

Food Insecurity among Households with and without Podoconiosis in East and West Gojjam, Ethiopia

Kassahun Ketema^{1*}, Girmay Tsegay², Dereje Gedle², Gail Davey³ and Kebede Deribe⁴

¹Department of Human Nutrition, Debra Markos University, College of Medicine and Health Sciences, Debre Markos, Ethiopia

²Department of Public Health, Debre Markos University, College of Medicine and Health Sciences, Debre Markos, Ethiopia

³Brighton and Sussex Medical School, United Kingdom

⁴Medical School Teaching Building, BSMS, University of Sussex, Brighton, United Kingdom

***Corresponding Author:** Kassahun Ketema, Department of Human Nutrition, Debra Markos University, College of Medicine and Health Sciences, Addis Ababa, Ethiopia.

Received: April 30, 2018; **Published:** June 20, 2018

Abstract

Background: Household food insecurity remained one of the most crucial challenges to economic development and has been aggravated by household health conditions. Nearly one billion people are undernourished of which 98% in developing countries like Ethiopia.

Objective: To assess households' food insecurity among podoconiosis patients and non-podoconiosis in East and West Gojjam Zone, Ethiopia, 2016.

Method: A community based comparative cross sectional study was conducted in East and West Gojjam, 2016. Multi-stage sampling technique was employed to select 208 podoconiosis and 400 non-podoconiosis household heads. Data was collected by using structured and pretested questionnaires. The collected data was cleaned, coded and entered into Epi data then exported to SPSS version 22. Descriptive and inferential statistics was performed. Both bivariate and multivariate logistic regression analyses was employed. The association was measured by adjusted odds ratio (AOR), 95%CI (confidence interval) and $P < 0.05$ was considered statistically significant.

Result: A total of 608 study participants were involved in this study. Food insecurity podoconiosis patients and non-podoconiosis household was 83.7%, 53% respectively ($p = 0.0001$). Podoconiosis and non-podoconiosis whose heads could not read and write AOR = 5.84, (95% CI: 2.14, 15.95) and AOR = 1.70, (95% CI: 1.06, 2.72) were food insecure respectively. Podoconiosis patients without off farm activities AOR = 4.90, (95% CI: 1.60, 14.95), not using fertilizer AOR = 4.38, (95% CI: 1.15, 16.67) and living at > 5 kilo meter distance from market AOR = 4.47, (95% CI: 1.38, 14.48) were food insecure. Non-podoconiosis heads with no perennial plant AOR = 2.11, (95% CI: 1.17, 3.34), not using improved seeds AOR = 2.20, (95% CI: 1.25, 3.87), no access to asset building program AOR = 2.07, (95% CI: 1.27, 3.34), living in medium and low altitude AOR = 8.87, (95% CI: 1.81, 43.40) and AOR = 10.04, (95% CI: 1.90, 52.93) were food insecure.

Conclusion: Food insecurity was higher among podoconiosis than non-podoconiosis households. Being a female, unable to read and write absence of off farm activities, not using of fertilizers and living in more distance from market were significantly associated with food insecurity among podoconiosis patients. Special emphasis should be given for improvement of food security of podoconiosis and non-podoconiosis households.

Keywords: Households; Food Security; Food Insecurity; East Gojjam; Podoconiosis

Introduction

Background: Food security is “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” [1]. Household food insecurity exists when one or more of the food security components (availability, accessibility and utilization) are not fulfilled [2,3]. Food insecurity is increasing globally, and an estimated 925 million people were undernourished in 2010. Of these, about 900 million people were living in low-income countries [4]. The majority of food-insecure and hungry people in the global context live in Asia and the Pacific (16%), Sub-Saharan Africa (30%), North Africa (8%), and Latin America and the Caribbean (9%). By 2012, the estimate had decreased slightly to 870 million people. Of these, about 852 million people were living in developing countries [5].

Household food security status may be affected by multiple factors. A study in the Punjab, Pakistan revealed that a household’s monthly income and the household head’s education level positively affected food security [6]. In the Sekyere-Afram Plains District of Ghana, household size, farm size, off-farm income, credit access, and marital status significantly influenced household food security [7]. In Ekiti State, Nigeria, male household head, educational level, age and income were positively associated with food security whereas household size was negatively associated. In Lupane and Hwange Districts, Zimbabwe, per capita aggregate production, fertilizer application, cattle ownership and access to irrigation were positively associated with household food security, whereas farm size and household size were negatively associated [8,9].

In Tigray, northern Ethiopia, age of household head, use of improved seeds, family size, number of adults per household and land size in hectares were found to be important at household level. Countrywide, environmental and economic factors such as poor soil fertility, land shortages, occasional droughts, degradation of farmland, frost attack, chronic shortage of cash income, poor farming technologies, weak extension services, high labor wastage, and poor social and infrastructural situations are all thought to have resulted in the serious and growing problem of household level food insecurity in Ethiopia [10,11].

Podoconiosis (endemic non-filarial elephantiasis) is a non-infectious geochemical disease among barefoot subsistence farmers who have long-term contact with irritant red clay soil of volcanic origins. The disease causes progressive bilateral swelling of the lower legs. The term podoconiosis was coined by Ernest Price, derived from the Greek words podos and konos, which mean foot and dust, respectively, and imply that the disease is caused by exposure of feet to irritant clay soil [12,13].

Podoconiosis is widely distributed in some countries. It is common in at least ten African countries, including Ethiopia, which has the largest number of podoconiosis patients [12,13]. It causes substantial disability and deformity among those affected and can lead to psychological, social and physical consequences. It is associated morbidities such as acute adenolymphangitis (ALA), mossy lesions and open wounds among productive age adults [14,15]. Households with insufficient access to food often face other challenges related to food insecurity including poor health and a decline in productivity. These challenges may create a vicious cycle in which health problems themselves lead to food insecurity

Methods and Materials

A community-based comparative cross sectional study was carried out in East and West Gojjam Zones, Northern Ethiopia, in February 2016. East and West Gojjam Zones are at an average elevation of 2,769 and 2,466 meters above sea level, respectively. West Gojjam Zone has an estimated total population of 2,106,596, and East Gojjam Zone of about 2,152,671, in 506,520 households [17]. The economy of both zones is reliant on predominantly plough-based (traditional) agriculture. Farmers depend on mähär (the main rainy season from June to September) crops, which provide more than 95 percent of the total agricultural production. In 2013, the prevalence of podoconiosis among people aged 15 years and above in these Zones was found to be 3.3%, and 87% of cases were in the economically active age group (15 - 64 years) [18,19].

The source population was households in endemic districts identified from a 2010 report by International Orthodox Christian Charities' podoconiosis treatment center. The study population was heads of podoconiosis-affected households and the heads of the two nearest unaffected households in the *kebeles* selected within these endemic districts. Household heads aged between 18 and 65 years were included.

Sample size was calculated using Epi-info 7 with the following assumptions: level of confidence 95%, power 80%, ratio of unexposed: exposed, 2:1, prevalence of food insecurity among households without podoconiosis, 70.7% [16], and that assumed among households with podoconiosis, 85.7%. The total sample size was 303 (101:202). After including a design effect of two and allowing for 5% non-response, the final sample size was 636.

A list of districts in East and West Gojjam Zones, known for the presence of podoconiosis based on expert opinion and key informants, was prepared. Stratified random sampling was applied to select eight districts, four from each Zone. A total of 32 *kebeles* were randomly selected from eight districts in these Zones. A list of podoconiosis-affected households in each selected *kebele* was obtained from Health Extension Workers. The sample size for each study *kebeles* was allocated proportional to the number of podoconiosis-affected households. After the head of a podoconiosis-affected household had been interviewed, the two nearest (in distance) unaffected household heads were selected and interviewed.

Data collection tools and procedures

Structured questionnaires were used to obtain information on demographics, socio-economic and agricultural factors, financial services and status of food security. The questionnaire was adopted from the Household Food Insecurity Access Scale (HFIAS) measurement tool. This can be used to classify households into two levels of food security, that is, 'food secure' if the household head responds 'no' to all of the items, and 'insecure' if the head of the household responds 'yes' to at least one of items 1 - 9 [22]. Health extension workers collected the data supervised by Bachelors degree health professionals.

Data quality assurance

A pre-test of the questionnaire was done and small corrections made to the instrument. The questionnaire was prepared first in English and then translated into the local language (Amharic), and then retranslated back to English by an expert to check its consistency. A one-day training on how to administer the questionnaire was given for all data collectors and supervisors. The principal investigators performed the immediate supervision on a daily basis. Data were entered using Epi data version 3.2 with double entry to minimize data entry errors.

Data processing and analysis

Data were checked for completeness, then entered and cleaned in Epi data version 3.2 and finally exported to Statistical Package for Social Sciences (SPSS) software version 22 for analysis. Co-linearity was checked for using variance inflation factors, and a cut-off of < 1 taken to indicate absence of co linearity. Model adequacy was checked by using the Hosmer-Lemeshow goodness of fit test. Binary and multiple logistic regression analyses were performed to assess the independent effect of each associated factor after controlling for all other factors. Explanatory variables associated with the outcome variable in bivariate analysis with a p-value of 0.2 or less were included in the multiple logistic models.

Ethical consideration

Ethical clearance was obtained from the Institutional Research Ethics Review Committee (IRERC) of the College of Medicine and Health Sciences, Debre Markos University. A letter of permission was obtained from East and West Gojjam Health Office. Household heads were asked for informed verbal consent before the questionnaire was administered. This approach to consent was approved by the IRERC.

Results

Socio-demographic characteristics of the study subjects

A total of 608 study participants were involved, 208 from podoconiosis affected households and 400 from unaffected households. The mean ages and standard deviations (SD) of podoconiosis-affected and unaffected household heads were 42 ± 12 SD and 41 ± 11 SD, respectively. Female-headed households made up 20.7% of affected households and 17.8% of unaffected households. Most households were located in rural areas (145, 69.7%, affected and 333, 83.2%, unaffected). The proportion of divorced household heads was considerably greater among podoconiosis-affected families (13.0% vs 2.8%). A higher proportion of heads of podoconiosis-affected households than unaffected households were unable to read or write (73.6% vs 59.0%). The majority of unaffected households (225, 56.2%) included children less than five years old, however only just over one third of affected households (80/208, 38.5%) (Table 1).

Variables	Podoconiosis affected (n = 208)		Unaffected with podoconiosis (n = 400)	
	Insecure (No, %)	Secure (No, %)	Insecure (No, %)	Secure (No, %)
Residence				
Urban	56 (32.2)	7 (20.6)	44 (20.8)	23 (12.2)
Rural	118 (67.8)	27 (79.4)	168 (79.2)	165 (87.8)
Sex of household head				
Male	133 (76.4)	32 (93.1)	167 (78.8)	162 (86.2)
Female	41 (23.6)	2 (6.9)	45 (21.2)	26 (13.8)
Age of household head (quartiles)				
18 - 30	33 (19)	10 (29.4)	61 (28.8)	52 (27.7)
31 - 42	50 (28.7)	13 (38.2)	65 (30.7)	38 (20.2)
43 - 50	42 (24.1)	5 (14.7)	41 (19.3)	52 (27.7)
51 - 65	49 (27.2)	6 (17.6)	45 (21.2)	46 (24.5)
Marital status				
Married	117 (67.2)	26 (76.5)	152 (71.7)	163 (86.7)
Single	25 (14.4)	1 (2.9)	31 (14.6)	12 (6.4)
Separated	9 (5.2)	7 (3.7)	24 (11.3)	7 (3.7)
Divorced/widowed	23 (13.2)	4 (11.8)	5 (2.4)	6 (3.2)
Literacy				
Cannot write and read	134 (77)	19 (55.9)	138 (65.1)	98 (52.1)
Can write and read	40 (23)	15 (44.1)	74 (34.9)	90 (47.9)
Occupation				
Farmer	146 (83.9)	28 (82.4)	189 (89.2)	163 (86.7)
Housewife	10 (5.7)	3 (8.8)	5 (2.4)	8 (4.3)
Daily laborer	15 (8.6)	1 (2.9)	11 (5.2)	4 (2.1)
Merchant	3 (1.7)	2 (5.9)	7 (3.3)	13 (6.9)
Family size (quartiles)				
< 3	73 (42)	13 (38.2)	57 (26.9)	55 (29.3)
3 - 4	55 (31.6)	13 (38.2)	75 (34.4)	51 (27.1)
5 - 6	24 (13.8)	3 (8.8)	54 (25.5)	51 (27.1)
7+	22 (12.6)	5 (14.7)	38 (13.3)	31 (16.5)
Presence of < 5 children				
No	107 (61.5)	21 (61.8)	92 (43.4)	83 (44.1)
Yes	67 (38.5)	13 (38.2)	120 (56.6)	105 (55.9)

Table 1: Demographic characteristics of podoconiosis-affected and unaffected households in East and West Gojjam Zones, Northwest, Ethiopia, 2016.

The majority of food insecure households had no perennial plants, undertook fewer off-farm activities, and lacked access to credit or asset building programs. This was the case whether households were affected by podoconiosis or not.

Food insecurity status in podoconiosis affected and unaffected households

A food secure household experiences none of the food insecurity conditions, or only experiences worry, but experiences this rarely. A large proportion of households both affected and unaffected by podoconiosis were found to be food insecure, and the difference by disease status was statistically significant (83.7% vs. 53%, respectively, $p = 0.0001$). Differences in level of food insecurity by disease status were also demonstrated (Figure 1). Households that experience one of three conditions (running out of food, going to bed hungry, or going a whole day and night without eating) even once in the last four weeks are considered severely food insecure.

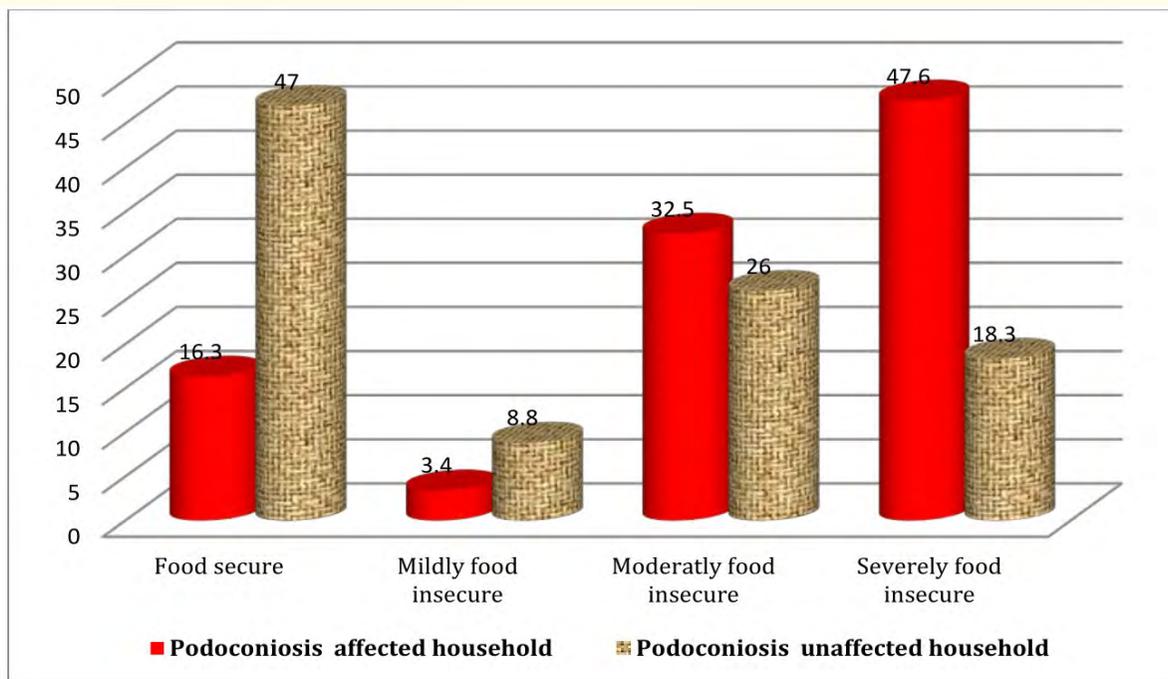


Figure 1: Percentage food insecurity status among podoconiosis-affected and unaffected households in East and West Gojjam Zones, Ethiopia, 2016.

Factors associated with food insecurity among podoconiosis-affected households

In multivariate analysis, only four variables (literacy, off-farm activity, use of fertilizers and living at a greater distance from market) were significantly associated with food insecurity among households affected by podoconiosis (Table 2).

Literacy was significantly associated with food insecurity among households affected by podoconiosis ($p = 0.001$). Affected households whose heads were unable to read and write were more than five times more likely to be food insecure as compared to those whose heads were able to read and write (AOR = 5.84; 95% CI: 2.14, 15.95). Podoconiosis-affected households with no-off farm activities were almost five times more likely to experience food insecurity than which undertook off-farm activities (AOR = 4.90; 95% CI: 1.60, 14.95).

Podoconiosis-affected households that did not use fertilizers were more than four times more likely to be food insecure than those which did use them (AOR = 4.38; 1.15, 16.67). Affected households situated more than 5 km from the nearest market were more than four times more likely to experience food insecurity than those situated less than or equal to 5km from the market (AOR = 4.47; 95% CI: 1.38, 14.48, Table 2).

Variables	Food security status		COR (95% CI)	AOR (95% CI)	P-value
	Insecure	secure			
Sex of household head					
Male	133	32	1		
Female	41	2	4.93 (1.13, 21.47)	0.57 (0.10, 3.14)	0.52
Literacy					
Cannot write and read	134	19	2.64 (1.23, 5.67)	5.84 (2.14,15.95)	0.001
Can write and read	40	15	1		
Off-farm activity					
Yes	11	11	1		
No	163	23	7.08 (2.76, 18.19)	4.90 (1.60,14.95)	0.005
Access to credit					
Yes	37	15	1		
No	137	19	2.92 (1.35, 6.30)	0.97 (0.60, 1.58)	0.92
TLU					
≤ 2.5	28	13	3.22 (1.44, 7.19)	1.29 (0.47, 3.54)	0.61
> 2.5	146	21	1		
House ownership					
Own	131	32	1		
Rented	36	1	8.79 (1.16, 66.57)	6.10 (0.52, 71.20)	0.14
Other*	7	1	1.71 (0.20,14.39)	85. (0.000,0.00)	0.99
Use of fertilizers					
Yes	84	26	1		
No	53	3	5.46 (1.57, 18.96)	4.38 (1.15,16.67)	0.03
Distance from market					
≤ 5 km	100	28	1		
>5 km	74	6	3.45 (1.36, 8.76)	4.47 (1.38,14.48)	0.01

Table 2: Multivariate analysis of factors associated with food insecurity among podoconiosis-affected households in East and West Gojjam, Northwest Ethiopia, 2016.

*Other includes freely provided, with another household or in a plastic shelter

Factors associated with food insecurity among unaffected households

The following variables were entered into the model after binary logistic regression: area of residence, sex of household head, literacy, marital status, ownership of perennial plants, access to credit, access to asset building programs, agro-climate, use of improved seeds and total livestock unit.

Five variables: literacy, ownership of perennial plants, access to asset building programs, use of improved seeds and living in medium or lower altitude areas, were significantly associated with food insecurity in unaffected households. Unaffected households whose heads were unable to read and write were nearly twice as likely to be food insecure as those whose heads were able to read and write (AOR = 1.70; 95% CI: 1.06, 2.72). Households without perennial plants were twice as likely to be food insecure as those with perennial plants (AOR = 2.11; 95% CI: 1.17, 3.34). Households without access to asset building programs were twice as likely to experience food insecurity as those with access (AOR = 2.07, 95% CI: 1.27, 3.34). Households at medium or low altitudes were eight and ten times more likely to be food insecure as those at high altitude (AOR = 8.87; 95%CI: 1.81, 43.40, and 10.04; 95% CI: 1.90, 52.93, respectively). Households that did not use improved seeds were twice as likely to be food insecure as those who did (AOR = 2.20; 95%:1.25, 3.87, Table 3).

Variables	Food security status		COR (95% CI)	AOR (95% CI)	P-value
	Insecure	Secure			
Residence					
Rural	168	164	1	1	
Urban	44	24	1.79 (1.04, 3.07)	0.55 (0.27, 1.09)	0.08
Sex of household head					
Male	167	164	1	1	
Female	45	24	1.84 (1.07, 3.16)	0.85 (0.42, 1.72)	0.65
Literacy					
Cannot write or read	138	98	1.71 (1.00, 3.12)	1.70 (1.06,2.72)	0.02
Can write and read	74	90	1		
Marital status					
Married	152	163	1	1	
Single	31	12	2.77 (1.37,5. 5.59)	1.60 (0.59, 4.37)	0.35
Divorced	24	7	3.67 (1.54, 8.78)	1.91 (0.67, 5.44)	0.22
Separated/widowed	5	6	0.89 (0.26, 2.98)	0.48 (0.08,2.69)	0.41
Perennial plant					
Yes	30	57	1		
No	182	131	2.64 (1.60, 4.33)	2.11 (1.17,3.34)	0.01
Access to credit					
Yes	62	75	1	1	
No	150	113	1.60 (1.06, 2.43)	0.86 (0.51, 1.44)	0.57
Access to asset building program					
Yes	51	77	1	1	
No	161	111	2.19 (1.42, 3.36)	2.07 (1.27, 3.34)	0.01
TLU					
≤ 2.5	122	72	2.18 (1.46, 3.26)	1.03 (0.62, 1.72)	0.89
> 2.5	90	116	1		
Agro-climate					
Highland	4	11	1	1	
Medium land	175	149	3.23 (1.00, 10.35)	8.87 (1.81, 43.40)	0.02
Lowland	33	28	3.24 (0.92, 11.31)	10.04 (1.90,52.93)	
Use of improved seeds					
Yes	28	60	1	1	
No	151	122	2.65 (1.59, 4.40)	2.20 (1.25, 3.87)	0.01

Table 3: Multivariate analysis of factors associated with food insecurity among unaffected households in East and West Gojjam, Northwest Ethiopia, 2016.

Discussion

This study provides a picture of the contribution of podoconiosis to household food insecurity by comparing podoconiosis-affected with unaffected households. Podoconiosis is one of the most chronic neglected diseases and is widely distributed in the study area. One possible limitation of this study was use of the HFIAS, which relies on recall over the past month. This may create recall bias or be influenced by social desirability bias, though attempts were made to minimize the latter by explaining the purpose of the study. The HFIAS cannot identify whether certain members of the household are more vulnerable than others, since it reports the level of food insecurity for the whole household.

This study has demonstrated that a greater proportion of podoconiosis-affected than unaffected households are food insecure (83.7% versus 53%, $p = 0.0001$). The extent of food insecurity among podoconiosis-affected households may arise from the severe social stigma and physical disability associated with the condition, the lack of access to off-farm activities, or the economic burden experienced by patients and their families. This finding is congruent with a study conducted among people living with HIV/AIDS in Uganda and with two previous studies in Ethiopia: the national nutritional baseline survey, and a survey of people with trichomatous trichiasis [23-25]. Each of these conditions, like podoconiosis, may impact on working time, access to education, and social and economic opportunities.

Severe food insecurity was more common among podoconiosis-affected than unaffected households (47.6% vs. 18.3%). This may be mediated by the complications of podoconiosis, including acute adenolymphangitis attacks, which are known to be a frequent cause of morbidity, causing multiple episodes when the patient is unable to leave their bed each year [19].

Households whose head cannot read or write were more food insecure than whose heads could read and write, and this applied to both affected and unaffected households. This may be the result of lower awareness of the possible advantages of modernized agriculture though lower ability to read instructions on fertilizer packs or diversify household incomes.

Lack of off-farm activity was significantly associated with food insecurity among households affected by podoconiosis ($p = 0.005$), but was not significantly associated among non-affected households. Potential employees may consider people with podoconiosis to be unable to work or capable of transmitting the disease. Off-farm activities augment household economy and food security by generating additional income and decreasing food deficits when agricultural production falls short.

Podoconiosis-affected households which did not use modern fertilizers for their farmland were significantly more likely to be food insecure than those that used modern fertilizers. This result was not seen in unaffected households, where the effect may have been mitigated through possession of more farm land.

Households affected with podoconiosis and living more than 5 km from a market were more likely to be food insecure than those situated within 5 km. These variables were not associated among unaffected households. This is likely to reflect the impaired mobility of people with podoconiosis, for whom distance to market is a significant barrier to trade and to other market-based work.

Unaffected households with no perennial plants were more likely to experience food insecurity than unaffected households with such plants. These plants may act as sources of extra income to the household, or contribute to the household's food supply directly, and may play an important role in poverty reduction. No association was seen among podoconiosis-affected households, probably because very few podoconiosis-affected households had any perennial plants.

Similarly, among unaffected households, access to asset-building programs was associated to lower odds of food insecurity ($p = 0.01$), while this relationship was not demonstrated among affected households. Again, the lack of association is likely to have arisen through low numbers, since very few podoconiosis-affected households had access to these programs. This suggests a significant oversight on the part of those operating the asset-building programs.

Not using improved seeds were significantly associated with food insecurity in podoconiosis unaffected households ($p = 0.02$), but this result was not observed in podoconiosis-affected households. It may be that more fundamental agricultural issues (amount of land possessed, hours spent farming) were at play in the affected households, meaning that the type of seed used was of relatively secondary importance in this group.

Conclusion

Food insecurity was more common and more severe among podoconiosis-affected than unaffected households. Being unable to write and read, the absence of off-farm activities, not using fertilizers and living further from the market were significantly associated with food security among affected families, while being unable to write and read, not having perennial plants, lack of access to asset building programs, the agro-climate and not using improved seeds were significantly associated with food insecurity among unaffected households.

While food insecurity must be addressed throughout the study area, podoconiosis-affected families are particularly vulnerable. Interventions to improve literacy, extend asset-building programs and use modern fertilizers must specifically target households affected by podoconiosis.

Acknowledgements

We would also like to express our gratitude to International Orthodox Christian Charities (IOCC) for its unreserved technical support throughout the whole work. We extend our appreciation to the study participants for allowing us to carry out this study in the West and East Gojjam Zone. Special thanks go to the data collectors and respondents who ensured high quality data collected amidst all the challenges in the districts. Finally, we want to express my thanks to Debre Markos University research and publication directorate who gave me support letter for different organizations.

Competing Interests

The authors declare that they have no competing interests.

Bibliography

1. Food Agriculture Organization (FAO). "State of food insecurity in the World: Eradicating world hunger, taking stock ten 2006 years the World Food Summit". Rome, Italy (2006).
2. Devereux S., *et al.* "Improving the analysis of food insecurity: Food insecurity measurement, livelihoods approaches and policies: applications in FIVIMS" (2004).
3. Kabsay S. "Rural household food security status. The case of Laelay Maichew "Woreda", Tigray Ethiopia". *International Journal in Commerce, IT and Social Sciences* 1.3 (2014): 3394-5702.
4. Food Agriculture Organization. "The state of food insecurity in the world: addressing food insecurity in protracted crises". Food and Agriculture Organization of the United Nations, Rome (2010).
5. Food Agriculture Organization. "The State of Food Insecurity in the World, Food and Agriculture Organization of the United Nations". Rome (2012).
6. Bashir MK., *et al.* "The determinants of rural household food security: The Case of Landless Households of the Punjab, Pakistan". Working Paper 1208, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia (2012).
7. Aidoo R., *et al.* "Determinants of household food security in the sekyere-afraim plains district of Ghana". 1st Annual International Interdisciplinary Conference, AIC, Azores, Portugal (2013).

8. Oluwatayo IB. "Explaining inequality and welfare status of households in rural Nigeria: Evidence from Ekiti State". *Humanity and Social Science Journal* 3.1 (2008): 70-80.
9. Sikwela MM. "Determinants of household food security in the semi-arid areas of Zimbabwe: A case study of irrigation and non-irrigation farmers in Lupane and Hwange Districts". *Journal of Economics and Sustainable Development* 5.3 (2008): 84-92.
10. Kahsay S and Mulugeta M. "Determinants of rural household food insecurity in Laelay Maichew Woreda Tigray, Ethiopia". *African Journal of Agriculture and Food Security* 2.1 (2014): 106-112.
11. Hussein B. "Major Causes of Household Food Insecurity in Wuchale-Jidda Woreda, Oromiya National Regional State". MA Thesis, Addis Ababa University (2006).
12. Price E. "Podoconiosis: Non-filarial Elephantiasis". Oxford: Oxford Medical (1990).
13. Davey G., et al. "Podoconiosis: non-infectious geochemical elephantiasis". *Transactions of the Royal Society of Tropical Medicine and Hygiene* 101.12 (2007): 1175 -1180.
14. Davey G., et al. "Podoconiosis: a tropical model for gene-environment interactions?" *Transactions of the Royal Society of Tropical Medicine and Hygiene* 101.1 (2007): 91-96.
15. WHO. Lymphatic filariasis (2015).
16. Worku E., et al. "Food Insecurity in Farta District, Northwest Ethiopia: a community based cross-sectional study". *BMC Research Notes* 7.1 (2014): 130.
17. West Gojjam Zone (2015).
18. Central Statistical Authority (CSA), the summary report of Population and Housing Census of Ethiopia Results from Amhara Region. Addis Ababa (2007).
19. Molla YB., et al. "Podoconiosis in East and West Gojam Zones, Northern Ethiopia". *PLOS Neglected Tropical Diseases* 6.7 (2012): e1744.
20. FAO. "The state of food insecurity in the world. The multiple dimensions of food security" (2013).
21. FAO. "Tropical Livestock Units (TLU)".
22. Coates J., et al. "Household Food Insecurity Access Scale (HFIAS) For Measurement of Food Access: Indicator Guide (V. 3)". Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development (2007).
23. Sheri D Weisera., et al. "Food insecurity is associated with morbidity and patterns of healthcare utilization among HIV-infected individuals in a resource-poor setting". *AIDS* 26.1 (2012): 67-75.
24. Ethiopian Health and Nutrition Research Institute (EHNRI). "Nutrition baseline survey report for the National Nutrition Program of Ethiopia". Addis Ababa, Ethiopia: EHNRI (2009).
25. Habtamu E., et al. "Trachoma and Relative Poverty: A Case-Control Study". *PLOS Neglected Tropical Diseases* 9.11 (2015): e0004228.

Volume 13 Issue 7 July 2018**©All rights reserved by Kassahun Ketema., et al.**