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The Nexus Between Women's Access to Training and Household Food Security in Tharaka Nithi County, Kenya

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Food insecurity continues to pose a significant challenge in Kenya, particularly within the Arid and Semi-Arid Lands (ASALs) such as Tharaka Nithi County. Women's access to training is widely recognised as a critical determinant of agricultural productivity and household food security, particularly in developing regions. Women are disproportionately affected due to limited access to training services. This study examined how women's access to training (WAT) influences HFS in Tharaka Nithi County, Kenya. The study sample comprised 341 women participating in the Uwezo Fund and the Women Enterprise Fund (WEF), across three constituencies: Chuka Igamba Ng'ombe (143), Tharaka (99), and Maara (99). WAT was proxied by an 8-item scale, rated on a 5-point Likert scale from strongly disagree to agree strongly. Household food security had four outcomes, namely: Food accessibility proxied by the 18-item Household Food Insecurity Access Scale (HFIAS), food utilisation and dietary quality proxied by the Household Dietary Diversity Score (HDDS) scale, and food coping behaviour under food stress was proxied by a 9-item Coping Strategies Index (CSI). The HDDS and CSI were rated on a 5-point Likert scale from never to always. The HFIAS scale was rescaled into a 4-point food security classification of food secure, mildly food insecure, moderately food insecure, and severely food insecure groups. Data analysis was done using STATA Version 16. All the scales showed a strong internal consistency reliability, with Cronbach's Alpha coefficients ranging from 0.864 to 0.939. The study adopted a correlational research design to establish how women's access to training influences household food security. The simple linear regression results revealed that women's access to training had a positive and statistically significant effect on HDDS, $b = 0.097$, $p = 0.025$, and CSI, $b = 0.089$, $p = 0.005$. Qualitative insights revealed that training enhanced women's financial literacy, agricultural skills, and household nutrition, better budgeting, production, and meal planning. The study concludes that women's access to training improves household food utilisation and stability by strengthening knowledge and adaptive capacities rather than directly increasing food access. The study recommends integrating WEF and Uwezo Fund programs with

county agricultural extension and local governance frameworks, decentralising training to community levels, tailoring content to women's needs, and enhancing outreach through local centres and regular field visits to improve participation and sustain household food security in arid and semi-arid regions.

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INTRODUCTION

Food insecurity remains a global challenge, disproportionately affecting low-income countries. In 2022, 735 million people faced hunger, up from 613 million in 2019 (FAO, 2023). The Global Hunger Index [GHI] (2025) scores indicate a decline from 23.5 in 2008 to 19.0 in 2016 and are expected to average 18.3 in 2025. The declining food insecurity is mostly due to declining rates in high-income countries. All American countries and most Asia countries experience moderate to low food insecurity (GHI < 19.9). High-income countries benefit from advanced agricultural technologies and robust social protection systems (Begum et al., 2021; Berkowitz et al., 2024). As a result, their food insecurity has been persistently declining over time. Despite a general decline in global hunger, food insecurity in Africa is high, with some countries, including Kenya, anticipated to have increased food insecurity in 2025, especially in arid and semi-arid lands (ASALs).

Food insecurity largely affects Africa, with one in five people experiencing hunger (Oluwole & Olagunju-Yusuf, 2022). Based on the 2025 GHI score, all the top 7 countries marked alarming globally, record high GHI scores between 35.0 and 49.9 are African countries comprising such including Burundi (35.0 - 49.9), South Sudan (37.5), Yemen, DRC (37.5), and Somalia (42.26) (GHI, 2024). Besides, 27 of the serious of 35 countries are from Africa, including all East African countries, with only a few African countries (14) comprising Morocco, Algeria, Libya, South Africa, and Namibia. These countries experience recurrent crises such as endemic diseases and conflicts or semi-arid conditions due to climate change, and consequently, economic instability.

Kenya, with a GHI of 25.0, ranks better than most East African neighbours except Uganda. Kenya GHI declined from 2008 to 23.1 in 2016 and is anticipated to rise to 25.9 in 2025. Food insecurity persists in most ASALs of Kenya, such as Tharaka Nithi County, where recurrent droughts and erratic

rainfall threaten agricultural productivity (FEWS NET, 2023). The Kenya Demographic and Health Survey (2023) reports that 32% of children under five in the county are stunted, and over 60% of households experience moderate to severe food insecurity. Given women's central role in agricultural production and household nutrition management, their access to capacity-building programs is increasingly viewed as a pathway to enhancing household food security. In Kenya, leading empowerment initiatives include the Government's WEF and Uwezo Fund. The programs provide affordable credit, entrepreneurship training, and capacity-building support to women, youth, and persons with disabilities, enabling them to start or expand income-generating activities, enhance financial inclusion, and improve household food security. Despite the women beneficiaries of these programs in Tharaka Nithi County, many households still struggle to achieve stable food access. This raises critical questions regarding the effectiveness of existing training programs.

Access to training and capacity-building programs is recognised as a fundamental strategy for addressing food insecurity. According to FAO (2024), enhancing women's knowledge through targeted training programs on improving skills in agriculture, entrepreneurship, and financial literacy strengthens agricultural productivity, nutrition practices, and household economic resilience. Women who participate in such programs are better equipped to utilise modern farming technologies, manage post-harvest losses, and diversify income-generating activities (Odey et al., 2022). Kenyan studies such as Njuki et al. (2023) suggest that women's access to training could significantly enhance food production and utilisation by increasing knowledge of climate-smart agriculture, entrepreneurship, and nutrition. However, the extent to which economic empowerment and training programs influence household food security outcomes in semi-arid contexts remains underexplored. No study has empirically examined

how women's access to training through the Uwezo fund and WEF improves household food security in Tharaka Nithi County. Understanding this relationship is vital for optimising empowerment strategies to achieve sustainable food systems.

The current study examined how WAT provided by the Uwezo fund and WEF programs influences HFS in Tharaka Nithi County, Kenya. Women's access to training is operationalised as the extent to which women can access, participate in, and benefit from training opportunities across domains such as agriculture, entrepreneurship, and nutrition. It encompasses both the availability and relevance of training programs, as well as the frequency of participation and practical application of acquired skills. Household food security was operationalised in a multidimensional, encompassing availability, accessibility, utilisation, and stability (FAO, 2008). The study is grounded in the Gender and Development (GAD) Theory, which emphasises the need to address structural gender inequalities and promote equitable access to resources and opportunities. Through this lens, women's training is anticipated to enhance food availability through increased productivity, accessibility through improved income generation, utilisation via nutrition education, and stability through risk management skills. The study hypothesised that:

H₀: There is no statistically significant relationship between women's access to training and household food security in Tharaka Nithi County, Kenya.

H₁: There is a statistically significant relationship between women's access to training and household food security in Tharaka Nithi County, Kenya.

METHODOLOGY

Location of the Study

This research was carried out in Tharaka Nithi County, located in Kenya's Eastern region. The county spans approximately 2,639 square kilometres and lies between latitudes 0°07' and

0°26' South and longitudes 37°19' and 37°46' East. It was selected due to its classification as a semi-arid area, where more than 60% of households face moderate to severe food insecurity (FEWS NET, 2023). In 2023 alone, over 120,000 residents required food assistance following extended drought periods. The county also ranks second among thirteen counties in Eastern and Central Kenya for child stunting under age five (32%), surpassing the national average of 18%. These conditions underscore the importance of assessing how socio-economic initiatives like the WEF and Uwezo Fund contribute to household resilience against food insecurity driven by environmental stressors.

Research Design

The study employed a parallel mixed-methods approach, combining quantitative and qualitative techniques to explore the relationship between women's training access and household food security in Tharaka Nithi County. The quantitative strand used a correlational design to assess the strength and direction of associations between training and food security indicators, while qualitative interviews offered a deeper contextual understanding. This design was suitable given the multidimensional nature of food security, which involves both quantifiable elements like income and dietary diversity, and qualitative aspects such as decision-making and perceptions.

Population of the Study

The study population comprised 32,000 women actively participating in the Uwezo Fund and WEF

within Tharaka Nithi County. These women were registered and active beneficiaries of the two government empowerment programs as of the data collection period between May and June 2025. The population estimate was obtained from Tharaka Nithi County Government (2024) records and was considered appropriate for examining the relationship between women's economic empowerment and household food security.

Sampling Procedure and Sample Size

A stratified random sampling design was adopted to ensure fair representation of the two main beneficiary groups: Uwezo Fund and WEF participants. Stratification was necessary due to the structural and operational differences between the two programs, which created heterogeneity in the population. Proportional allocation between the strata was determined based on the actual number of registered beneficiaries, with 10,000 from the Uwezo Fund and 22,000 from WEF. Using Yamane's (1967) formula (Equation 1) at a 95% confidence level and a 0.05 precision level, a total target sample of 395 respondents was computed.

$$n = \frac{N}{(1 + N(e^2))} \quad (1)$$

Where: n = sample size, N = population size = 32000, and e is the desired level of precision (0.05). The target sample was proportionally distributed as 123 respondents from Uwezo Fund and 272 from WEF to reflect their relative population sizes (Table 1).

Table 1: Response Rates by Respondent Group

Category	Total Number	Target Sample	Achieved Sample	Response Rate
Women benefiting from the Uwezo Fund	10000	123	118	95.93%
Women benefiting from the WEF	22000	272	223	81.99%
Total	32,000	395	341	86.33%

The sampling units where the individual woman was enrolled and was actively participating in either program at the time of data collection (May – June 2025). Within each stratum, simple random sampling was applied to give every eligible woman an equal chance of selection and to minimise bias (Mugenda & Mugenda, 2003).

Research Instruments

The study variables comprised demographic variables such as age, education level, marital status, and main sources of livelihoods, and main study constructs, WAT and HFI. The dependent variable was HFI, which has three sub-domains: food accessibility proxied by the 18-item HFIAS, food utilisation and dietary quality proxied by the HDDS scale, and food coping behaviour under food stress was proxied by a 9-item CSI. The FAOs 9-item HFIAS measured whether households had different forms of insecurity outcomes including worrying that the household would not have enough food, eating a limited variety of foods due to a lack of resources, eating some foods they do not want due to lack of resources to buy other types of food, eating a smaller meal or fewer meals in a day over a period of the past four weeks from the time of study (FAO et al., 2007). Besides, respondents who reported these forms of food insecurity rated how often it happens on a three Likert scale from 1=Rarely (once or twice in the past four weeks), 2=Sometimes (three to ten times in the past four weeks), and 3= Often (more than ten times in the past four weeks). The 18 items showed internal consistency reliability based on Cronbach's alpha coefficient (CA) = 0.874 (DeVellis, 2017). The HFIAS was then rescaled into a 4-point food security classification of 1) food secure, 2) mildly food insecure, 3) moderately food insecure, and 4) severely food insecure groups based on FAO's algorithm (FAO 2007, Pg 21).

In the HDDS scale, respondents were asked to rate the availability of 12 food stuff (Cereals e.g. maize, Tubers such as cassava, sweet potatoes, Pulses such

as beans, Fruits, Vegetables, Fish/meat/eggs/poultry, Oil/fat, Milk, Sugar, Salt, Maize flour, and Tea/coffee) in their household in the last one month at the time of study on 5-Point scale from 1=never, 2=rarely, 3=sometimes, 4=often and 5=always. HDDS represents the number of distinct foods consumed over a given reference period (FAO, 2011). Often, it is operationalized as count of the food group consumed by a household from the 12-food groups in a single point, particularly over a 24-hour recall period and categorized as low dietary diversity status if the sum score is 0 - 3, medium if the sum score is 4- 6 and high if the score is 7-12 (Azeez, 2023, Nengovhela et al., 2022, Panchol, 2021). In the current study, the reference period was over the past month to align with the HFAS, which was operationalised as over the past three months. Given the long span, the chances of consuming all the 12 food groups become high and can often skew the dietary diversity, and can suffer from sampling bias. Thus, the food items were rated based on the 5-point availability scale. The approach also ensures all the variables have a common relative scale and minimises variance. The 12 HDDS items showed internal consistency reliability based on CA = 0.873.

The study also adapted the CSI scale, which is a widely validated scale used to measure household responses to food insecurity (Ademola et al., 2021; Shakeel & Shazli, 2021). In this study, respondents rated nine coping practices on a 5-point Likert scale ranging from 1 (never) to 5 (always). The items included behaviours such as “gone without food,” “reduced number of meals per day,” “reduced portion eaten per day,” “sold livestock to buy food,” and “borrowed food or money to buy food.” These indicators met the content validity thresholds and were found to be internally consistent in the current study (CA = 0.894), confirming the reliability of the CSI for assessing household food insecurity.

The WAT construct was operationalised to measure the extent to which women access and benefit from training programs designed to enhance their

economic and financial empowerment. Since no standardised tool exists for assessing access to training, the indicators were self-developed from theoretical and empirical literature on financial literacy, entrepreneurship, and women's empowerment (Rehman & Mia, 2024; Kaiser & Lusardi, 2024; Demedeme & Opoku, 2022; Eseza et al., 2025; Sanze et al., 2024). Based on the studies, the WAT scale was constructed to capture three broad domains. Participation, accessibility, and relevance of training, and comprised eight indicators: (1) frequency of participation in financial and/or savings training programs, (2) attendance in financial and savings workshops, (3) accessibility of training opportunities, (4) adequacy of agricultural training sessions, (5) adequacy of business-related training, (6) tailoring of training content to individual needs, (7) application of learned skills in daily life; and (8) perceived usefulness of the training received. Each indicator was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Content validity was achieved through field experts who ensured that the adopted items adequately covered all the domains relating to each construct and were relevant. Construct validity was assessed using exploratory factor analysis, which confirmed that all eight items loaded above the 0.50 threshold (0.7802 to 0.8821), supporting the one-dimensionality of the construct. The CA coefficient was above 0.70 (CA = 0.933), demonstrating satisfactory internal consistency reliability.

Data Collection Procedure

The primary data was obtained from women beneficiaries of the Uwezo and WEF fund using a printed semi-structured questionnaire with closed and open-ended questions. A familiarisation meeting was held with program coordinators and research assistants to identify and map women participants in the two programs, establish fieldwork protocols, and resolve logistical matters. Additionally, research assistants received training on administering household questionnaires using

printed formats to ensure accurate and complete responses. The data collection was carried out in two phases to comprehensively address the study objectives. The first phase involved distributing structured questionnaires to selected women participants. This phase gathered quantitative data on demographics, women's participation in empowerment programs, household food security, and related challenges. Data collection was conducted over a period of one and a half months between May and June 2025.

Data Analysis Procedure

The collected primary data were coded in STATA version 16 for analysis. Categorical responses were analysed descriptively using frequencies and percentages. Quantitative data were summarised using minimum, maximum, mean, and standard deviation (SD). Inferential data analysis entailed the use of Pearson correlation analysis and simple ordinary least squares (OLS) linear regression analysis. Pearson Correlation analysis was used to examine the strength and direction of bivariate relationships between the study variables. Simple linear regression was used to determine the influence of WAT variables on HFS. The WAT, CSI and HDDS constructs were measured on 5-point scales and averaged into continuous indices, while HFIAS had four ordinal categories ranging from food secure to severely food insecure. OLS regression was applied to maintain methodological consistency across the three household food security measures and to minimise bias that could arise from using different statistical techniques. For robustness checks, ordinal logistic regression was also estimated for the HFIA model. The level of significance was set at a 5% level. Preliminary diagnostic tests were conducted to check for any potential violation of the classical assumptions of OLS linear regression. Qualitative data were analysed thematically, allowing patterns and insights to emerge from participants' narratives. The mixed-methods design strengthened the study's validity by integrating the quantitative data with the

depth of qualitative perspectives to enrich interpretation and triangulate the findings.

Ethical Considerations

Prior to the commencement of data collection, ethical approval was obtained from the Chuka University Ethics Committee under reference number CUIERC/NACOSTI/728 issued on April 25, 2025. The institution's ethical approval confirmed that the study complied with institutional and national research ethics standards. A research permit was subsequently granted by the National Commission for Science, Technology, and Innovation (NACOSTI) under permit number 172746, issued on May 20, 2025, authorising the fieldwork in Tharaka Nithi County. Informed consent was obtained from all participants before data collection. The consent form, embedded within the questionnaire, clearly stated the study's academic purpose, objectives, and the voluntary nature of participation. Respondents were informed

of their right to decline participation or withdraw at any stage without penalty. To maintain confidentiality and data integrity, no personal identifiers such as names or contact details were recorded. Completed questionnaires were securely stored and accessible only to the research team. For the qualitative component, anonymity was ensured by assigning pseudonyms to all direct quotations, such as Res70, to conceal participants' real identities while preserving the authenticity of their views. The measures collectively ensured compliance with ethical principles in research.

RESULTS

Demographic Characteristics of the Study Participants

The distribution of the study respondents by constituency, age, marital status, and the highest level of education completed is summarised in Table 2.

Table 2: Distribution of the Women Beneficiaries of the Uwezo Fund and the WEF

Variable	Categories	N	Valid Percent
Constituency	Chuka Igamba Ng'ombe	143	41.9
	Tharaka	99	29
	Maara	99	29
	Total	341	100
Age	18-24	13	3.8
	25-34	48	14.2
	35-44	81	23.9
	45-54	80	23.6
	55-60	63	18.6
	Over 60	54	15.9
	Total	339	100
Marital Status	Single	29	8.5
	Married	237	69.5
	Widowed	53	15.5
	Divorced	7	2.1
	Separated	15	4.4
	Total	341	100
Highest level of education completed	No formal education	30	8.8
	Primary	152	44.7
	Secondary	86	25.3

Variable	Categories	N	Valid Percent
	Tertiary	72	21.2
	Total	340	100

The distribution shows that the respondents were drawn from all three constituencies of Tharaka Nithi County. Most participants were from Chuka Igamba Ng'ombe (41.9%), reflecting its higher concentration of trading centres, SACCOs, and financial institutions compared to Tharaka (29%) and Maara (29%). The majority of respondents were women in economically active age groups, particularly those aged 35 - 44 (23.9%) and 45 - 54 (23.6%). Most were married (69.5%), while 15.5% were widowed, and smaller shares were single, separated, or divorced. Education levels were relatively low to moderate, with 44.7% having primary education, 25.3% secondary, and 21.2% tertiary, indicating varied but adequate literacy for training participation. These characteristics show that beneficiaries represented diverse ages, marital statuses, and educational backgrounds, supporting the generalizability of the study findings across the county.

Household Food Security Levels

Food security was proxied using three indicators. Based on the HDDS scale, the study found that 49% of households achieved moderate dietary diversity (5 - 8 food groups), 31% had low diversity (≤ 4 food groups), and 20% had high diversity (≥ 9 food groups). The HFIAS, measured on a 4-point scale (1 = Secure, 4 = Severe), revealed that the majority of respondents experienced significant food insecurity. Among the 264 households assessed, 61.7% (N = 163) were classified as severely food insecure, while 33.7% (N = 89) fell into the moderate category. Only 4.6% (N = 12) reported mild food insecurity. The findings indicate that nearly all respondents faced some level of food access challenges, with severe insecurity being the most

prevalent. The CSI showed that households commonly resorted to strategies such as reducing meal size (61%) or borrowing food (43%) during shortages. These patterns align with previous county-level statistics showing persistent food insecurity among women-headed or women-managed households (FEWS NET, 2023).

Women's Access to Training

Out of 395 respondents, 72% reported having participated in at least one training session under WEF or Uwezo Fund within the past two years. The training covered entrepreneurship (43%), financial management (38%), agricultural production (31%), and food preservation or nutrition education (24%). However, 64% of respondents indicated that the training duration was short (1–3 days), and 47% reported challenges in attending due to household responsibilities. About 41% stated that they were not notified early enough to prepare for attendance, while 32% cited transport constraints. These responses reveal that although training programs exist, participation and effectiveness are moderated by accessibility, duration, and gendered barriers such as time poverty.

For regression analysis, the study used the composite construct computed by averaging each of the indicators of the HDDS, CSI, and WAT since each of the respective items was on a five-point scale. The HFIAS scale was then rescaled into a 4-point food security classification of 1) food secure, 2) mildly food insecure, 3) moderately food insecure, and 4) severely food insecure groups based on FAO's algorithm. Table 3 presents the descriptive statistics for HFIA, HDDS, CSI, and WAT.

Table 3: Descriptive Statistics of the Study Variables

Variable	N	Mean	SD	Min	Max
Household Food Insecurity Access	264	3.572	.581	2	4
Household Dietary Diversity Scores	341	3.452	.71	1	5
Coping Strategies Index	341	2.175	.683	1	4
Women's Access to Training	340	3.509	1.058	1	5

The results show that HFIA had a mean score of 3.572 (SD = 0.581), indicating moderate food insecurity levels. HDDS showed a mean of 3.452 (SD = 0.710), reflecting moderate dietary diversity. CSI recorded a lower mean of 2.175 (SD = 0.683), suggesting limited reliance on coping mechanisms. WAT had a mean of 3.509 (SD = 1.058), indicating moderate access to training opportunities.

Diagnostic Tests

The preliminary analysis entailed testing for classical linear regression assumptions of the regression models. Scatter plots revealed positive linear patterns for all variables except HFIA (Appendix I). HFIA, measured on a four-point ordinal scale, lacked continuity and did not meet the linearity assumptions. Thus, an ordinal logistic regression was fitted for robustness of the findings. Pairwise correlation results showed a positive and statistically significant correlation with HDDS, $r = 0.144$, $p = 0.008$, and with the CSI, $r = 0.189$, $p < 0.001$. However, its correlation with HFIA was weak and not statistically significant, $r = 0.062$, $p =$

0.319. These results suggest that while training access is associated with improved dietary diversity and coping capacity, its direct link to food insecurity severity was not supported due to a lack of a strong linear relationship. All three models violated the normality assumptions based on the Shapiro-Wilk test of model residuals ($p < 0.001$) (Appendix II). The HFIA model met the evidence of the homoscedasticity assumption based on the Breusch-Pagan/Cook-Weisberg test, $p = 0.5778$. However, the HDDS and CSI models exhibited significant heteroskedasticity, $p < 0.01$ (Appendix III). The violation of the normality and homoscedasticity assumptions reduces the reliability of coefficient estimates and validity of the results (Farrar, 2022). Thus, the models were fitted using robust standard errors to correct for potential heteroscedasticity.

Regression Results

Table 4 summarises the regression results examining the effect of WAT on each of the three food security outcomes.

Table 4: Simple Ordinary Least Squares Regression Results

Variables/Statistic	Statistic	(1) HFIA: OLS	(2) HFIA: Ordinal logistic regression	(3) HDSS: OLS	(4) CSI: OLS
WAT	β	0.035	0.136	0.097**	0.122***
	SE	(0.036)	0.123	(0.043)	(0.043)
	t/Z	0.983	Z = 1.100	2.246	2.852
	p	(0.326)	(0.272)	(0.025)	(0.005)
Constant	β	3.443***		3.109***	1.744***
	SE	(0.137)		(0.162)	(0.162)
	t/Z	25.102		19.184	10.769
	p	(0.000)		(0.000)	(0.000)
Moderate Food Insecurity	β		-0.256		
	CI		[-3.583, -1.537]		

Variables/Statistic	Statistic	(1) HFIA: OLS	(2) HFIA: Ordinal logistic regression	(3) HDSS: OLS	(4) CSI: OLS
Severe Food Insecurity	SE		(0.522)		
	β		0.011		
	CI		[0.465, -0.900]		
	SE		(0.922)		
Observations		264		340	340
R-squared		0.004		0.021	0.036
F (1, 337)		0.970		5.04	8.13
p-value (F)		0.036		0.025	0.005
Wald chi2(1)			1.21		
Prob > chi2			0.2715		
Pseudo R ²			0.0028		

Notes. HFIA: Household Food Insecurity Access, HDSS: Household Dietary Diversity Score, Parameters order: Coefficient, (Robust se), t-statistic, (p-value); ***p<0.01, ** p<0.05, * p<0.1' confidence interval in [].

The simple linear regression results showed that WAT has no significant effect on HFS, $b = 0.035$, $p = 0.326$, R-square = 0.004, but has a positive significant effect on HDDS, $b = 0.097$, $p = 0.025$, R-square = 0.021, and CSI, $b = 0.089$, $p = 0.005$, R-square = 0.036, at a 5% significance level. The Ordinal logistic regression also supported the insignificant effect of WAT on HFS, $b = 0.136$, $p = 0.272$. The ordinal logistic regression also showed that higher WAT participation was associated with lower odds of being in the moderate food insecurity category ($b = -0.256$, $SE = 0.522$, 95% CI [-3.583, -1.537]) than the mild food insecurity group. In contrast, the effect of severe food insecurity was statistically insignificant. Based on the results, H_0 which states that there is no statistically significant relationship between women's access to training and household food security in Tharaka Nithi County, is partially rejected. The regression results showed that WAT significantly influenced HDDS and CSI, but not HFS. The findings imply that training enhances households' ability to diversify diets and adopt more effective coping mechanisms during food shortages, but does not directly translate into improved food access levels. The results

suggest that women's training enhances households' capacity to diversify diets and adopt better coping strategies by improving financial management, agribusiness, and entrepreneurial skills. However, these gains mainly strengthen adaptive food insecurity coping mechanisms and nutritional diversity capacities rather than directly improving household food access. The low R-square values suggest that while WAT contributes to food security outcomes, it explains only a small fraction of the observed variability in food security. Thus, other socio-economic and environmental factors, such as income stability, access to land, and control over houseless assets, are potential factors that likely play stronger roles in determining overall household food security.

Qualitative Results

The interviews revealed that women in Tharaka Nithi County participate in diverse training programs offered by both government and development agencies, mainly focusing on agriculture, business management, and financial literacy. Key informants highlighted that agricultural training remains the cornerstone of women's empowerment, directly improving household food production and dietary diversity. One informant explained,

“Training in agriculture has helped women adopt better farming practices, increasing their production” (KIG05).

Similarly, financial literacy training was reported to strengthen budgeting and resource management, enabling women to make informed consumption and investment decisions. As one key informant observed,

“Trainings improve their skills and knowledge in matters financial. For instance, women are able to manage their finances and ensure there’s food” (KIG07).

Together, these interventions were described as central to improving household food access and economic stability.

Respondents also reported notable challenges that restrict training participation and effectiveness. Cultural expectations, domestic workloads, and poor infrastructure were repeatedly cited as barriers preventing full inclusion of women in training initiatives. One key informant stated,

“Yes, cultural barriers and gender roles; limited access to information about training opportunities; lack of time due to household responsibilities” (KIG06).

Similarly, logistical constraints such as distance, poor roads, and weak mobile networks limited the frequency and reach of training sessions. Another informant explained,

“Poor roads, the trainers are unable to travel everywhere. Poor network issues... lack of education among the women groups on the importance of trainers” (KI01).

These access constraints mirror the quantitative findings that pointed to distance, lack of information, and competing responsibilities as key

deterrents to training participation. Informants also emphasised that agricultural training, especially those under programs such as the Kenya Climate Smart Agriculture Project (KCSAP), had the greatest and most visible effect on women’s livelihoods and food security.

“Agricultural training has had the greatest impact because it directly increased food production, improved nutritional knowledge and reduced reliance on external food resources” (KIG04).

Another added,

“Agricultural training by KCSAP... farmers received equipment and knowledge of farming practices. With all these, farmers realise greater harvest” (KIG07).

These responses underscore the transformative potential of well-coordinated agricultural and financial education in strengthening household resilience. They also highlight the synergy between training and input support, confirming that capacity building must be sustained through institutional linkages and local extension partnerships to achieve long-term food security gains.

DISCUSSION

The regression results showed that WAT had a statistically significant positive effect on HDDS and the CSI, but no significant effect on HFIA. This pattern suggests that while training improves dietary quality and coping capacity, it does not directly translate into enhanced food access. The positive association between WAT and HDDS can be explained by the training’s emphasis on financial management, agribusiness practices, and entrepreneurship, which empower women to make better household budget decisions, plan food purchases, and invest in diversified food production. Training on savings, income reinvestment, and improved crop and livestock

management practices enhances women's ability to ensure regular availability of diverse food groups, thereby improving household dietary diversity. The qualitative findings reinforce the quantitative evidence that women's training significantly enhances food security by equipping them with practical agricultural and financial skills. Participants' responses, such as those describing better budgeting, improved farm yields, and diversified diets, corroborate the statistical associations between training access and dietary diversity.

Similarly, the significant effect of WAT on CSI indicates that training strengthens households' resilience and adaptive behaviour during periods of food stress. Skills gained in record keeping, group savings, and small-scale enterprise management improve cash flow and enable women to adopt less erosive coping strategies, such as using savings or selling non-productive assets, instead of skipping meals or reducing food portions. These outcomes reflect the capacity-building role of WAT in stabilising food security through improved household planning and resource management. In contrast, the insignificant relationship between WAT and HFIA implies that training alone does not directly alleviate food access challenges. Households may still face structural barriers such as low purchasing power, fluctuating agricultural incomes, limited market access, or cultural norms that constrain women's financial autonomy. This finding suggests that while women acquire knowledge and skills, translating them into improved food access requires complementary interventions such as credit facilities, input support, and improved market linkages. Overall, these findings demonstrate that women's training exerts an indirect influence on food security by improving dietary diversity and coping capacity rather than directly expanding food access in Tharaka Nithi County. Strengthening WAT through integration with credit, agribusiness mentorship, and market-oriented programs could enhance its long-term effectiveness in improving food access and stability.

The findings align with the GAD theory, showing that empowering women through equitable access to training and productive resources enhances their ability to influence household food access, availability, and dietary diversity. Thus, addressing gender inequalities promotes women's economic inclusion and strengthens overall household food security. Similar empirical evidence from other Sub-Saharan African countries reinforces the present study's findings. In Uganda, Ikendi et al. (2023) found that participation in livelihood education programs covering agronomy, post-harvest handling, livestock integration, and nutrition significantly improved household food security. Respondents in the current study similarly highlighted training in financial literacy, agriculture, and agribusiness as key to enhancing food outcomes. These forms of training align with Dooley and Grady Roberts (2020), who noted that agricultural extension programs build women's capacity in sustainable practices such as non-chemical pest control and efficient water management, thereby improving resilience under climate stress. Sly (2021) observed that women's groups receiving agricultural and nutrition training alongside support for kitchen gardens achieved higher dietary diversity in Rwanda. Nabuuma et al. (2021) also linked low diversity to limited access to training and agricultural information in Uganda's Kiboga District. These studies collectively suggest that access to targeted training programs strengthens women's decision-making and household food security. Further, evidence from Malawi and Mali underscores how agroecological and nutrition education fosters healthier dietary patterns and increases the likelihood of meeting minimum diversity thresholds (Adubra et al., 2019; Owoputi et al., 2022). Likewise, Garbero and Jäckering (2021) reported that agricultural training in low-income households shifts consumption toward nutrient-rich foods such as eggs, meat, and dairy. Consistent with these insights, the current study found that women who acquired budgeting and meal-planning skills were better able to diversify

household diets and adopt coping strategies such as adjusting meal frequency, saving food stocks, and reallocating income during shortages, thereby enhancing HDDS and CSI. Collectively, these findings highlight that women's training contributes meaningfully to food security across different contexts by enhancing knowledge application and adaptive capacity.

The study demonstrates that women's participation in training programs enhances household food security by improving dietary diversity and coping strategies during periods of food stress. Training that builds women's nutrition knowledge, financial literacy, and farming skills strengthens their capacity to make informed food and income decisions. Programs such as the Uwezo Fund and WEF can further enhance these outcomes by addressing the highlighted barriers that limit the full potential of such programs. Distance to training venues, lack of timely communication, and household responsibilities reduce participation, especially for women in remote or resource-poor areas. Cultural expectations and time poverty exacerbate these exclusions, highlighting that access alone does not guarantee impact. Some women noted that even where training was available, its quality, frequency/irregular sessions, or contextual relevance was insufficient for sustained outcomes. To strengthen future interventions, training must be context-specific, decentralised, and supported by follow-up systems that link women to markets, credit, and advisory services. Programs such as Uwezo Fund and WEF can enhance their reach and inclusivity by integrating flexible scheduling, transport facilitation, and awareness campaigns through both traditional and digital platforms. Embedding agricultural, financial, and nutritional education within local governance and extension frameworks such as KCSAP can ensure sustained learning and equitable participation and strengthen their impact on household resilience and food security.

While the regression results revealed statistically significant effects of women's training on dietary diversity and coping capacity, the models' very low R^2 values (below 0.04) indicate that training accounted for only a small proportion of the variation in household food security outcomes. This suggests that although the effects were statistically significant, the large unexplained variance (about 96%) indicates the influence of other determinants, such as household income, land size, market accessibility, and cultural decision-making dynamics, that shape food security in Tharaka Nithi County. The insignificant association between WAT and food access further underscores this limitation, implying that knowledge and skills gained from training may improve household planning and adaptive behaviour but are insufficient to overcome structural and economic barriers that restrict consistent access to adequate food.

CONCLUSION

The study concludes that WAT significantly enhanced household dietary diversity and coping strategies but did not have a direct effect on food access levels. This suggests that training influences food security indirectly by improving knowledge, budgeting, and adaptive capacities rather than through immediate food availability. While training remains vital for strengthening women's livelihood and financial skills, its effectiveness is constrained by barriers such as poor access, low awareness, and distance to training centres. To enhance participation and impact, WEF and Uwezo Fund programs should be integrated with county agricultural extension and local governance frameworks, decentralised to community levels, and tailored to women's specific roles and constraints. These programs should also expand local training centres, intensify community outreach, and conduct regular field visits to bridge logistical and informational gaps that limit women's engagement. Nonetheless, the low explanatory power (R -squared < 0.04) indicates that other factors, such as land size, household income, and market access, play a critical

role in determining food security. Future research should therefore employ longitudinal and multi-county approaches to assess the long-term and cross-context effectiveness of women's training programs on household food security.

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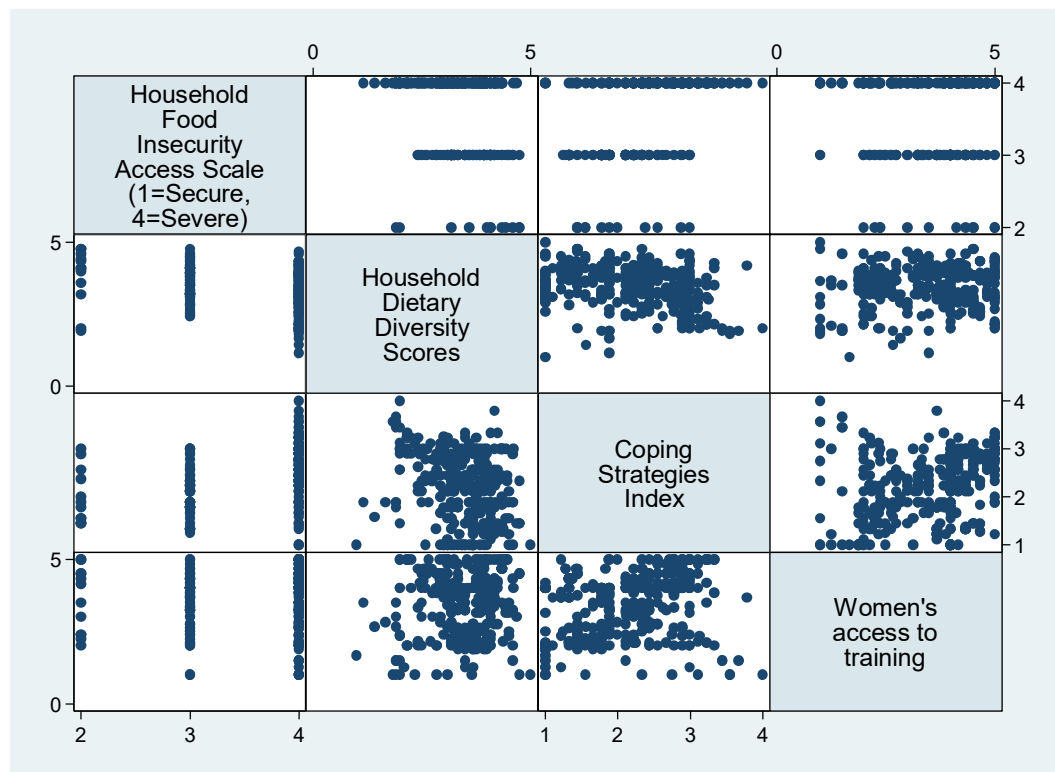
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APPENDIX

Appendix I: Scatter Plot Matrix



Appendix II: Shapiro-Wilk of Model Residuals.

Variable	N	W	V	z	p-value
Residuals: HFIA	264	0.73484	50.455	9.147	0.00000
Residuals: HDDS	340	0.97291	6.450	4.402	0.00001
Residuals: CSI	340	0.98351	3.927	3.230	0.00062

Appendix III: Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

Model	Degrees of freedom	Ch-sqaure	p-value
HFIA model	1	0.310	0.5778
HDDS model	1	6.730	0.0095
CSI model	1	12.04	0.0005

Notes: Ho: Constant variance