attention in the food-security literature. The major objectives of this paper are to assess household food security and livelihood strategies and to understand the role of migration in response to food insecurity. The research questions and objectives achieved the main focus of the study. The results showed that the food-security situation in the study area is mildly food-insecure. Households employed diversified coping strategies when livelihoods and food production collapsed and food insufficiency worsened. Various strategies were applied, including adjustments in consumption, which may involve e.g. consumption of the same variety of food, shifting to less-preferred food /eating cheaper foods, asking migrant family members for remittance to purchase food, reducing the portion size of food, selling assets, doing daily wage labor, or borrowing money or grain from neighbors. Employing more extreme and exhausting coping strategies that affect the food intake quantitatively was also an option when food insecurity worsened, though these are life-damaging strategies that can lead to starvation and death.

What is obvious from this study is that rural households apply one strategy or a combination of strategies to pursue their livelihoods where subsistence agriculture is the basic source of livelihood, with direct and indirect implications for the households' economy. Therefore, the empirical evidence from this present study could be vital to stakeholders who engaged in food-security policies and strategies to alleviate hunger. However, since agricultural activities are seasonal and take place in contexts of environmental uncertainty that are subjected to natural hazards such as drought, pests, flooding, environmental degradation, livestock, and crop diseases, the overall livelihoods deteriorate. In the presence of land fragmentation, rainfed farming is not enough to fulfill consumption needs and improve the food security of farming households. Households with diversified livelihoods were likely to be more food-secure than those which engaged solely in subsistence farming. The study further found out that households' asset base, such as land holding and stock ownership, access to small-scale irrigation, additional incomes, remittance, credit packages, age, and sex of the household head, also determines their food security. Therefore, the major finding from this study is that it is crucial to consider a livelihoods perspective when assessing food security, since the latter is an outcome of livelihoods, and because encouraging the diversification of livelihoods tends to reduce risks, which helps to make consumption and income more stable. Hence, food security would recognize if the overall livelihood has been addressed. The results further showed that migration and remittance are integral parts of households' livelihoods both as adaptive and coping strategies, making a valuable contribution to their livelihoods as well as their food security by increasing their ability to directly purchase food during times of food stress. In the long term, remittances invested in diversifying livelihoods for better earnings enable households to improve their food and livelihood security permanently. Thus, the households who are receiving remittances are less food-insecure, and the likelihood that they will have to employ unhealthy coping strategies is lower in comparison to those who have no source of remittance. Therefore, when considering migration and remittance as one central part of rural households' livelihoods and food-security strategies, it would be better to create awareness and enhance capabilities for migrant-sending households to adopt changes over time that transforming remittance as a coping strategy to remittance as a deliberate adaptation strategy by which they permanently generate some sort of earning, rather than employing it as a short-term response to the food crisis. In addition to people's adaptation strategies, the issue of food security needs urgent support, in terms of both short- and long-term strategies and policies, in cooperation by governmental and non-government organizations, particularly during the crisis to ensure food security.

Declaration of Competing Interest

The authors declare no competing interests.

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Data availability statement

The data will be available upon request.

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