

American University in Cairo

## AUC Knowledge Fountain

---

Faculty Journal Articles

---

10-17-2022

### A gender approach to time and food security: a case study of Egypt

Noha E. ElKhorazaty

Hassan H. M. Zaky

Follow this and additional works at: [https://fount.aucegypt.edu/faculty\\_journal\\_articles](https://fount.aucegypt.edu/faculty_journal_articles)

---

#### Recommended Citation

##### APA Citation

ElKhorazaty, N. & Zaky, H. (2022). A gender approach to time and food security: a case study of Egypt. *Discover Sustainability*, 3, 10.1007/s43621-022-00102-w  
[https://fount.aucegypt.edu/faculty\\_journal\\_articles/5590](https://fount.aucegypt.edu/faculty_journal_articles/5590)

##### MLA Citation

ElKhorazaty, Noha E., et al. "A gender approach to time and food security: a case study of Egypt." *Discover Sustainability*, vol. 3, 2022,  
[https://fount.aucegypt.edu/faculty\\_journal\\_articles/5590](https://fount.aucegypt.edu/faculty_journal_articles/5590)

This Research Article is brought to you for free and open access by AUC Knowledge Fountain. It has been accepted for inclusion in Faculty Journal Articles by an authorized administrator of AUC Knowledge Fountain. For more information, please contact [fountadmin@aucegypt.edu](mailto:fountadmin@aucegypt.edu).

Research

## A gender approach to time and food security: a case study of Egypt

Noha E. ElKhorazaty<sup>1</sup> · Hassan H. M. Zaky<sup>2</sup>

Received: 15 June 2022 / Accepted: 23 September 2022

Published online: 17 October 2022

© The Author(s) 2022 [OPEN](#)

### Abstract

Women's subsistence contribution to household food security is undeniable. However, due to the dominance of capital bias in most labour economies, rural women in particular lack agency to improve capacity and access to resources and opportunities, and they need to be more productive. This knowledge gap is the subject of many studies on sustainable agricultural development and gender equity. Although the consensus necessitates policy interventions targeting the gender gap in agriculture resources, not enough research has been dedicated to quantifying the importance of women subsistence agricultural labour within the Egyptian national context. This article seeks to statistically analyse women's role in subsistence agriculture, estimated by a national time-use survey conducted in 2018 in Egypt. The goal is to highlight their capacity to contribute to food and nutrition security and quantify the real impact of rural women's subsistence agriculture labour on rural household food security versus that of rural men. This will contribute to the debate that investigating rural women in agriculture promotes rural community sustainability and highlights their capacity for agricultural production.

### Highlights

1. Egyptian rural women work significantly longer hours than men in total subsistence labor, shouldering most of the nonagricultural subsistence labor.
2. Although more rural women are engaged in agricultural subsistence labor tasks compared to men, rural men who confirm their involvement in subsistence labor spend significantly more time agricultural subsistence than women.
3. However, the impact of hours spent in subsistence agriculture by women in the household on the probability of their household's food security was higher than that of men.

**Keywords** Women · Agriculture · Subsistence Labour · ELMPS 2018 · Egypt · Household Food Security

### Abstract

Women's subsistence contribution to household food security is undeniable. However, due to the dominance of capital bias in most labour economies, rural women in particular lack agency to improve capacity and access to resources and opportunities, and they need to be more productive. This knowledge gap is the subject of many studies on sustainable agricultural development and gender equity. Although the consensus necessitates policy interventions targeting the gender gap in agriculture resources, not enough research has been dedicated to quantifying the importance of women

✉ Hassan H. M. Zaky, [hzaky@aucegypt.edu](mailto:hzaky@aucegypt.edu) | <sup>1</sup>Population Council Egypt Office, Cairo, Egypt. <sup>2</sup>Department of Psychology in the School of Humanities and Social Sciences, and Research Scholar, Social Research Centre, The American University in Cairo, Cairo, Egypt.



subsistence agricultural labour within the Egyptian national context. This article seeks to statistically analyse women's role in subsistence agriculture, estimated by a national time-use survey conducted in 2018 in Egypt. The goal is to highlight their capacity to contribute to food and nutrition security and quantify the real impact of rural women's subsistence agriculture labour on rural household food security versus that of rural men. This will contribute to the debate that investigating rural women in agriculture promotes rural community sustainability and highlights their capacity for agricultural production.

## Highlights

1. Egyptian rural women work significantly longer hours than men in total subsistence labor, shouldering most of the nonagricultural subsistence labor.
2. Although more rural women are engaged in agricultural subsistence labor tasks compared to men, rural men who confirm their involvement in subsistence labor spend significantly more time agricultural subsistence than women.
3. However, the impact of hours spent in subsistence agriculture by women in the household on the probability of their household's food security was higher than that of men.

**Keywords** Women · Agriculture · Subsistence Labour · ELMPS 2018 · Egypt · Household Food Security

## 1 Introduction

Women's subsistence contributions include a large amount of time and effort—essentially work—that is not adequately valued as labor in most national economies. Accordingly, their real contribution is often underestimated in gross national calculations [19]. Drawing on the capital bias described by Federici [9], systematic measures of labor are often biased in favor of production for the market and direct contribution to the Gross National Product of a state. Hence, what is categorized under 'housework' or 'domestic responsibility' is still not considered by many as 'real work' [9]. Subsistence labor for the needs of their respective families, which includes the unpaid household duties that women shoulder, such as child care, cooking, and cleaning, as well as drudgery labor, such as fetching fuelwood and water common in developing countries, is not only underestimated in national economies but also reflects the failures of a state's public services and welfare system [20]. In this paper, we will provide quantified evidence on the value of rural women's subsistence agricultural labor on the food security of their households to advocate the potential outcomes of empowerment initiatives for women in agricultural production.

Subsistence agricultural labor<sup>1</sup> in developing countries is a protuberant feature of most rural traditions and rural livelihoods. Subsistence agricultural labor is generally assumed to be taken on by women in rural households to produce and farm food for their family's consumption [13]. Thus, the term 'subsistence farming' or 'subsistence agriculture' is widely associated with women's agriculture and is often categorized under household responsibility and not real work [9]. This status effectively limits women's time for other typical forms of income-generating economic activities [10]. This form of social reproduction in gender roles is focal to the continued underestimation of women's agriculture activities in labor force statistics because women and others are less likely to define subsistence activities as agriculture work despite working longer hours than men [7]. The implications of this have led to the marginalization of women in the agriculture development process, which includes unequal benefits, rights, protection, and space for political participation [19]. Despite the fact that the latest international statistics show that women account for almost half of the agricultural labor force, constituting 43% of the agricultural labor force in developing countries [7, p.22], archaic gender norms impede the development of the sector and threaten the sustainability of national food security systems [3].

Throughout history, women in agriculture have been consistently confined by colonists and subsequently in modern times by developers to a gendered division of labor based on women's subordination to men. This included unpaid labor to assist the men in the cultivation of commercial cash crops. To date, women continue to be the primary subsistence farmers despite the commitment of contemporary independent governments to economic development along

<sup>1</sup> Subsistence Agriculture or Farming "a form of farming in which nearly all of the crops or livestock raised are used to maintain the farmer's family, leaving little, if any, surplus for sale or trade" (Britannica, 2020).

capitalist means. While in reality, many scholars in humanitarian fields contribute the work of women in subsistence farming to reproducing cheap labor for international capitalism by 'liberating' male workers to be employed in the waged work for the cultivation of cash crops. On the other hand, subsistence agriculture has also undoubtedly played a vital role in pressuring for fair treatment and better work conditions, supporting waged workers during times of conflict in labor strikes and political protests. This theory highlights the strategic importance of rural women's access to land and agricultural resources for their communities and, consequently, the capitalist schemes of companies and governments. The means to cultivate crops and other agriculture practices, even in urban centers, allow the maintenance of a degree of autonomy from the market [9].

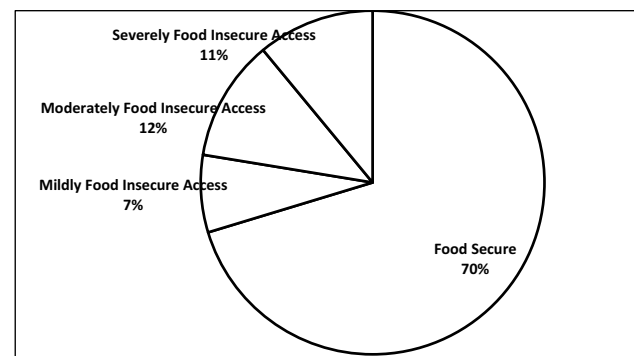
However, despite the importance of subsistence farming for rural wellbeing and sustainability, especially in Africa and Asia, where most of the world's population lives, it is very difficult to measure. The most obvious reason is the fact that many women themselves do not describe it as work, as it is unwaged work and often is not done on a formal farm. Second, the definitions used internationally to monitor labor participation statistics have previously failed to sufficiently capture women's real contribution to the national economy. As noted by an FAO publication [8], discrepancies exist in national surveys to capture women's real contribution to the national economy in Pakistan. Pakistani women's labor force participation varied from 3% according to their 1981 Population Census to 12% according to the 1981 Labor Force Survey, while the 1980 Agriculture Census estimated that 73% of women in agriculture households were economically active [8]. Moreover, in their subsequent 1990/91 Labor Force Survey, women's economic contribution ranged from 7% using the conventional questionnaire and 31% with questions on specific activities typically considering the domestic responsibilities of women, such as transplanting rice, picking cotton, grinding, drying seeds and tending livestock [8]. As such, research scholars have sought time-use surveys as an adequate measurement approach to estimate the labor force, in which the frequency and duration of each activity were recorded [15].

In the context of agricultural development, most of the focus has been on men as the typical image of rural farmers. Little evidence in the Middle East and North Africa (MENA) is available to compare the impact of initiatives targeting the empowerment of rural women in agriculture. A 2017 rapid impact assessment report observed the gender equity outcome of several Active Labour Market Programmes (ALMPs) in rural communities in the MENA region (namely, programs in Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Somalia, Syria, Tunisia, United Arab Emirates, West Bank and Gaza, and Yemen). The assessment shows that while programs in Egypt, Jordan, Morocco and Tunisia were mainly focused on skills training, this approach had positive short-term effects on women's self-esteem and entrepreneurial attitudes. Microfinance programs appear to have positive short-run effects on established businesses. The assessment concludes that gender aspects must be included when designing ALMPs. This includes planning for aversion to barriers to female labor market participation and program take-up. Finally, to assess the actual impact of these programs, empowerment measures must be taken into consideration, such as gender parity, time use, work-life balance and decision-making abilities within and outside the household [1].

Specific to the Egyptian context, there is not enough information to support gender inclusive policies for the sustainability of the agriculture sector. "Egypt Sustainable Agricultural Development Strategy towards 2030 (SADS) (2010–2030)" and "National Strategy for the Empowerment of Egyptian Women 2030" were reviewed to reflect Egypt's political commitment to the autonomy of women's in agriculture. SADS emphasizes the roles of women in agriculture and rural development under policies to improve the livelihood of rural inhabitants. It also mentions the importance of strengthening the role of women in agricultural development through media campaigns promoting the role of women, consolidating all the entities working for rural women, and stimulating institutional support to implement the proposed policy. However, the sole national program dedicated to women in the strategy appears less focused on agricultural production and centers on improving rural living conditions of rural women and their participation in the different activities [14]. Similarly, very few provisions related to agriculture and rural development are included in the National Strategy for the Empowerment of Egyptian Women 2030. Under the economic empowerment pillar, rural women's needs for social insurance and income security were linked to their prevalence in seasonal agriculture workers and temporary paid jobs or unpaid household work. The strategy mentions the role of women in agriculture in coping with environmental risks and climate change by promoting sustainable management of natural resources and organic agriculture [18].

This article will focus on uncovering the true importance of rural women's contribution to agricultural productivity to increase household food security. The analysis here will assess the impact of men versus women subsistence agricultural labor on household food security in Egypt. This will substantiate the potential impact of investing in women on agricultural productivity. The aim is to corroborate evidence to entice development interventions directly targeting gender equality by rebalancing the scales of power and tailoring agriculture development projects sensitive to the contextual gender bias with women [16]. To answer the research question, we analyse the data from the nationally representative

**Fig. 1** Household Food Insecurity Access Scale Score (n=9735, 2018) Source: Calculated by the authors from the data of ELMPS 2018



fourth wave of the Egyptian Labor Market Panel Survey (ELMPS 2018). As a representation of household wellbeing, the analysis will compute the categorization of household food security developed by Coates, Swindale & Bilinsky [2]. The definition of food security by the Food and Agricultural Organization (FAO)<sup>2</sup> is focused on identifying the determinants of household food security [6]. As such, the associated variables under the integral components of Food Security will be derived from a review of empirical research conducted on multiple developing countries by Drammeh, Hamid, and Rohana [5]. The study will quantify women versus men subsistence agricultural labor using a detailed time-use survey of ELMPS 2018. In addition, we attempt to analyse the validity of the generalized hypothesis that women in agriculture are the main subsistence farmers in rural households with contemporary data specific to the Egyptian context. Subsequently, the analysis will expose the significance of women subsistence agricultural labor on the probability of their respective household's food security while controlling for the effect of other influential variables identified in the literature.

## 2 Materials and methods

Gender analyses in agricultural data require the examination of the comparative behaviors of both men and women in agriculture, as well as the context facing both [4]. Thus, the analysis will take into consideration the difference between men and women to quantify the difference in time occupied in subsistence farming among rural inhabitants in Egypt. Additionally, the analysis will test the impact of women subsistence farming on rural household food security as a proxy for household wellbeing and sustainability to substantiate the potential impact of investing in women on agricultural productivity. The analysis will utilize the latest wave of the longitudinal Egypt Labor Market Panel Survey 2018 (ELMPS 2018).<sup>3</sup>

### 2.1 Variable definition

#### 2.1.1 Household food security

Our analysis focuses on a main dependent variable that measures the classification of household food security in the sample over the survey period. The variable Household Food Insecurity Access Scale (HFIAS)<sup>4</sup> is an established indicator

<sup>2</sup> The definition of Food Security by the Food and Agricultural Organization (FAO) is "At the individual, household, national, regional and global levels is achieved, when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." Hence, Food Insecurity "exists when people do not have adequate physical, social or economic access to food as defined above" [6].

<sup>3</sup> The Egypt Labor Market Panel Survey (ELMPS) is a longitudinal periodical survey carried out by the Economic Research Forum (ERF) in cooperation with the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS). The fourth wave was conducted in 2018 follows previous waves in 1998, 2006 and 2012. ELMPS has provided researchers with empirical data on the changes in the Egyptian labor market over the years, as well as many studies on the different dimensions of human development in Egypt [12].

<sup>4</sup> HFIAS is an experience-based scale developed between 2001 and 2006 by the USAID-funded Food and Nutrition Technical Assistance II project (FANTA) in collaboration with Tufts and Cornell Universities, among other partners (Project INDDDEX, 2018). Indicators calculated from the HFIAS module provide detailed data on: *access-related conditions* of the surveyed households; *access-related domains* whether anxiety and uncertainty, insufficient quality, and insufficient food intake; *prevalence* in which households are categorized into 4 main groups ranging from food secure to severely food insecure; and provide an *access scale score* [2].

**Table 1** List of Subsistence agriculture and Non-Agriculture Tasks in ELMPS 2018

---

Subsistence agriculture labor tasks
1. Agriculture work
2. Raise livestock
3. Dairy production
Subsistence non-agriculture labor tasks
4. Making non-food (clothing, baskets)
5. Fetching wood or fuel
6. Collecting water
7. Cooking for family
8. Washing dishes
9. Doing laundry
10. Managing family affairs (paying bills, recoding accounting, purchasing goods and services)
11. Cleaning household
12. Assisting in home construction
13. Shopping for hh (buying food, clothing, and hh needs)
14. Care for elder hh members
15. Care for children

---

of food insecurity in the literature. The ELMPS<sup>5</sup> households were categorized using the definitions of the HFIAS following Coates et al. [2]. As presented in Figure 1 below, seventy percent of rural households in ELMPS2018 were categorized as food secure (70%). These are households that rarely experience some worry about food access, and they do not experience food access restrictions. The remaining 30% of households showed varying degrees of food insecurity.

### 2.1.2 Determinants of household food insecurity

The explanatory variables in the analysis are drawn from the conceptual model developed by Drammeh, Hamid, and Rohana in their 2019 article [5] reviewing the determinants of household food insecurity and its association with child malnutrition in Sub-Saharan Africa. The authors used empirical data from multiple countries in the region to relate several factors under each of the integral components of household food insecurity: availability, accessibility, utilization, and stability<sup>6</sup> [6]. At the forefront of the availability component is farm food production for family needs ‘subsistence agriculture’. Additionally, their research identifies the correlation between food production and several other influential household factors, such as the age and gender of the household head and the education of farmers. Households headed by women, older household heads, and uneducated farmers were more vulnerable to household food insecurity due to hinders food production.

In the ELMPS 2018 dataset, all individuals in the household of labor age (15 to 64 years) were asked approximately 15 separate subsistence labor<sup>7</sup> tasks specific for the needs of their respective families during the week prior to the survey in the form of a time-use survey. Table 1 below lists the tasks asked in the subsistence labor section of the ELMPS survey. The first three signified subsistence agriculture labor tasks, and the remaining twelve were subsistence nonagricultural labor tasks.

<sup>5</sup> In the ELMPS 2018 questionnaire the set of questions specified in HFIAS were included to measure household food insecurity under the section titled “Household Shocks and Coping Means” [17].

<sup>6</sup> The ‘Stability’ component pertains to the consistency of the other three dimensions over time. Under this component, one is considered food insecure even if food intake is adequate today, but inadequate on a periodic basis, thus risking nutritional and health deterioration. Hence, adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) can be detrimental to food security. Although ‘Stability’ is a vital component of the sustainability of household food security and its wellbeing, it would require longitudinal panel analysis which will not be handled in the scope of this thesis.

<sup>7</sup> The subsistence labor variables were initially computed for individuals and then aggregated on the household level. The number of hours each individual dedicated weekly to subsistence labor tasks was calculated by multiplying time in hours each day by the number of days in a week. Individuals who did not partake in the activity were coded “0: zero hours weekly.” In the following step the individual data is aggregated on the household level; by summing the total number of hours all women in each household dedicates to subsistence labor. Then, this step was repeated for the total number of hours all males in each household spends weekly in subsistence labor tasks.

**Table 2** Primary characteristics of rural households in the sample

	Mean	SD	Min	Max	N
<b>Availability</b>					
Age of the household head (in years)	45	15	15	99	9511
<b>Education of household head<sup>8</sup> (%)</b>					
Illiterate	0.347				9511
less than intermediate	0.205				9511
intermediate and above intermediate	0.344				9511
University	0.104				9511
Women in Household in subsistence agricultural labor (count)	0.422	0.063	0	6	9511
Women in Household in subsistence nonagricultural labor (count)	1.21	0.69	0	10	9511
Men in Household in subsistence agricultural labor (count)	0.16	0.47	0	5	9511
Men in Household in subsistence nonagricultural labor (count)	0.45	0.64	0	5	9511
<b>Accessibility</b>					
Household size (count)	4	1.9	1	25	9511
Household members in labor age (count)	3	1.76	0	18	9511
<b>Utilization</b>					
Household head is a woman (%)	0.186				9511

Source: Calculated by the authors from the data of ELMPS 2018

## 2.2 Sample properties

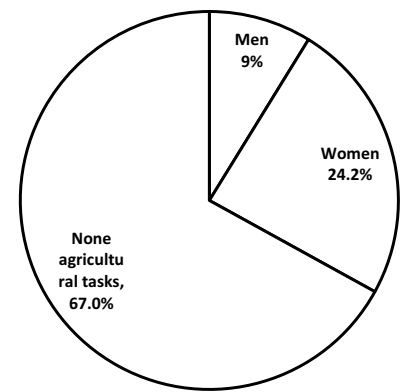
Table 2 presents a summary of the main statistics of the sample households and subsistence labor divided as referenced in the conceptual framework of the determinants of household food insecurity. In the framework, the characteristics of the household were important in identifying the probability of household food security. The sample shows that household heads are typically middle aged, with an average age of 44 years and limited access to formal education, as 35% are illiterate and 21% did not complete the preparatory education stage (less than intermediate). The average household in the sample has approximately four members, of which approximately three are of working age (15 to 64 years of age). In terms of subsistence labor, the variable is separated by gender and type among all households in the sample. Among all households, the average number of women engaged in subsistence agricultural labor exceeded that of men in the household, with 0.4 women compared to 0.16 men.

## 2.3 Statistical methods

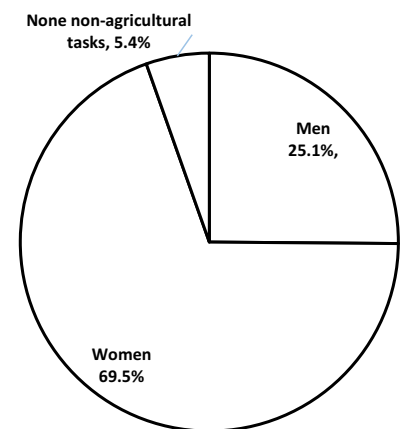
The analysis conducted in the research utilizes different statistical tools for descriptive and inferential analysis. Assessment of independent relationship between two categorical variables will be measured using Pearson's Chi-Squared test for independence. The measure will be used to convey whether the differences between the responses of the two independent samples were statistically significant at the 95% level of confidence ( $p$  value  $< 0.05$ ). Student's  $t$  test for independent samples ( $t$  test) is an inferential statistical tool to determine whether there is a significant difference between the means of two independent groups. The level of probability (alpha or level of significance or  $p$  value) signifies the willingness to accept a significant difference between the means before we collect data. The commonly used value is ( $p$  value  $< 0.05$ ) or (95% confidence level). The  $t$  test for independent samples will be used to identify whether there is a significant difference in the weekly mean hours in subsistence labor between men and women. Since the samples (men and women) have different numbers of subjects, unequal variance is assumed. Finally, logistic regression is the inferential tool used to control for the other factors that have been empirically proven to impact household food insecurity.

<sup>8</sup> Less than an intermediate level of education ranges from those able to at least read and write, primary stage, up to preparatory stage of education. The intermediate and above intermediate level pertain to the general secondary or Azhari secondary, 3 or 5-year technical secondary schooling, and middle (vocational) institute.

**Fig. 2** Gender distribution of Agricultural Subsistence labor among rural individuals by labor age occupied in Subsistence labor.(n = 16,124, ELMPS 2018)\*



**Fig. 3** Gender distribution of Non-Agricultural Subsistence labor among rural individuals by labor age occupied in Subsistence labor.(n = 16,124, ELMPS 2018)\*



### 3 Results

#### 3.1 Gendered subsistence labor among rural individuals

As mentioned above, this article seeks to highlight rural women's subsistence agriculture labor, as well as the nonagricultural domestic responsibilities women shoulder on the wellbeing of their respective families through their food security. The initial analytical sample of rural residents in labor aged 15 to 64 years was a total of 30493 individuals, among which approximately 53% (16124 individuals) partook in at least one of the listed subsistence labor tasks, with nonagricultural tasks taking precedence over agricultural tasks (approximately 50% and 17%, respectively). The gender division of subsistence labor shows that rural women clearly exceed their male counterparts in both agricultural and nonagricultural subsistence labor tasks (observe Figs. 2 and 3 below). In Fig. 2, the data show that among those engaged in any subsistence labor, 24% were women in agricultural tasks (compared to only 9% men in agricultural tasks). In Fig. 3, the data show that among those engaged in any subsistence labor, approximately 70% were women in nonagricultural subsistence labor (compared to 25% men). Moreover, this gendered division of subsistence labor was further substantiated, as the chi-squared test of independence reveals the difference between genders in both agricultural and nonagricultural subsistence labor to be statistically significant ( $p$  value = 0.000 for both). \*Significant difference between men and women rural residence using Chi-squared test of association Source: Calculated and produced by the authors from the data of ELMPS 2018.

In the sample, rural women engaged in subsistence labor spent on average 3.44 h a week ( $SD = 9.45$ ) on subsistence agricultural labor, compared to 7.3 h a week ( $SD = 16.78$ ) among rural men, as shown in Table 3 below. This indicates that although more women partake in subsistence agricultural labor, men engaged in subsistence labor spend significantly more time in subsistence agriculture.<sup>9</sup> The differences observed in the time survey showed that women spend on average

<sup>9</sup> Considering the average time spent on each task weekly; rural males spend almost 6 h a week in agricultural work, 1.4 h in raising livestock, and only a few minutes in dairy production. While women spend a little less than 3 h tending to livestock, less than an hour in agricultural work or dairy production.



**Table 3** Mean hours per week spent in the subsistence labor task by gender among rural individuals in labor age occupied in subsistence labor (n = 16,124, ELMPS 2018)

Subsistence labor tasks	Men		Women		Total		Assumed unequal variance p value
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation	
Any Subsistence Agricultural Labor <sup>a</sup>	7.30	16.78	3.44	9.45	4.60	12.26	0.000
Any Subsistence Non Agricultural Labor <sup>a</sup>	4.10	8.23	28.62	22.51	21.23	22.39	0.000
Any Subsistence Labor	11.4	18.13	32.06	25.71	25.83	25.51	0.000
Total Count	4855		11,269		16,124		

Source: Calculated by the authors from the data of ELMPS 2018

<sup>a</sup>Significant difference between men and women rural residence using independent sample t test (p value < 0.05)

significantly more time weekly in subsistence nonagricultural labor than their male counterparts. The analysis shows that rural women spend approximately 29 h weekly (SD = 23) in subsistence nonagricultural domestic tasks,<sup>10</sup> while men spend only 4 h weekly (SD = 8).

### 3.2 Association between women's subsistence of agricultural labor and household food security

The objective of the analysis is to identify the significance of women's subsistence agricultural labor on the odds of experiencing food insecurity among rural households. As such, the analysis seeks to highlight the difference between the effect of women's and men's subsistence agricultural labor on their households. This will determine whether women in rural households have potential as autonomous food producers. The analysis here will construct a logistic regression model to determine the statistical significance and role of each of the identified determinants on the odds of household food security.

The correlation analysis between the identified determinants shows that the strongest linear associations lie between the total number of household members in labor age (15–64) and the household size ( $r = 0.878$ ). By differentiating between men and women in the labor age, the data reveal a similar strong positive correlation with household size (women  $r = 0.712$  and men  $r = 0.710$ , respectively). This indicates the possibility of multicollinearity presence; thus, the modelling methodology will prioritize household size over the total number of household members in the labor age. Another finding from the correlation matrix is the notable correlation between the total number of women in subsistence nonagricultural labor and the number of female household members in the labor age ( $r = 0.667$ ). This further substantiates the finding that domestic duties are shouldered by able women in the household, which may limit their availability to take on "money-making" activities.

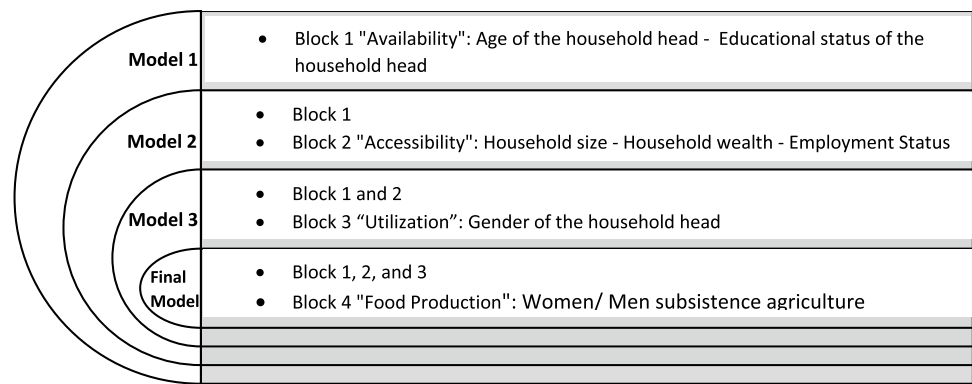
The correlation analysis substantiates the economic vulnerability of households with headed by a woman. The gender of the household head was found to be inversely correlated with the number of household members ( $r = -0.294$ ). A significant inverse correlation was found between the gender of the household head and the total number of household members in labor age ( $r = -0.252$ ), as well as the number of male household members in labor age ( $r = -0.316$ ). This meant that households with headed by a woman contained fewer household members able to work, which may increase their economic vulnerability. Additionally, the household head's level of education was found to be moderately and inversely correlated with their age, as older household heads completed lower levels of education ( $r = -0.428$ ).

### 3.3 Regression model for the association between women's subsistence of agricultural labor and rural household food security

Seventy percent of rural households were categorized as Food Secure. As such, the percentage of households mildly, moderately, or severely food insecure reached 30%. The variables available in the 2018 ELMPS data did not cover all identified variables in the theoretical conceptual framework developed by Drammeh, Hamid, and Rohana in their 2019

<sup>10</sup> Rural women spend on average 10 h a week cooking for their families, 5 h washing dishes, 5 h doing laundry, and 4 h cleaning the household. Whereas the men spend on average only a few minutes to 2 h on each subsistence nonagricultural task.

**Fig. 4** Variables included in each logistic regression model cumulative block method  
Source: Produced by the authors



**Table 4** Results of the logistic model for household food security (n = 9511, ELMPS 2018)

Independent variables	Exp(B)	1/Exp(B)
EDUC of household head (reference is university)		
Illiterate	0.541 <sup>a</sup>	1.848
Less than Intermediate	0.564 <sup>a</sup>	1.773
Intermediate and Above Intermediate	0.719 <sup>a</sup>	1.391
Gender of household head (reference is male)		
HH headed by a woman	0.878 <sup>c</sup>	1.139
Age of household head	1.007 <sup>a</sup>	0.993
Household size	0.903 <sup>a</sup>	1.107
Household rural wealth quintile (reference is richest) <sup>a</sup>		
Poorest	0.222 <sup>a</sup>	4.505
Poor	0.417 <sup>a</sup>	2.398
Middle	0.493 <sup>a</sup>	2.028
Rich	0.583 <sup>a</sup>	1.715
Number of hours of household women engaged in subsistence agro labor	1.009 <sup>a</sup>	0.991
Number of hours of household men engaged in subsistence agro labor	1.004 <sup>b</sup>	0.996
Number of hours of household women engaged in subsistence non-agro labor	0.997 <sup>a</sup>	1.003
Number of hours of household men engaged in subsistence non-agro labor	0.993 <sup>b</sup>	1.007
Constant	10.571	0.095

Source: Model results estimated by the authors using ELMPS 2018 data

<sup>a</sup>Significant impact at the 99% level of confidence (p value < = 0.01)

<sup>b</sup>Significant impact at the 95% level of confidence (0.01 < p value < = 0.05)

<sup>c</sup>Significant impact at 90% level of confidence (0.05 < p value < = 0.10)

article [5]. The cumulative block method presented in Figure 4 was applied in which all available variables in the dataset identified for each block<sup>11</sup> were entered into the logistic model in consecutive runs.

After running model 1, model 2, and model 3, the analysis identified the significant variables from these consecutive model runs. Hence, the identified variables to distinguish the household head characteristics were education level, gender, and age. The household variables were size and wealth quintiles.

In the final version of the logistic model in Table 4 below, the analysis will take into consideration the difference between men and women engaged in subsistence labor to examine the comparative behaviors of both men and women in subsistence agriculture. Hence, for the final Model (shown in Table 4 below) to assess the true impact of women's subsistence agriculture on their respective households' food security, the independent variable 'food production' was examined using the number of total hours all women in the households spent on subsistence labor in the week prior to the survey and the same for men. Additionally, since the literature cites the preoccupation of women in the sustenance

<sup>11</sup> Each block represented a component of household food security [6]; availability, accessibility, utilization, and the final block included the food production variable (subsistence agricultural labor by gender).

of nonagricultural labor, its effect should not be disregarded in addition to the household properties and household head characteristics specified in Model 3.

From the model (Table 4), we can deduce the following regarding rural women's agricultural subsistence labor: As the total number of hours of subsistence agricultural labor for all women in the household increases by one hour per week, the odds of household food security increases by 0.9% (1.009)—holding all other variables constant, which is double that of men (0.4%). In contrast, as the total number of hours of subsistence nonagricultural labor for all women in the household increases by one hour per week, the odds of household food security decrease by 0.3%—holding all other variables constant, which is more than double that of men (0.7%).

With regard to the other specified determinants, the education level of the household head significantly affected the odds of a household falling into food security, controlling for the effect of other independent variables. Compared to households with heads holding a university degree and controlling for all other variables, those with illiterate household heads are 85% less likely to be food secure; those with less than intermediate degrees are 77% less likely, and those with intermediate or above intermediate degrees are 39% less likely. When the age of the household head increases by one year, the likelihood of food security increases by 0.7%. As household size increases by one member, the odds of food security decrease by 10%. Understandably, compared to the richest rural households, and holding all other variables constant, the likelihood of food security decreases by (4.5) times among the poorest rural households, (2.4) times among the poor rural households, twice among the middle wealth rural households, and (1.7) times among the rich rural households. Finally, food security decreases by 14% when the household head is a woman compared to households headed by a man.

## 4 Discussion

Gender refers to the power relations between men and women. Similar to feminism movements, gender is often wrongly accused of solely focusing on women. While closing the gender gap in agricultural assets refers to women owning and controlling productive assets, policy makers and developers require evidence to substantiate the potential of empowering women in agriculture [16]. Promoting women's autonomy as capable breadwinners in agriculture not only positively impacts their wellbeing but also ensures the health and well-being of their children [16]. Indeed, the potential outcomes of achieving gender equity in the agriculture sector of developing countries far exceed the benefits of the individual. According to the latest FAO figures of 2019, the percentage of undernourished people in the world<sup>12</sup> has remained virtually unchanged at 11%, while the total number of undernourished people has been slowly increasing for several years. The number of undernourished people in the world reached levels previously seen in 2010, with slightly over 820 million people suffering from hunger, corresponding to approximately one in every nine people in the world. This underscores the immense challenge posed in achieving 'SDG1: Zero Hunger' by 2030. According to the FAO findings, bridging the yield gap could decrease the number of undernourished people in the world by approximately 100–140 million people [7, page 8].

Within the Egyptian context, discourses on agricultural development lack the required focus on gender issues in agricultural productivity in light of the escalating environmental challenges, cumulative rural expulsion rates, and import inclusive economic opportunities; as such, contemporary evidence is needed to amend this evident knowledge gap [14]. The analysis presented in this article seeks to shed light on an area of rural life that is often shrouded and undervalued economically. More women in rural areas are engaged in subsistence agricultural labor and bear the load of most subsistence labor. Increasing the total number of hours household women spent in subsistence agriculture significantly increases the probability of household food security; moreover, their impact was double that of men, while holding the other identified determinates of household food security constant [5, 5]. Humanities scholars and international development agendas have acknowledged the interdependency of our common future; thus, we can no longer afford to shroud the contributions of rural women's labor in their households under the normalization of the gender role and household responsibility.

<sup>12</sup> At the time of the 2011 FAO report the number of undernourished in the world people was reported at 925 million.

## 5 Conclusion

The analysis has validated the hypothesis articulated in the literature within the Egyptian rural context. Subsistence agriculture is significantly more prevalent among poorer rural households in Egypt. Similar to most developing countries, rural women are the main subsistence farmers in Egypt. The analysis shows that more women than men perform any subsistence agriculture task for their households. The unpaid household duties that women shoulder limit their time for productive agricultural activities. Although more rural women are engaged in agricultural subsistence labor tasks than men, rural men who confirm their involvement in subsistence labor spend significantly more time in agricultural subsistence than women. However, the impact of hours spent in subsistence agriculture by women in the household on the probability of their household's food security was higher than that of men.

### 5.1 Study limitations

The scarcity of updated agricultural data disaggregated by gender has hindered regional estimates on the autonomy of women in agriculture. Ideally, studies to measure the gender gap in agriculture should survey plot-specific ownership variables rather than household-level data. Individual-level data are needed to research the impact on climate shock and resilience and the effect of recent political and economic instability. Additionally, the real contribution of women in agriculture might be underestimated in the analysis concluded in this study due to the lack of quantifiable estimates on the effect of patriarchal norms on women's subsistence labor and access to land or productive resources.

### 5.2 Recommendations

An empowered woman in agriculture has access to needed inputs and resources. This is founded on creating an enabling environment through targeted interventions for women's empowerment and social inclusion. Similar to the recommendations of Cooke [11], national-level policy engagement is needed to recognize the value of women's unpaid domestic work for society and the economy, directing public investments to infrastructure and labor-saving technologies [11]. We also encourage eliminating all forms of discrimination against women in legislation and regulations, as gender-neutral policies and laws are not sufficient. Further political agency is needed to lobby for rural women in agriculture and to improve access to microcredit and training in income-generating agricultural activities, in addition to financial and legal literacy training. Moreover, we recommend designing more gender-transformative interventions to stimulate positive behavior change to understand and challenge discriminatory gender norms that drive gender inequalities and hinder growth.

**Acknowledgement** The authors extend special thanks to the Population Council for their support in the publishing of this article.

**Author contributions** All authors contributed to the study conception and design. NE conducted the analysis and drafted the manuscript. HZ edited the draft and produced the final version of the manuscript. All authors read and approved the final manuscript.

**Availability of data and materials** The dataset used in the manuscript comes from the Economic Research Forum (ERF) and the Central Agency for Public Mobilization & Statistics (CAPMAS), Egypt Labor Market Panel Survey, ELMPS (2018), Version 2.0 of the licenced data files (October 2019). It is provided by the Economic Research Forum by request. The link to the data is <http://www.erfdataportal.com/index.php/catalog/157>.

#### Declarations

**Competing interests** The authors declare no competing interests.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

1. Bruer, V. (2017). Promoting women's empowerment in the Middle East and North Africa A rapid evidence assessment of labour market interventions. Youth employment programme—Taqeem initiative international labour office (ILO)
2. Coates J, Swindale A, Bilinsky P. Household food insecurity access scale (HFIAS) for measurement of food access: indicator guide VERSION 3. Washington: Food and Nutrition Technical Assistance Project (FANTA). 2007.
3. De Brauw A, Kramer B, Murphy M. Migration, labor and women's empowerment: Evidence from an agricultural value chain in Bangladesh. *World Dev.* 2021;142: 105445.
4. Doss C. Chapter 3: Data Needs for Gender. In: Analysis in Agriculture Gender in Agriculture closing the knowledge gap The Food and Agriculture Organization. Dordrecht: United Nations and Springer Science; 2014. p. 55–68.
5. Drammeh W, Hamid N, Rohana A. Determinants of Household Food Insecurity and Its Association with Child Malnutrition in Sub-Saharan Africa: A Review of the Literature. *Current Research in Nutrition and Food Science.* 2019;7(3):610–23.
6. FAO. (2008). Food Security Information for Action Practical Guides: An Introduction to the Basic Concepts of Food Security. European Union Food Security Programme.
7. FAO. The State of Food and Agriculture; Women in Agriculture, closing the gender gap. Rome: Food and Agriculture Organization Of The United Nations; 2011.
8. FAO. (2020). Gender-related agricultural statistics: problems and significant activities. Retrieved from FAO: <http://www.fao.org/3/x2785e/X2785e09.htm>
9. Federici S. Women, land-struggles and globalization: an international perspective. *J Asian African Stud.* 2004;39:47.
10. Huyer S. Closing the gender gap in agriculture. *Gend Technol Dev.* 2016;20(2):105–16.
11. Cooke J. How to reduce rural women's domestic workload through labour-saving technologies and practices. Rome: International Fund for Agricultural Development. 2016.
12. Krafft C, Assaad R, Wahe K. Introducing the Egypt labor market panel survey 2018; working paper No. 1360. Giza: Economic Research Forum (ERF). 2019.
13. Krall S. What is sustainable agriculture? Bonn and Eschborn, Germany: Federal Ministry for Economic Cooperation and Development (BMZ) Division rural development and global food security, deutsche gesellschaft für internationale zusammenarbeit (GIZ) GmbH. 2015.
14. Ministry of Agriculture and Land Reclamation (MALR). The sustainable agriculture development strategy towards 2030. Ministry of Agriculture and Land Reclamation (MALR) of Arab Republic of Egypt, Cairo. 2009.
15. Pentland WE, Harvey AS, Lawton MP, McColl M. Time Use Research in the. New York: Kluwer Academic Publishers; 2002.
16. Quisumbing R, Meinzen-Dick TL, Raney A, Croppenstedt JA, Behrman AP. Gender in agriculture: closing the gender gap. Dordrecht: The food and agriculture organization of the united nations, Springer Science; 2014. pp. 31–54. <https://doi.org/10.1007/978-94-017-8616-4>.
17. Sieverding M, Hassan R. Associations between economic vulnerability and health and wellbeing In Egypt; Working Paper No. 1364. Giza: Economic Research Forum (ERF). 2019.
18. National Council for Women. National strategy for the empowerment of Egyptian women 2030 Vision and Pillars First edition. Cairo: National Council for Women. 2017.
19. Verschuur C. From the centre to the margins and back again: women in agriculture at the ILO. *International development policy revue internationale de politique de développement.* 2019;11:152–76. <https://doi.org/10.4000/poldev.3068>.
20. Wodon Q, Montenegro C, Nguyen H, Onago A. Missed opportunities: the high cost of not educating girls. the cost of not educating girls notes series. Washington, DC: The World Bank; 2018.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.