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Examining the Effect of Urban Household Food Insecurity on Fertility in Lideta Sub-City, Addis Ababa, Ethiopia: A Cross-Sectional Study

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Abstract

Despite investment and support for family planning in developing countries, some people living in poverty are hesitant to use modern birth control methods, and usage rates are insufficient. Improved reproductive health is directly related to enhanced nutrition, while optimal nutrition fosters superior reproductive health outcomes. This study aims to examine the relationship between household food insecurity and fertility in Lideta Sub-City, Addis Ababa, Ethiopia. A study was conducted on 649 reproductive-age women in three randomly selected Woredas (districts) from a sub-city from February to March 2023. Data were collected through a validated survey by trained individuals, and household income and expenditure were used to measure food insecurity access. Poisson regression was used to examine the link between household food insecurity and fertility, considering other covariates. The result of the study shows that food insecurity status was a significant predictor of the number of children ever born. The number of children ever born for women within food-secure households is 0.655 times lower compared to women with food insecurity. Similarly, the age of the mother, marital status, contraceptive use, women's income, and childhood mortality were significant in predicting the number of children ever born at $P < 0.05$. Household food insecurity exhibits a positive correlation with the number of children ever born. Thus, it is imperative to recognize food insecurity as a barrier that must be addressed when developing family planning services.

Keywords

Fertility, Children ever born, Food insecurity, Lideta Sub-City, Addis Ababa, Ethiopia

Introduction

The world's population has experienced a remarkable increase, growing from 1 billion in 1800 to a staggering 8 billion today. The less developed countries of Africa, Asia, and Latin America now account for 85 percent of the world's population but account for 99 percent of global population growth [1]. The highest fertility rates and higher childhood mortality rates are found in the poorest and most food-insecure countries [2,3]. Surprisingly, the world is still home to over 800 million undernourished people, over 97% of whom live in developing countries. The rate of undernourishment worldwide is on the rise, affecting 9.9% of people globally [4].

Sub-Saharan Africa, with a population of 1.3 billion (17% of the world population), has by far the fastest-growing population of any major region in the world [1]. Despite significant advancements in reducing child mortality and enhancing life expectancy, reproductive health among women residing in developing nations, particularly in sub-Saharan Africa, remains insufficient, leading to persistently high birth rates. On average, women residing within the region have about 4.26 children [1]. The widespread adoption and utilization of family planning methods have become instrumental in mitigating the growth of the population as well as addressing the issues of hunger and malnutrition [5].

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Ethiopia remains one of the world's most impoverished and food-insecure nations, with 30.8% of its population living below the poverty line for sustenance [6]. The majority of urban households in Ethiopia, comprising approximately 80%, exhibit food insufficiency and rely heavily on market mechanisms to procure their food requirements [7]. Following the Interim Report on Poverty Analysis Study in Ethiopia (2017), there was an estimated 14.8% proportion of the population in urban areas categorized as being below the food poverty line. In Addis Ababa, the estimated proportion of individuals experiencing food insecurity, defined as those unable to purchase consumption items that yield a minimum of 2,200 kilocalories, is 19.1% [8]. Similarly, the proportion of people suffering from food insecurity in the Lideta sub-city, which is considered to be one of the most deprived sub-cities in Addis Ababa, was estimated at around 29.3%. This means that about one-third of the population falls below the threshold of adequate food intake [9]. The share of total household income spent on food is around 42.2% [10]. Urban food insecurity is mostly chronic, combined with higher urbanization rates, food price changes, and market instability [2,11], and persists for long periods, if not lifetimes [3]. It is closely associated with urban poverty. As the study conducted in Ethiopia showed, chronic food insecurity in households can result in persistent malnutrition as a consequence of the inability to secure adequate and sustained access to food [12]. In situations where there is a surge in food prices, households that do not engage in food production, particularly those located in urban areas, are compelled to procure food through alternative means, predominantly through purchase. The purchasing power of households is contingent upon their income, so a rise in the prices of food can have adverse effects on their ability to access sufficient amounts of food [2].

Indisputably, households experiencing poverty typically encounter a plethora of challenges, such as unfulfilled family planning demands, families with sizes that exceed their preferences, and inadequate financial resources to afford the necessary quantity and quality of nourishing sustenance to meet the needs of their families. The condition of poverty precipitates inadequate access to family planning and, in turn, serves as a consequence thereof. Families with lower economic status experience limited availability of family planning services. They allocate a greater portion of their budget towards sustenance while expending a lesser amount of money per individual on food as opposed to affluent households [5,13]. Though the total fertility rate in Addis Ababa is relatively better compared to other regions of Ethiopia and is estimated at 1.8 children per woman, the fertility rate is still high at the national level, which is 4.6 children per woman [14]. A crucial consideration towards maintaining sustainable population growth that does not burden the world's finite resources needs foremost attention to the interrelationship between food security and reproductive health [15].

Economic, social, and religious factors like income, education, religion, work status, age at first birth, age at first marriage, contraceptive use, and childhood mortality affect fertility [16-22]. Among the various theories of population and fertility, Neo-classical Microeconomic Theory [23] and Demographic Transition Theory [24] are considered the most useful in examining the interrelationship between food insecurity, fertility, and contraceptive use. These theories center on the principal determinants that are responsible for the elevated fertility rates observed in developing nations. This phenomenon is commonly attributed to a dearth of economic advancement. According to demographic transition theory, high infant and child mortality, poor agricultural productivity, insufficient utilization of contraceptives, and a relatively lower socioeconomic standing in terms of women's education, occupation, and social status contributed to the high fertility norm.

Although various studies have been conducted to show the effects of food insecurity on child health and development [25,26], education performance, and intellectual development [27], external and internal behaviors [28], and stunting, wasting, and underweight [29-33], insufficient emphasis has been placed on investigating the correlation between urban household food insecurity and demographic outcomes within scholarly discourse. Undoubtedly, endeavors have been made to elucidate the correlation between women's reproductive health status, fertility, and the household's food security [29,34]; however, scant attention has been given to elucidating the reciprocal relationship between the different dimensions of food security, fertility, and family planning. This study aims to investigate the relationships between urban household food insecurity and fertility, providing policymakers and development stakeholders with valuable insights to guide well-informed decision-making and effective interventions.

Data and Methods

Study design and area

A cross-sectional study design was used to collect data from February to March 2023 in Lideta sub-city, located in the central-western area of Addis Ababa. Borders are shared with Addis Ketema, Arada, Kirkos, Nifas Silk-Lafto, and Kolfe Keranio. The sub-city is divided into ten Woredas. The study randomly selected three Woredas and collected data at respondents' residences in the sub-city. Lideta Sub-City covers 9.18 sq km with a population of 284,208, including 134,372 males and 149,836 females. The study focuses on a highly populated and poor district in Addis Ababa with a population density of 30,960 people per square kilometre [35].

Sampling design and procedure

Sample size was determined by the single mean formula proposed by [36] with the assumption that the single population proportion experiencing food insecurity is often estimated to be 50%, with a margin of error of 5% and a 95% CI ($z_{1/2}$ = 1.96). A design effect of 1.5 for cluster sampling and some allowance were also added, considering the variability in the study population and controlling non-response rates and outliers, respectively. The sampling strategy of this study was operationally predicated on the pre-established enumeration areas of the sub-city, which had been delineated by the central statistical service of Ethiopia. Samples are drawn from a population using a multi-stage random sampling technique. In multistage random sampling, three Woredas are randomly selected at the first stage. Secondly, each Woreda comprises different Ketenas (villages), and from each of these three Woredas, two Ketenas are selected using the random sampling method. In the last step, a total of six Ketenas were there to select the final 649 respondents. The total sample, which was selected using a multi-stage random sampling technique, was divided among all those Woredas and then among Ketenas proportionally to their population. The households from the respective Woreda were selected by systematic random sampling based on a sampling frame of house numbers developed from Ketena records. Individual respondents of women within the age range of 15 to 49 years who would be either household heads or spouses and gave birth within the last 15 years preceding the survey were sampled.

Study variables

The outcome variable of this study is fertility. It refers to the reproductive performance of an individual, a couple, a group, or a population, which could be measured by using the number of children ever born, the consecutive birth interval, or the total fertility rate. Here, fertility is measured by taking the number of children ever born (CEB) as a discrete outcome variable. Predictor variables and covariates include household food insecurity status and other demographic and socioeconomic variables such as the age of the mother, marital status, women's education, women's income, religion, work status, age at first birth, contraceptive use, the desired number of children, and childhood mortality.

Analytical methods

The relationship between urban household food insecurity and fertility will be analyzed using the Poisson regression model, taking children ever born as a dependent variable and household food insecurity status as the main predictor. More formally, the Poisson regression model will be expressed as

$$\lambda_i = {}_e\beta_0 + \beta_1 Xi_1 + \beta_2 Xi_2 + \ldots \beta_n Xi_n + \mu_i$$

λ_i is the number of children for women in the Lideta Sub-city, xi is a vector of k characteristics, β_o is the intercept, β is the vector of covariate parameters, and u_i is the error term. The present study shows the outcomes of the model, which reveal the incidence rate ratio or EXP(ß), elucidating the relative change in the number of children given a unit change in the explanatory variable, while keeping all other variables constant. The present study employed a Poisson regression model to evaluate the association between household food insecurity and the number of children ever born, along with several other independent variables. Descriptive statistics, on the other hand, will help to give bivariate analytical results for the study.

The data were collected using KoboCollect 3.5 and entered into the SPSS 24 software with caution. The completeness and errors related to inconsistencies were verified using the data cleansing method. Bivariate analysis was employed to identify the variables that exhibited a statistically significant association with fertility. In this study, the variables that exhibited a p-value of less than 0.25 were subjected to a thorough examination for multicollinearity issues utilizing the variance inflation factor (VIF). Following this preliminary assessment, the identified variables were included in the Poisson regression model to determine their effect on the outcome variable (children ever born). Incidence rate ratios with their corresponding 95% confidence intervals were computed. A significance level of 0.05 was deemed statistically significant in the present study.

Measurement of household food insecurity

The caloric value of foods that meet the threshold requirement of 2,200 kilocalories (kcal), as recommended by the Food and Agriculture Organization [37], for enabling healthy and moderately active adult living is determined by their corresponding national average prices to establish the food poverty line. Although the 2016 Interim Poverty Analysis Report estimated the cost at 3,772 birr per year per adult person in Ethiopia [9,38], this price is not feasible and had to be adjusted based on current food prices. However, the overall percentage of inflation has reached 122.2 % from June 2016 to January 2023; computing the amount of food inflation year by year brings the estimated cost to Birr 11,524.52 per year per adult [39,40]. Accordingly, the cost of one kilocalorie is estimated to be Birr 0.0143.

In this article, the national food poverty line was used to measure food insecurity status. The food poverty line determines whether a given household can have enough daily food expenditure (total household income spent on food) to meet its members' minimum daily calorie needs. Therefore, households that cannot afford the money or are unable to source consumer goods for these daily calorie needs are considered to be food insecure. However, individual access to food depends

on household food distribution and gender parity, which in practice means that consumption patterns are not uniform [41]. Often, children, women, and older household members consume less food compared to those male adults [42]. A per capita adult equivalent estimate is obtained by dividing the total daily income or calories by all household members, assuming a uniform food consumption pattern for families with different compositions. Therefore, if this adult person equivalent estimate were taken, Birr 31.46/2,200 kcal would be used as a standard threshold to identify food-insecure households from those that are not. But such an approach could make households food-insecure that were almost certainly not insecure since they fail to consider the presence of household members with distinct energy needs. Thus, in this article, an adult-equivalent estimate of the calorie availability scale that has an adult-equivalent conversion factor was used (Appendix 1). The application of an adult-equivalent scale effectively narrows the variance between estimated and actual food intake, thereby enabling the discernment of the relative contributions of distinct household members towards the overall dietary pattern of the household, which is not feasible with the utilization of per capita metrics. Household income and expenditure survey is standard and widely applicable to measure household food insecurity and poverty at the household level [43-45]. The World Bank, USAID, the International Development Association (IDA), and the Ethiopian government have applied this monetary approach to measure household food insecurity/poverty related to the urban productive safety net program in urban Ethiopia [46]. Moreover, the government of Ethiopia and other developing countries have also applied this monetary approach to food poverty and insecurity analysis, identifying the prevalence, gap (shortfall), and severity of household food insecurity [8,38].

Results and Discussion

Demographic and socio-economic characteristics of respondents

As shown in Table 1, a total of 649 households participated in the study. Of these, nearly half, or 48.7%,

Table 1: Demographic and socio-economic characteristics of respondents.

Variables	Freq.	%	Mean	Sig.	Variables	Freq.	%	Mean	Sig.
Employment status					**Contraceptive use**				
Unemployed	242	37.3%	1.69	0.081*	Yes	322	49.6%	1.31	0.000*
Employed	407	62.7%	1.52		No	327	50.4%	1.85	
Women income in Birr					**Marital status**				
0-1500	204	31.4%	2.18	0.000*	Married	432	66.6%	1.87	0.000*
1500.01-3000	134	20.6%	1.54		Single	114	17.6%	0.79	
3000.01-4500	133	20.5%	1.36		Divorced	87	13.4%	1.18	
> 4500	178	27.4%	1.09		Widowed	16	2.5%	1.75	
Age at first birth					**Age of Mother**				
15-19	138	22.8%	1.88	0.008*	20-24	33	5.1%	1.03	0.152
20-24	240	39.6%	1.70		25-29	159	24.5%	1.48	
25-29	137	22.6%	1.67		30-34	156	24.1%	1.96	
30-34	66	10.9%	1.39		35-39	141	21.8%	2.00	
> 35	25	4.1%	1.40		> 40	159	24.5%	1.06	
History of Child mortality					**Household food security status**				
No	534	87.8%	1.63	0.000*	Food-secure	206	31.7%	1.14	0.000*
Yes	74	12.2%	2.11		Food-insecure	443	68.3%	1.79	
Desired number of children					**Religion**				
0-2	262	40.4%	1.50	0.278	Orthodox	418	67.5%	1.52	0.035*
3-4	251	38.7%	1.65		Protestant	108	17.4%	1.45	
> 5	136	21.0%	1.62		Muslim	93	15.0%	1.89	
Women level of education									
Uneducated	77	11.9%	1.48	0.649					
Informal	44	6.8%	1.50						
Primary	219	33.7%	1.76						
Secondary	257	39.6%	1.51						
Above Diploma	52	8.0%	1.42						

*P < 0.25 significant association

are between 25 and 34-years-old. Of all respondents, single, married, divorced, and widowed account for 114 (17.5%), 432 (66.6%), 87 (13.4%), and 16 (2.5%), respectively. The majority of respondents (39.6%) attended secondary school, followed by primary school (33.7%). In addition, 8.0% had a diploma or higher and 11.9% had no educational qualifications. Regarding their employment status, the majority (62.7%) of respondents are engaged in any income-generating activities, while (37.3%) of the respondents were not employed in any labor sector at the time of the survey. Significant proportions of the survey participants (67.5%) were Orthodox Christians, 15.0% were Muslims, and Protestants accounted for 17.4%. The majority of respondents (50.4%) are not using any modern contraceptive method and 12.2% of respondents have at least a history of childhood mortality. The majority of respondents, around 72.5%, earn a monthly income of 0-3000 Birr. Regarding age at first birth, the majority of respondents (39.6%) started childbearing at the age between 20 and 24. Moreover, measuring a household's food insecurity status also revealed that 68.3% of the sample households were food insecure and the remaining 31.7% were food secure.

The relationship between food insecurity and fertility

Table 1 presents the mean values of children ever born among women, categorized based on food insecurity and socio-demographic characteristics. The findings of the survey indicate that households experiencing food insecurity exhibit a higher mean number of children ever born at 1.79 compared to those who are food-secure, with a mean number of children ever born of 1.14. The mean number of children ever born exhibits variance across various religious groups. According to the findings of the survey, Muslims exhibited the highest mean number of children ever born, with a value of 1.89, followed by Orthodox Christians with 1.52 and Protestants with 1.45. Based on the findings of the survey, it was determined that women with monthly earnings ranging from 1,500 to 3,000 Birr and 3,000 to 4,500 Birr had a mean number of children ever born of 1.54 and 1.36, respectively. This result falls below the replacement level as it signifies that these women are not producing enough children to replace themselves. Comparably, the number of children that have ever been born to individuals belonging to the high-income category (earning over 4500 Birr per month) and low-income category (earning between 0 and 1500 Birr per month) was determined to be 1.09 and 2.18, respectively. According to the findings, the mean number of children ever born to married women (1.87) was compared to those of unmarried, divorced, and widowed women, whose mean numbers of children ever born were 0.79, 1.18, and 1.75, respectively. These results suggest a significant association between marital status and the number of children ever born. In contrast, the findings indicate that females with no education and those holding degrees and above exhibit the greatest and least mean numbers of children ever born, standing at 1.48 and 1.42, respectively. Concerning the demographic category of females, there is a positive correlation between maternal age and the mean number of children ever born. The findings indicate that women in the age bracket of 35 to 39 exhibits a significantly greater mean number of children ever born (2.00) in contrast to young women (1.03).

Factors of household fertility in Lideta Sub-City, Addis Ababa, Ethiopia

A bivariate analysis was conducted to ascertain potential variables for inclusion in the Poisson regression. Utilizing specific criteria, the variables of maternal age, marital status, women's income and work status, age at first birth, food insecurity, and childhood mortality were deemed suitable for inclusion in the Poisson regression analysis. After adjusting for confounding factors, including maternal age, marital status, contraceptive use, and household food insecurity status, and childhood mortality, significant statistical associations were observed with fertility at $p < 0.05$ (Table 2). Efforts have been made to assess whether or not the necessary assumptions for the application of Poisson regression are fulfilled. The present study compared the adequacy of two regression models, namely Poisson and negative binomial, in explaining a given set of data by utilizing two popular model selection criteria, namely Kaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The results revealed that both AIC and BIC were lower for the Poisson distribution than for the negative binomial distribution. This finding suggests that the Poisson regression model represents a better fit for the data compared to the negative binomial regression model. Conversely, the evaluation of model fit using the goodness of fit test reveals a deviance below 1, signifying that under dispersion is present and the value approaches zero. This result is indicative of zero inflation, thereby suggesting that the Poisson regression model is best fitted. The utilization of an omnibus test in the Poisson regression model has resulted in a significant p-value of 0.001, indicating that all predictor variables incorporated in the model are meaningful predictors of the number of children ever born.

The result of the study shows that household food security status was a significant predictor of the number of children ever born at $p < 0.05$. Holding the other variables constant, the number of children ever born for women within food-secure households is 0.655 times lower compared to women with food insecurity. Women's monthly income was also a significant predictor of the number of children ever born. Holding the other variables constant, the number of children

Table 2: Coefficients and odds ratio of fertility in Lideta Sub-City, Addis Ababa.

Variables	B	Sig.	Exp(b)	95% CI for Exp(b)	
Marital status					
Married (Widowed)	-0.139	0.491	0.870	0.585	1.293
Single (Widowed)	-0.509	0.025*	0.601	0.385	0.938
Divorced (Widowed)	-0.371	0.089	0.690	0.450	1.058
Women income					
0-1500 (> 4500)	0.402	0.000*	1.495	1.233	1.812
1500.01-3000 (> 4500)	0.252	0.019*	1.287	1.042	1.588
3000.01-4500 (> 4500)	0.212	0.050*	1.236	1.000	1.529
Contraceptive use					
Yes (No)	-0.183	0.015	0.833	0.719	0.965
History of Child mortality					
Yes (No)	-0.327	0.000	0.721	0.601	0.865
Household food security status					
Food-secure (Food-insecure)	-0.423	0.000*	0.655	0.544	0.789
Age of Women					
20-24 (> 40)	0.306	0.130	1.359	0.914	2.020
25-29 (> 40)	0.318	0.007*	1.375	1.092	1.731
30-34 (> 40)	0.520	0.000*	1.682	1.359	2.084
35-39 (> 40)	0.498	0.000*	1.646	1.334	2.031

Note: The reference group is listed in the parentheses

ever born for women with monthly incomes of 0–1500, 1500–3000, and 3000–4500 Birr is 1.495, 1.287, and 1.236 times greater, respectively, compared to those women having an income of Birr higher than 4500. This means that the reduction in income levels from Birr 4500 and above to Birr 3000–4500, Birr 1500–3000, and Birr 0–1500 is associated with increases in the number of children ever born by 23.6%, 28.7%, and 49.5%, respectively.

The results of the study show that marital status has a significant effect on the number of children ever born. The finding indicates that single women have 0.601 fewer children compared to their widowed counterparts. A woman's age is one of the most significant biological and demographic factors affecting fertility. The present investigation indicates that there is a significant disparity in the number of children born by older women as compared to their younger counterparts, meaning that a younger age at first birth is associated with a higher number of children ever born. When comparing the number of children ever born across different age groups, it is evident that there is a decreasing trend as age decreases. Specifically, the age group of 20–24 displays a low number of children ever born, whereas the age group of 30-34 exhibits a high number of children ever born. Women belonging to the age groups of 20–24, 25–29, 30-34, and 35–39 have 1.359, 1.375, 1.682, and 1.646 fewer children, respectively, when compared with their counterparts in the 45–49 age brackets.

The difference in the number of children ever born between contraceptive users and non-users was also found to be significant at $P < 0.05$. Other factors being equal, the number of children born for contraceptive users is 0.833 times lower than for non-users. The history of child mortality and the need for children were also found to be significant predictors of the number of children ever born. Holding other factors constant, women with childhood mortality experiences have 0.721 more children than women without childhood mortality experiences.

Discussion

The present study endeavours to evaluate the association between food insecurity and fertility in Lideta Sub-City. According to the present investigation, the average number of children ever born to women of childbearing age in the study area is 1.58, which is below the replacement level. This finding was comparable with the study conducted in Addis Ababa, which was 1.9 births [47], but lower than what was reported in the Ethiopian Demographic and Health Survey at the national level (2.84 births) [14]. The observed variability could potentially arise from differences in the demographic, socioeconomic, or cultural status of women or from other factors pertaining to health, such as disparities in counselling proficiency [48].

The findings of the study also show that the number of children born from food-insecure households was higher compared to children from food-secure households. This finding was consistent with some

studies [33, 34, 49]. The study conducted in Butajira District, South Central Ethiopia, showed that food security is a significant predictor of having fewer children [49]. The findings of the study indicate that women residing in food-insecure households exhibited a 6% increase in the number of children ever born relative to women inhabiting food-secure households. Another study conducted in Tanzania also showed that food insecurity is positively related to the fertility experience of households when controlling education, place of residence, age of the mother, and number of living children [33]. According to the finding, women who encounter household hunger exhibit a higher likelihood of desiring additional children or expressing uncertainty about having more children in comparison to their counterparts who do not experience household hunger. The study undertaken in the Assayita District of the Afar Regional State in Ethiopia has demonstrated a significant correlation between household food insecurity and household fertility [29]. The results of the study indicate that households characterized by a parity of five or more children were found to exhibit a significantly greater likelihood of experiencing food insecurity when compared to those who had not yet born children (parity 0). According to this study, women who have two or more children under the age of five are at a statistically significant increased risk of being underweight due to malnutrition, with odds greater than nine times that of women without young children below five years of age. The plausible explanation for this phenomenon is that children residing in households experiencing food insecurity are perceived as contributing meaningfully to enhancing the socio-economic status of their family [50-52]. Moreover, women who belong to households experiencing food insecurity are at a high risk of experiencing negative sexual and reproductive health consequences, including ineffective utilization of contraception and unintended pregnancies. These outcomes are predominantly attributed to limited decision-making abilities and inadequate communication with their partners [53]. The socio-economic status of women is also a significant factor in contributing to their participation in fundamental approaches to regulating fertility and promoting the effective utilization of progressive healthcare services [54].

Considerable differences in the number of children ever born exist according to women's age, income, marital status, food security status, contraceptive use, and childhood mortality. The effect of marital status on the number of children ever born was found to be significant at $p < 0.05$. This finding was in line with the findings of previous studies and reports [14,48], but opposed by a study conducted in the Tigray region of Ethiopia [55]. Single women are susceptible to precarious sexual and reproductive health outcomes, such as inadequate utilization of contraception and undesired pregnancy, primarily attributable to insufficient decision-making and inadequate communication with their spouses compared to married women [54].

The age of the mother was also found to have a significant relationship with the expected number of children ever born at $p < 0.05$. This finding was consistent with a study conducted in Ethiopia [29,56,57] but opposed the finding of a prior study [58]. The importance of these variables could be due to the fact that the likelihood of marrying and having more children increases as women get older, meaning that as women progress in age, there is a corresponding progression in their desire to achieve independence and establish an autonomous lifestyle. The cultural dimension also serves as a significant factor in the reinforcement of reproductive-age women to bear children before the cessation of their childbearing years [55].

In the majority of instances, there is an inverse correlation between education level and fertility. The present study indicates that the absence of primary education among women is associated with increased fertility rates in comparison to those who have attained secondary and higher education [14,59]. However, in this study, the level of education was not found to be statistically significant in predicting the number of children ever born. This finding was in line with prior studies [56,59] but in contrast with studies [49,55,57,60,61]. Although educated women are usually more aware of family planning methods and the advantages and disadvantages of having children, they should have more autonomy and power in making reproductive decisions, so that they experience a lower fertility rate.

This study has further revealed that employment status was not found to be a significant predictor in determining the number of children ever born. This finding corroborates studies [56,58,60] but contradicts the findings of previous studies [60,62]. This fact might be elucidated by the observation that a significant proportion of women are employed in the informal sector, which is characterized by relatively low impacts on fertility.

The finding of this study also confirms that there is a negative association between women's income and fertility, and this is in agreement with other studies [48,63,64], but opposes a study conducted in the east of Iran [59], which prioritizes the demand for children as the key predictor of the number of children ever born. The relationship between income and fertility rates was also reported to be direct by [65]. The observed inconsistency may be attributed to the selection of respondents exclusively from urban areas, where educational resources are plentifully available even to individuals with low socioeconomic status. Moreover, urbanization, commonly referred to as urbanism, is likely to be linked with a shift in ideas and attitudes

concerning larger families. Moreover, it is plausible that individuals living in urban areas possess enhanced means to procure contemporary contraception methods, consequently empowering them to efficiently implement their intentions to limit fertility rates [66].

The difference in the number of children ever born between contraceptive users and non-users was also found to be significant at $P < 0.05$. Other factors being equal, the difference in the rate of children ever born for contraceptive users is 0.641 times lower than for non-users. This finding was consistent with some studies [48,56,57,60,63] but in contrast with [55,58]. The rationale behind the decline in fertility rates can be attributed to the crucial role played by contraception in promoting healthy timing and spacing of pregnancies. Further, contraception has been proven to increase the likelihood of child survival through the spacing of births [67,68].

The findings of this study also reveal that the history of child mortality and the need for children were also found to be significant predictors of the number of children ever born. Holding other factors constant, the number of children ever born is higher when women have a history related to child mortality. This finding corroborates studies [48,56,57,60,63] but opposes the findings of studies [55,58]. The aforementioned phenomenon may be explicable by the fact that women who have experienced child mortality have the desire to replenish their children. Nonetheless, they are apprehensive of a recurrence of the adverse outcome [55,69].

Finally, the study findings have been reinforced by the utilization of rigorous statistical analysis techniques and the attainment of high response rates in the data collection process. Moreover, utilizing a thoroughly validated, structured questionnaire could have effectively mitigated the presence of instrumental and inter-rater biases. Despite the extensive exploration of the interrelationship between household food insecurity and fertility, while adjusting for potential confounding variables, the cross-sectional design of the dataset restricts our ability to draw definitive cause-and-effect relationships between outcome and independent variables.

Conclusions

The current research demonstrates that the ability to access family planning services and effectively manage fertility is significantly hindered by food insecurity. Moreover, within households experiencing food insecurity, women exhibited a decreased propensity towards utilizing contraceptive techniques in pursuit of attaining a suitable and satisfactory family size. The integration of suitable strategies aimed at enhancing the adoption of family planning services within food-insecure households is a crucial aspect of interventions geared toward regulating household fertility. Therefore, stakeholders are anticipated to engage in collaborative and coordinated efforts across various sectors to address the challenges of food insecurity and fertility issues. Such actions will prioritize expanding women's education, voluntary family planning initiatives, job creation programs, and initiatives to strengthen women's economic empowerment. Continuous, long-term surveys and standardized measurement tools, such as the Household Food Insecurity Access Scale, need to be employed in future studies to ascertain causal relationships among variables and discern the various levels of food insecurity. This is imperative to establishing a comprehensive understanding of the phenomenon under investigation.

Declaration

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Competing interests

There is no competing interest.

Authors' contributions

ETG: Conceptualization, Data Collection and Analysis; TDB & MKA: Review, Editing and Analysis.

All Authors have approved the manuscript.

Ethics approval and consent to participate

Ethical clearance and a letter of support were obtained from IRB of Addis Ababa University, College of Development Studies, and the Center for Population Studies. Letters were distributed to all the respective Woredas. Informed consent was obtained from participants before the commencement of data collection. The purpose of the study was explained to both the respondents and the Woreda experts.

Consent for publication

There is no restriction on publication.

Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

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Appendix 1: Conversion factor for estimation of adult-equivalent calorie requirements

Age (years)	Adult - equivalent conversion factors
Newborn	
0-1	0.29
Children	
1-3	0.51
4-6	0.71
7-10	0.78
Men	
11-14	0.98
15-18	1.18
19-24	1.14
25-50	1.14
51+	0.90
Women	
11-14	0.86
15-18	0.86
19-24	0.86
25-50	0.86
51+	0.75

Source: Claro et al. (2010). Per capita adult-equivalent estimates of calorie availability in household budget surveys. Cademos de Saúde Pública, 26 (11)