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Land Tenure Security and Households' Food Security Nexus: Implications for an Improving Land Governance in Iringa District, Tanzania

Gerald Usika[1]
Samwel J. Kabote[2]
Justin K. Urassa[3]

[1]gerald.usika@gmail.com
[2]sjkabote@sua.ac.tz
[3]urassa@sua.ac.tz

[1,2]Department of Policy, Planning and Management, College of Social Sciences and Humanities, [3]Department of Development and Strategic Studies, [1,2,3]Sokoine University of Agriculture, [1,2]P.O. Box 3035, [3]P.O. Box 3024, [1,2,3]Chuo Kikuu, Morogoro, Tanzania

ABSTRACT

This study was conducted to determine the contribution of the Certificate of Customary Rights of Occupancy (CCRO) to farming households' food security in the Iringa District Council. Particularly, the study aimed to determine the influence of land tenure security on the food situation of households, the influence of land tenure security on food consumption, and the influence of land tenure security on the source of food for households. The study was guided by the institutional theory and the theory of access, these theories linked the study to the existing body of literature. The study adopted a quasi-experimental research design where villages that received CCRO were considered as the treatment group of the study and those villages without CCRO were categorized as the control group for the study. The study decided to adopt the Propensity Score Matching method for constructing a comparison group. The total sample size for this study was 404 households, with equality divided between the two villages, with and without CCRO. The study used a systematic random sampling approach to select a sample size of 404 households from the targeted population. The study employed a mixed methods approach whereby both qualitative and quantitative data were collected through questionnaires and interviews respectively. The collected data was analyzed using descriptive and inferential statistics using IBM SPSS for quantitative data, while qualitative data was analyzed using a content analysis approach. The study found that those households with CCROs show a high score of food consumption compared to households without CCROs, this indicates that CCROs enhance food security in households. This was supported statistically by regression results and bivariate outcomes that illustrate the significance of CCROs ownership in improving the food situation of households between households having CCROs compared to those that haven't. Furthermore, the study found that there is a difference in food consumption patterns between households with CCROs and those without CCROs. The study concluded that land tenure security has a great impact on the food security of households in the Iringa district, also, it was concluded that CCRO ownership contributes to improving the food situation of households enhancing their capacity to access diverse food groups. The study recommended that government and local government authorities develop policies and strategies that are tailored and applicable to agriculture development and land ownership to improve land governance structure that allows land registration easy.

Keywords: CCRO, Certificate of Customary Right of Occupancy, Food Diversity, Food Security, Land Tenure Security

1. INTRODUCTION

For humans to have a sustainable life need to have access to basic human needs such as access to food, shelter, and clothes, the accessibility to food provides activeness and healthy life to human beings which makes food security become vital topic globally (Omotoso, et al, 2019). Food security is considered as the ability of an individual to have secured access to quality food sufficiently over the year since the main source of food is generated as output of agricultural products that make the linkage between availability of land and food security to households (Landesa, 2012).

The Land is one of the natural resources that are vital to humans and other living organisms and it plays a vital part in human life as more than 80% of foods are developed through the land, thus it becomes necessary to have land tenure security (Roth & Myers, 2010). Land tenure is considered the legal framework that controls and governs ownership of land and the uses of an individual in given land, majority of land uses in rural areas are for agricultural purposes (Amwata, 2004). Almost three-quarters of the world's population depend on the land to run their daily activities from the exploitation of natural resources generated by land such as forest products, grazing, and others that have direct linkage with land utilization, but since the population is growing while land is becoming scarce lead to land grabbing and other conflict related to land.

Most developing countries depend on the development of the agriculture industry as a tool to attain required economic development through improving citizen lifestyles and eradicating poverty by giving access to food, thus

creating a relationship between land tenure security and food security (Omotoso et al, 2019). The relationship between land and food security attracted the attention of many researchers to conduct a study on land tenure security and food security (Liversage, 2021). Normally those two concepts are studied differently due to the nature of the coverage, as land tenure involves a complex framework structure including legal framework and ownership (Omotoso et al, 2019).

Historically the concept of land tenure can be traced back to the early 11th century after the rise of feudalism in Western culture, under the feudalism system all land is owned by a minor system where lords are superior to certain pieces of land and other low-class are obligated to duties under the lord of the given minor under the consideration of given shelter and security. Under the feudalism system, the lord and peasant can form an agreement of transferring land ownership where the lower class can have access to the lord's land with an agreement to provide labor and percentage of crops cultivated (Ellsworth, 2002).

When the feudalism system fell during 12sth century, it led to an opening of those land to competition among powerful individuals and institutions that traded the untradeable right of land forced Western countries such as British and the United States to intervene with environment protection arguments (Ellsworth, 2002). The arguments suggested that for the value of land to be protected it should be entrusted by the local communities or the national government will provide ownership to individuals for the preserving value of land (Ellsworth, 2002), thus leading to the concept of land tenure which give the customary right to the individual over the piece of land under the government agreement in the given country.

In African countries, most land was owned by tribes under their leaders and chiefs, however after the colonial era the land was owned by colonial states. The notable Land tenure system was established by the British administration as they enacted Land Ordinance Number 3 in 1923, the ordinance entrusted Land to the hand of the colonial Governor. The Ordinance was redefined in 1923 which included the title to own land for the community under customary laws (ANRC, 2019). After the independence, most African countries reformed the colonial laws to enable different registrations that allow natives to own land, for example, Land Act No. 4 placed land under three categories which are general land, village land, and reserve land (ANRC, 2019). The Land Act enables individuals to have rights over the village land by obtaining a Certificate of Customary Right of Occupancy (CCRO) from local land communities via the local government (ANRC, 2019).

The ownership of land gives opportunities for food production either through agricultural activities or the exchanging of byproducts from agriculture with other products, the land tenure gives entitlement to the household access to natural resources. Statistics show that due to food insecurity globally caused more than 870 million people to live with chronicle malnutrition, the reason is limited access to food and lack of food security caused by land conflicts, or other hazards (Roth, 2013). Most international organizations cooperating with the Government established programs that ensure food security like availability, accessibility, and quality of food, but to ensure the security of food for the majority of urban people, of whom 80% rely on agriculture there should be an enhancement on agriculture system (Christiaensen et al, 2012). Land tenure has a great impact on food security within Africa as it determines what is produced and consumed, land tenure minimizes land disputes that allow people to invest in food production to improve the food security of their household as they will have access to foods and food security (FAO, 2012).

1.1 Statement of the Problem

Tanzania has recognized three main development enemy that are poverty, ignorance, and diseases which affect mostly rural areas as half of the population of Africa includes Tanzanians. With all the challenges facing rural areas in Tanzania, the majority of Tanzania's population depends on the foods produced in those rural areas to feed the urban population as well (ECA, 2009). The statistics show that there is food insecurity in Tanzania regions such as Dodoma, Singida where it counts up to 55% food insecurity and rural areas such as Manyara, Mwanza, and Kagera have food insecurity of about 30%, with average food insecurity in a rural area within Tanzania are approximated to be 15% for household (Bromley, 2011). Iringa region located in the southern zone of Tanzania experiences only 3% of food insecurity in the country contributed by the Iringa district with 15% and the Kilolo district with 6% of food insecurity within the region (Prime Minister's Office & FSIT, 2006)

Iringa District, Iringa Region a rural area, primarily operates under customary land ownership (Sikira & Kashaigili, 2017). Despite the presence of laws and regulations governing land ownership in the Iringa Region, only 10% of households held CCROs by the end of 2015. The limited availability of CCROs in Iringa district as well as in many other developing countries, constrains household decision-making regarding land investments aimed at enhancing food security.

In 2016, USAID/Tanzania initiated a land tenure security project in Iringa, Tanzania. This project aimed to facilitate the clarification and documentation of land ownership for villagers, support local land-use planning efforts and enhance local comprehension of land use and land rights in Tanzania. The intervention successfully enabled 36 villages in the Iringa district to issue a total of 63,000 CCROs that provided education on land laws and management (Grabe,

2014). The issuance of CCROs aimed at mitigating land tenure insecurity, with the belief that secure land rights are central to achieving food security.

Existing land conflicts, land instability, and restricted access to available land pose a significant threat to food security in rural households in Iringa Region (Fabih, 2004). At the household level in Tanzania, these challenges are compounded by limited land utilization for innovative food production and the existence of land markets conducive to land grabbing. Despite the presence of a structured framework guiding land registration and titling procedures, most of the rural land is informally owned. This is due to the perception of the entire system as complex, unwelcoming, costly, and time-consuming, impeding the optimal utilization of land resources for food production (Makesha et al., 2018).

It has been argued that the Iringa Region in Tanzania's southern zone contributes to the reduction of food insecurity in the country. The region accounts for only 3% of the nation's food insecurity, with the Iringa district experiencing a higher level of food insecurity at 15% compared to the neighbouring Kilolo district which records 6% of food insecurity (Prime Minister's Office & FSIT, 2006).

Despite the critical importance of land tenure security for household food security, only a limited number of studies have been conducted in Tanzania, particularly in the Iringa district. Moreover, the studies have failed to consider additional variables that could directly impact household food security, such as household food situation, food consumption patterns, and sources of food. Generally, household food security exists when a household has the physical, economic, and social means to consistently obtain an adequate quantity of food that fulfills all nutritional requirements for maintaining an active and healthy body (Asesefa et al., 2018). Therefore, the present study aligns with the second global sustainable development goal (SDG2), which aims to eradicate hunger, achieve food security, improve nutrition, and promote sustainable agriculture which supports Tanzania's 1995 land policy (USAID, 2016). Under Tanzania's 1999 Village Land Act, individuals who use or occupy village land have the right to obtain formal documentation of their use rights via a Certificate of Customary Right of Occupancy (CCRO), issued by the local government (USAID, 2016). The study on which the manuscript is based sought to address the gaps in the existing body of knowledge regarding the relationship between land tenure security and rural households' food security using the Iringa district as a case study. Specifically, it assesses the impact of land tenure security on factors including households' food situation, food consumption, and diversity, its food sources.

1.2 Objective of the Study

The main objective of this paper was to determine the impact of land tenure security on households' food security in the Iringa District Council.

1.3 Specific Objectives

i. To determine the influence of land tenure security on the food situation of households in Iringa District Council
ii. To determine the influence of land tenure security on the food consumption of households in the Iringa District Council
iii. To determine the influence of land tenure security on the source of food for a household of households in the Iringa District Council

1.3 Research Questions

i. Does land tenure security determine the food situation of households?
ii. Does land tenure security influence the food consumption of households?
iii. Does land tenure security influence the source of food for households?

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 The Institutional Theory

The Institutions are reefed to a regulatory body established to manage the system that prevalent social interaction on the existing rules (Schouten et al, 2017), this means the institutions are the one that provides a structural framework that regulates the society on how to access production resources that in case of food island. The institutional theory explains the influence of institutions on the established regulatory framework and how it affects the people's access to land, from rules provided on obtaining land tenure security that in the case of Tanzania is CCRO to norms and routines that need to be followed for the whole process to complete. The institutional theory establishes the interaction between society and people in obtaining ownership of productive resources like land, the theory assumes that individual behaviour is constructed to follow the rules and regulatory body provided by the regulatory institutions (Kraft & Furlong, 2017).

In the case of this study, the institutional theory explains the concept of land tenure security function on factors such as food situation in households, food consumption, and availability of food sources. The theory assumed that the institutional framework needs to be followed by households to have access to land and productive resources, and how households benefitted from obtaining land tenure security and to have the opportunity of having food security. The theory explains how Land institutions and authority work and how those procedures influence households on access to land that can be utilized to ensure food insecurity is eradicated. As indicated by the study by (Temba et al., 2015) conducted to analyze the performance of Rice Actor in the implementation of rice policy in Indonesia, which influenced this study to adopt the institutional theory from (Temba et al, 2015) to determine the impact of land tenure security on household food security.

2.1.2 Theory of Access

The theory of access provides the framework for how those two factors can be combined, which means configuring together a bundle of power to the land and a bundle of rights to the given land to influence access to the productive resources that will enable households to have food security.

The adaptation of access theory (Koch, 2008) conducted a study on the perspective on access to and management of natural resources aimed to address the inequality over natural resources with the management of those resources through an overview of different approaches concerned with the resources. The theory used by the study to establish the relationship and interaction between bundles of rights which concern formality and informality ownership of land and natural resources and bundles of power that present different factors that enable households to produce foods such as labor forces, abilities, and resources. The study used the theory of access to establish the impact of land tenure security on food security in the Iringa district by determining whether land access has influenced the households to have food security in rural areas of the Iringa district.

2.2 Empirical Review

The study reviewed different studies conducted previously that focused on the related topic of land tenure and food security by measuring the contribution of land tenure on the food situation of the household, food consumption of the household, and the creation of a source of food for the household. Omotoso et al, (2019) show that food security and land tenure security operate in uni-directional causality between them. Hagos and Holden, (2013) show that certification program has an influence on the availability of calories and quality food intake, and also they increase productivity in the investment to the owned land that increases food access and availability. Another paper was prepared (Nkomoki & Bavorova, 2019) and found that land tenure security, level of education, labor forces, and size of land enhance household food security and nutrition. Lyakurwa et al. (2016) found out that income level, education level, and land tenure security significantly enhanced food security in the household, the recommendation from the study was to improve agricultural input to ensure food security in the households is improving. Another empirical evidence found in a study by Kehinde et al. (2021) indicated that a household with a share of farmland on purchase and also participating in other activities is likely to have a household food security situation, also the household that shares farmland on purchase can invest on the diversity of crops cultivated are reducing the risk of food insecurity.

III. METHODOLOGY

3.1 Research Design

The study employed a quasi-experimental research design, whereby villages that had received CCROs formed the treatment group and those without were the control. It is noteworthy that several previous studies that focused on land tenure security have also utilized quasi-experimental research designs (Gebru et al., 2016). However, since the quasi-experimental design is considered to have some disadvantages that limit the study's ability to conclude a causal association between an intervention and an outcome (White & Sabarwal, 2014) randomization is not utilized. The study utilized Propensity Score Matching (PSM) to treat selection biases that concerned the use of quasi-experimental research design by constructing an artificial control group that matched food security for each household with CCRO with that household without CCRO by considering characteristics similarity particularly, age, sex, education status and duration CCRO received by the household.

3.2 Population of the Study

The study divided the study population into rural households with CCROs and without CCROs in the Iringa District Council to determine the impact of land tenure security on household food security in selected villages.

3.3. Sample Procedures and Sample Size

The study used probability and non-probability sampling procedures, the sampling is the process of selecting a subset of the study population individuals that have similar characteristics to the population and are considered to yield the same results as the targeted sample framework (Bengesi, 2013). The study applied a systematic random sampling approach, with the applicable skipping interval of the nth household of the population in the village (Hemed, 2016), where the nth case is counted after random selection. The study selected a sample size of 404 households divided equally between two villages that were selected as treatment villages with CCROs to determine the impact of land tenure security on household food security and as control villages without CCROs to enable background references for variables that impact land tenure security on household food security.

3.4 Data Collection Methods

The study adopted a mixed methodology where both qualitative and quantitative data were collected, through a questionnaire administered to households quantitative data was collected and qualitative data was collected through Key informant interviews (KIIs).

3.5 Data analysis

In the assessment of the impacts of land tenure security on household food security in Iringa District Council, the study used quantitative data analysis to establish the relationship between the independent variables and the dependent variable of the study through correlation analysis and descriptive statistics computed in the study through SPSS Version 26. Qualitative data, on the other hand, was analyzed using Excel by classifying themes, categories, and aspects and interpreting what informants said and what the researcher saw and read carefully. The study proceeded to determine descriptive statistics (frequencies, means, and percentages) and inferential statistics. Multiple Linear Regression analysis at both the bivariate and multivariate levels was conducted to determine whether land tenure security had a significant association with household food security. This association was evaluated using the Household Food Consumption Score (HFCS) as the dependent variable/indicator.

The multiple linear regression model was used to test the relationships between HFCS and CCRO ownership which are expressed as follows:

$$\gamma = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \text{ --------} + \beta n X n + \epsilon \quad \text{..... Eq 2}$$

Where: γ is total HFCS, $\beta 1$-----n is slope coefficients, β_0 constant term, X_1----X_n are independent variables which are the functions of holding CCRO (tenure security), including food situation at the household, source of food and food consumption, and ϵ is an error term.

IV. FINDINGS & DISCUSSIONS

4.1 Demographic Characteristics

The study conducted in the Iringa district adopted a gender-sensitive approach, with a focus on female respondents (61.9%), acknowledging their central role in ensuring household food access in rural areas. This emphasis aligns with findings that women often bear primary responsibility for such tasks (Grabe, 2014). Additionally, the study found that the majority of respondents fell within the age range of 20-40 (51.5%) and had attained at least primary education (77.5%), suggesting the capability to understand land tenure procedures (Grabe, 2014).

Livelihoods were predominantly agricultural (86.1%), with household sizes consistent with national averages in Tanzania (NBS). Notably, 45% of respondents had joint land ownership (husband and wife) listed on the Certificate of Customary Right of Occupation (CCRO), reflecting considerations for women's land ownership (Grabe, 2014). The result of demographic data shows that land tenure security through CCROs has a significant contribution to improving agriculture activities and productivity in the Iringa district. This was empirically supported by past studies, Nkomoki and Bavorova (2019) found that land tenure security, level of education, labor forces, and size of land enhance household food security and nutrition. Lyakurwa et al, (2016) found that income level, education level, and land tenure security significantly enhanced food security for households.

4.2 Demographic Features and CCRO Ownership among Respondents

Table 2 presented the influence of respondents' demographic characteristics on the ownership of CCRO (Certificate of Customary Right of Occupation). The study employed cross-tabulation along with the Chi-Square test to analyze the relationships. The results reveal that, among various demographic characteristics, only gender and participation in CCRO and land use training had a notable influence on CCRO ownership among the respondents. Specifically, the Chi-Square values for gender and CCRO ownership and participation in CCRO and land use training were 5.1 and 29.1, respectively, with corresponding P-Values of 0.000 and <0.001. These P-values are less than the 0.05

level of significance, indicating a statistically significant relationship. The analysis shows that males own CCRO (57.1%), while most females (54.4%) do not own CCRO. This indicates that being male is associated with a higher likelihood of CCRO ownership compared to being female. Moreover, the majority of respondents who attended CCRO and land use training (60.8%) own CCRO, whereas most of those who did not attend the training (66.7%) do not own CCRO. This indicates that receiving training on CCRO and land use is associated with a higher likelihood of CCRO ownership. However, other demographic features such as education level, marital status, economic activities, age group, and the number of household members were found to have no significant influence on CCRO ownership.

Table 2

Demographic Variables and CCRO Ownership (N = 404)

Respondents Demographic Features		CCRO Ownership		Influences	
Variable & categories		Own CCRO	Not Owning CCRO	Chi-Square	Sig.
Gender	Male	88=57.1%	66=42.9%	5.1	0.0
	Female	114=45.6%	136=54.4%		
Education Level	Primary	155	158	5.2	0.4
	Secondary	33	30		
	Certificate	4	5		
	Diploma	1	1		
	University	1	5		
	No education	8	3		
Marital status	Married	160	158	3.3	0.3
	Divorced	1	4		
	Widow/er	24	18		
	Never married	17	22		
Economic activity	On own/family farm	179	169	9.7	0.1
	Livestock keeping	2	1		
	Unpaid family helper	2	0		
	A paid employee	1	8		
	Business	8	14		
	Self-employed	10	10		
Age groups	20-40	97	111	3.5	0.3
	41-60	98	83		
	61-80	11	7		
	81 and above	0	1		
Household Members	1-5	139	144	2.2	0.3
	6-10	61	58		
	11 and above	2			
CCRO and Land Use Training	Yes	149=60.8%	53=39.2%	29.1	<0.001
	No	96=33.3%	106=66.7%		

4.3 Impact of Land Tenure Security on Household's Food Security

The relationship between land tenure security and food security can manifest in both direct and indirect ways. Directly, land tenure security involves securing property rights, which, in turn, enables investments in land, labor, and capital for food production. Indirectly, it can facilitate the selling of agricultural produce or secure property rights for businesses that provide wages, earnings, or income, allowing farmers, landowners, and workers to access and purchase food (Ghebru et al., 2016).

To gauge food security, the study utilized the Household Food Consumption Score (FCS) as a proxy. The FCS for households was computed by multiplying food group weights by the weekly consumption frequency. Summing these weighted food group scores generated the FCS, and the study categorized households' food consumption status into three thresholds: Poor (0-21), Borderline (21.5-35), and Acceptable (>35) [15].

The results presented in Table 3 show that there are no food security issues in the study area. Both households with and without CCROs exhibited mean FCS scores above 35; signifying an acceptable level of food security. However, households with CCROs had a relatively higher mean food consumption score of 62.9, making them 1.2 times more likely to experience food security compared to households without CCROs. This suggests that having a CCRO is associated with increased food consumption scores among rural households, thereby enhancing their food security. This was complimented by the discussion shared by the participants indicating that;

"We have observed how being able to invest more in our farms is made possible by having secure land rights through CCROs. We're more willing to invest the time, energy, and resources required for increased agricultural productivity when we know that our land is ours." (FGD participants).
"A CCRO makes it easier for people to get bank loans or even personal loans from relatives. The additional funds significantly enhance our overall food security by enabling us to purchase food items that we are unable to grow on our own."(FGD Participants)

Table 3
Mean Household Food Consumption Score (N=404)

Own CCRO?	Mean FCS	Frequency	% Of n	Std. Deviation	Min	Max	Median
Yes	62.9	202	54.3%	13.8	29.0	103	61.00
No	52.9	202	45.7%	18.2	24.5	212	50.0

The study employed the bivariate regression model to assess the strength of the relationship between the possession of CCRO and food security, as proxied by the Household Food Consumption Score (FCS) of households in the study area. The regression analysis conducted in this study utilized Chi-Square Tests to determine the relationship between CCRO ownership and FCS. The results of this analysis are presented in Table 4 below.

Table 4
Chi-Square Tests Results on Ownership of CCRO (n=404)

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	144.029[a]	120	.067
Likelihood Ratio	184.672	120	.000
Linear-by-Linear Association	34.837	1	.000
N of Valid Cases	404		

The Pearson Chi-Square value is 144.029 with a significance level of 0.067, which is below the designated P-value level of the study (0.1). This indicates that the outcome (FCS) was statistically significant. In other words, there is a relationship between possessing a CCRO (Land Tenure Security) and the Household Food Consumption Score (FCS) in the study. This suggests that having a CCRO influences the food security of households in the Iringa district. The likelihood ratio is 184.672, and its significance level is 0.000, which is lower than the designated P-value for the study. Moreover, this confirms that having a CCRO (Land Tenure Security) has a significant influence on the FCS of households in the Iringa Region.

Moreover, the study conducted a Multivariate Regression Analysis to assess the relationship between the dependent variable, Food Consumption Score (FCS), and predictor variables grouped under food situations of households, sources of food for households, and food consumption frequencies of households. The regression model, as detailed in Table 5, shows that the multiple linear regression model has an R-squared value of 0.53 with a P-value of 0.000. This demonstrates that having a CCRO has a statistically significant impact on household food security at the 0.05 significance level.

Table 5
Multivariate Regression Analysis (n=404)

Independent variables		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
	(Constant)	-17.552	4.300		-4.082	.000		
	Food Situation	14.538	.723	.712	20.098	.000	.936	1.068
	Source of Food	1.303	.650	.071	2.006	.046	.926	1.080
	Food consumption	3.852	1.628	.082	2.367	.018	.975	1.026
R	**.728**	**R Square**	**.530**	**Sig. F Change**		**.000**		

According to multivariate linear regression analysis, food situation in the households (ß of 14.538); source of food (ß of 1.303); and food consumption of the household (ß of 3.852) have a positive statistical significance relationship with household food consumption score (FCS) at 95% confidence interval: all their P-Values (0.000, 0.046

and 0.18 respectively) were less than 0.05 level; indicating that for a unit change of food situations of household, source of food to household, and food consumption in the household attributed by having CCRO (Land Tenure Security) will lead to 14.538; 1.303; and 3.852 changes in FCS (food security) respectively, other factors remaining constant.

4.4 Food Situation in Surveyed Households

Based on the descriptive statistics presented in Table 6, it is apparent that respondents possessing a Certificate of Customary Right of Occupation (CCRO) exhibited a higher level of food security compared to those without a CCRO. This observation stems from the fact that their mean scores for food security were 2.9 and 2.7, respectively, which are closer to the scale value of 3. It suggests that households with CCRO were less likely to encounter situations where they had no access to food resources. According to (ANRC, 2019) the food situation is considered a situation when households have the physical, economic, and social ability to access sufficient food that meets all dietary requirements needed for the active body at any time.

However, it is important to note that both sets of households reported instances where someone in the household was unable to consume their preferred types of food or had to reduce their meal frequency due to resource limitations. This is evident in their mean scores falling within the range of 0-1, with households without CCRO being closer to the scale value of 1, indicating an absence or instability in the food situation within the household. Such challenges in food availability and access have a notable impact on the overall food security of these households. This observation is corroborated by the following quotes:

> *"……When you depend on agriculture, it happens that sometimes you have less food to eat for the family and this affects the food security in our family. We have to deal with those situations and to survive with the food we have…."* (Kihorogota, Female KI, 9th March 2022)
>
> *"…. that does not happen to our household, and it rarely happens in rural areas for households to lack any kind of food. But sometimes we might face food shortage which forces us to have either breakfast or dinner or have only one meal per day. And sometimes we may want to eat a certain kind of food but, due to lack of resources and access to such food we fail to get it and we eat what we have in the household"* (Kihorogota Female KI, 9th March 2022).

The disparities highlighted in Table 6 indicate that the ownership of a CCRO exerts a significant influence on household food security in rural areas. This finding aligns with the theory of access, which underscores the crucial link between access to productive resources, such as land, and household food security. As previously postulated by (Po et al., 2018), access to essential resources like the land is a fundamental prerequisite for achieving food security. This underscores the importance of land tenure security, as symbolized by CCRO ownership, in contributing to enhanced food security among rural households.

Table 6

Food Situation Likert Scale Criteria Measurement (n=404)

	Households Without CCRO (n=202)				Households With CCRO(n=202)			
Interview Questions	Std. Dev.	Mean	Max	Min	Min	Max	Mean	Std. Dev.
HH is not able to eat the kinds of foods they would have preferred to eat because of a lack of resources.	0.829	0.802	3.00	0.00	0.00	3.00	0.485	0.617
HH had to eat fewer meals in a day because there was not enough food.	0.645	0.619	3.00	0.00	0.00	3.00	0.337	0.505
HH has no food to eat of any kind in the house, because of a lack of resources to get food	0.643	2.693	3.00	0.00	0.00	3.00	2.881	0.368

4.5 Household's source of food

In rural settings, food production remains the primary source of sustenance for households; however, alternative sources also play a role. The study's findings as given in Table 7, show that about three-quarters (73%) of the surveyed households' food supply is derived directly from their agricultural activities. Notably, households with a CCRO exhibited a higher propensity to purchase food with cash (44%) compared to those without a CCRO (13%).

When considering households that utilize both common sources of food, both from cash purchases and direct farm production, over four-fifths (85%) of those with CCROs displayed a more substantial reliance on these combined sources in comparison to households without CCROs. This, suggests that households with CCROs procure more food through

cash transactions, which in turn secures them with greater access to food and nutrition. Furthermore, this enables them to purchase additional food items using the cash generated, enhancing their overall food security and nutritional well-being. It is further found that sources of food are statistically insignificant and related to the food consumption score (food security) of the household because its Chi-Square of 182.246 had a P-Value of 0.358 greater than 0.05 level of significance. However, it is significant to those with no CCROs. This implies that having CCRO among households increases the chances of diversifying food sources than depending only on food crops. This is like the study (Omotoso., 2019) which argued the sustainability of land tenure and food security in developing economies in Osun Nigeria concluded that, food security and land tenure security operate in uni-directional causality between them and that households with land security can invest on the diversity of crops without fear of losing land, which reduces the risk of food insecurity.

Table 7

Source of Food Likert Scale Criteria Measurement (n=404)

	Households With CCRO(n=202)			Household Without CCRO(n=202)		
Sources of Food	Frequency	Percent	Asymptotic Sig	Frequency	Percent	Asymptotic Sig
Direct from farm production	73	36.1	Chi-Square = 182.246 Sig = 0.358	108	53.5	Chi-Square =270.892 Sig = 0.001
Bought using cash	44	21.8		13	6.4	
Direct from Farm and Brought Using Cash	85	42.1		81	40.1	
Total	202	100.0		202	100.0	

In interviews conducted with farmers who are also members of the land committee, it was ascertained that households possessing CCROs utilize the same as collateral to secure loans from financial institutions and family members. The additional funds acquired through these loans serve a dual purpose for these households. They allocate the funds towards enhancing their agricultural production and purchasing food items that were not cultivated within their farms. This practice underscores the pivotal role played by the CCRO in facilitating access to financial resources that not only bolster agricultural activities but also contribute to securing a diversified and more extensive food supply. The statement below confirms this perspective.

> *"Given current lifestyles, it will be impossible to rely solely on our farms as a source of food for the households. For instance, I use my food that comes directly from the farm, but there are certain foods I am compelled to purchase from the market, such as sugar, oil, and livestock products such as meat and milk because I do not have livestock"* (Mgama, Male KI, 12th March 2022).
>
> *"We generate our food, which is our primary source of nutrition. The farm serves as our grocery store in addition to being a source of revenue. It is the source of our staple foods, such as vegetables and grains."*
>
> *"A CCRO function makes doors open. We need that money, which we utilize to get loans. It lets us purchase extra food that we are unable to grow, so it's not simply for farming." FGD* Participant

According to literature, (Tenaw et al., 2009) rural households' food security is intricately linked to the availability of productive resources, particularly land. Therefore, the possession of a CCRO can provide secure access to land, which significantly impacts a household's agricultural production. For example, land can serve as collateral for obtaining loans, enabling the acquisition of agricultural technologies that enhance productivity. Moreover, literature (Roth, 2013) shows land is a fundamental natural resource crucial for the sustenance of both humans and other living organisms. It plays an indispensable role in human existence, given that over 80% of food production is reliant on land. Consequently, the establishment of land tenure security becomes imperative, as it instills confidence in increasing food production on secured land as opposed to unsecured land.

4.6 Households' Food Consumption

The mean values of food items consumed by households, as presented in Table 8, were compared between households with and those without CCROs.

Table 8

Number of Times Households Eat a Kind of Food

	Households Without CCRO (n=202)					Households With CCRO (n=202)				
	Days in the week					Days in the week				
Kind of food	Std. Dev.	Mean	Max	Min	Sig	Min	Max	Mean	Std. Dev.	Sig
Maize, Rice, Sorghum, Millet, Bread and other cereals	1.64923	5.594	7.00	1.00	0.001	1.00	7.00	6.787	0.63027	0.005
Cassava, potatoes, and sweet potatoes	2.23092	4.525	7.00	0.00	0.001	1.00	7.00	6.009	1.38933	0.002
Beans, peas, groundnuts and Cashew nuts.	1.30305	6.059	7.00	1.00	0.005	2.00	7.00	6.331	1.32481	0.002
Any kind of fruits	2.37265	2.772	7.00	0.00	0.001	0.00	7.00	4.188	2.20001	0.001
Beef, Goat, pork, poultry and fish	1.57970	2.178	7.00	0.00	0.001	0.00	7.00	2.213	1.48265	0.001
Milk, yogurt, and any other dairy	2.75921	2.465	7.00	0.00	0.001	0.00	7.00	2.574	2.31949	0.001
Sugar and sugar products	1.63737	5.975	7.00	1.00	0.295	0.00	7.00	4.842	2.43209	0.058
Oils, fats, and butter	1.58987	5.767	7.00	0.00	0.619	0.00	7.00	5.025	2.35302	0.015

The analysis of the dietary patterns between households with and without CCRO reveals notable differences in their consumption habits. Households possessing CCROs exhibit a higher frequency of consuming staple cereals like maize, rice, sorghum, millet, and bread, with an average consumption almost every day of the week (mean=6.787 days/week), compared to those without CCROs (mean=5.594 days/week). This higher frequency indicates a possible correlation between land tenure security, as evidenced by CCRO ownership, and improved access to or availability of staple foods as noted by one respondent.

> *"In rural areas, the main source of food are cereals and root crops, for example, potatoes and pulses the majority of which we farm ourselves. In addition, fish and meat as we have a small amount in Ruaha River and Mtera within Iringa district: our income situation contributes to us eating cereals frequently compared to other food items"* (Mgama Female KI, 10th March 2022).

In terms of root vegetables such as cassava, potatoes, and sweet potatoes, households with CCROs again show a higher consumption frequency (mean=6.009 days/week) than those without CCROs (mean=4.525 days/week). This pattern might reflect the ability of CCRO-holding households to cultivate or purchase these food items more regularly, potentially due to greater land security or economic stability.

For legumes and nuts, including beans, peas, groundnuts, and cashew nuts, both groups show high consumption frequencies, but households with CCROs consume these slightly more frequently (mean=6.331 days/week) than those without (mean=6.059 days/week). This small difference suggests that these protein-rich foods are accessible to both groups, albeit slightly more to those with CCROs.

The consumption of fruits is notably higher in households with CCROs (mean=4.188 days/week) compared to those without (mean=2.772 days/week). This disparity could be indicative of better access to diverse and nutritious food options among households with land tenure security. It might also reflect a higher income or purchasing power that enables these households to include more fruits in their diet.

For animal-based products such as meat, poultry, fish, and dairy, the consumption frequencies are generally low in both groups. However, households with CCROs consume these products marginally more frequently than those without, suggesting a possible link between land ownership and access to or preference for animal-based proteins.

Interestingly, the consumption of sugar and sugar products is higher in households without CCROs (mean=5.975 days/week) compared to those with CCROs (mean = 4.842 days/week). This pattern could point to dietary choices or availability issues. Likewise, the consumption of oils, fats, and butter is more frequent among households with CCROs (mean=5.025 days/week) compared to those without (mean=5.767 days/week), possibly reflecting differences in cooking habits or access to these food items.

During the focus group discussion, participants shared their views on the subject as presented below;

> *"CCROs offer Diversity in the selection of food sources. There are many different kinds of food available to humans such as cereals, fruits, and meats are all within our budget. A diversified diet is a luxury that has a favorable effect on our health."* Participant in FGD.

"We eat staple foods like rice and maize virtually every day. It's a routine, and know that we can keep it that way with CCROs. For us, it provides some stability." Participant in FGD.

"We still need to exercise caution while using CCROs. Certain foods cost more than others. For this reason, you may observe that homes without CCROs tend to consume more unnatural food due to less productivity" - Participant in FGD.

Literature (Hagos et al., 2017) shows that food consumption is closely linked to food availability, a fundamental aspect of food security. Therefore, it is quite challenging for households to consume food they do not have access to in sufficient quantities either due to low production or inability to purchase from the market.

4.7 Intervening Variables

To examine the relationship between CCRO ownership and three independent variables; food situation, food consumption, and sources of food, the study also considered two intervening variables: the decision to use and invest in secured land, and to invest in land. These intervening variables were analyzed to understand how they might influence the connection between CCRO ownership and the independent variables, offering insights into the complex dynamics at play in the nexus of land security, agricultural investment, and household food security outcomes.

4.7.1 Households' Decision to Use CCRO

The first intervening variable examined in the study is the decision to utilize the CCRO to access loans, rent it out, or sell it, thereby providing households with financial resources to purchase food and diversify their food sources. According to Table 9, there is a statistically significant effect of using CCRO to secure loans on food security among smallholder farmers, as evidenced by a Chi-Square value of 6.913 and a P-value that is below the 0.05 significance threshold. However, it is noteworthy that only 47.5% of households in possession of CCRO have received credit

Table 9

Household Received Loan or Credit in the Past 5 years

	Frequency	Percent	Chi-Square	Asymptotic Sig (2-sided)
No	106	52.5	6.913	0.009
Yes	96	47.5		
Total	202	100.0		

According to Table 10, the sources of food consumed by households are statistically significantly influenced by the possession of CCRO, as indicated by a Chi-Square value of 23.72 and a P-value of 0.001, which is below the significance threshold of 0.05.

Table 10

CCRO Ownership Source of Foods Consumed by Households Crosstabulation*

		sources of the most foods consumed by your households					
		Direct from farm production	Bought using cash	Direct from farm and brought using cash	Total	Pearson Chi-Square	Asymptotic Significance (2-sided)
CCRO ownership	Yes	73	44	85	202	23.724	0.001
	No	108	13	81	202		
Total		181	57	166	404		

This analysis reveals that holders of CCRO exhibit a more diversified source of food, encompassing both farm production and cash purchases, in comparison to those without CCRO. This diversification is attributed to the fact that a substantial proportion of households possessing CCRO (42%) have implemented changes in their agricultural practices following land mapping and CCRO acquisition. These modifications include the adoption of agricultural extension services and the cultivation of cash crops. Despite the notable impact of these practices on the household food consumption scores, evidenced by a Chi-Square value of 32.076 and a corresponding P-Value of 0.001 (significantly below the 0.05 threshold), a mere 1.5 percent of respondents with CCRO have utilized it as collateral. Furthermore, the employment of loans does not exert a significant effect on the household food consumption score, as indicated by a Chi-Square value of 8.462 with a non-significant P-value of 0.076. In line with the findings of Kehinde et al. (2021), households engaging in the purchase of farmland and participating in supplementary activities are more likely to achieve

food security. Additionally, the strategy of investing in a diverse array of crops, facilitated by the acquisition of farmland, serves as a measure to mitigate the risk of food insecurity.

Table 11

The decision to use CCRO

The decision to use CCRO		Frequency	Percent	Chi-Square	Sig
Farming Practice Changes	Yes	85	42.1	60.645	0.001
	No	117	57.9		
	Total	202	100.0		
CCRO as collateral	No	199	98.5	32.076	0.001
	Yes	3	1.5		
	Total	202	100.0		
Loan Uses	Buy food	5	7.1	8.462	0.076
	As a source of Income	1	1.4		
	Invested in agriculture	44	62.9		
	Used to expand my business	10	14.3		
	Meeting household basic needs (paying school fees, buying clothes, etc.)	10	14.3		
	Total	70	100.0		

4.7.2 Decision to Invest in Secured Land

It is found that a mere 14.4% of households in possession of a Certificate of Customary Right of Occupancy (CCRO) have elected to invest in their land parcels. This figure stands in contrast to a lower percentage (5%) of households without CCRO making similar investments. Thus, despite the security of land tenure provided by CCRO, a significant majority of households have refrained from investing in their land. Conversely, the analysis demonstrates that leasing out a household's land parcel substantially enhances food security, as evidenced by a Chi-Square value of 10.245 and a significant P-value of 0.001, falling below the 0.05 threshold. This suggests that the act of investing in land, secured through tenure, to augment food production effectively improves the household's food situation. It increases the availability and variety of food, thereby positively affecting overall food consumption patterns.

Table 11

Decision to Invest in Secured Land

			Invest in securing land		Total		
			Yes	No		Chi-Square	Sig
CCRO ownership	Yes	Count	29	173	202	10.245	0.001
		%	14.4%	85.6%	100.0%		
	No	Count	10	192	202		
		%	5.0%	95.0%	100.0%		
Total		Count	39	365	404		
		%	9.7%	90.3%	100.0%		

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

The study aimed to assess the impact of land tenure security on household food security. Specifically, it aimed to determine the influence of land tenure security on the food situation of households, the influence of land tenure security on food consumption, and the influence of land tenure security on the source of food for households. The result of the study found that there is a statistically significant relationship between households in Iringa district having CCRO and food consumption of household, the study concluded that having Land Tenure Security statistically influences the food security of households in Iringa district. Also, it was concluded that land tenure security has a significant relationship with the food situation in the households. It was noted that having CCROs increases food consumption of the households which improves household well-being compared to a household that does not own CCROs. Furthermore, the study found that there is statistical significance between household sources of food and land tenure security which

enhances food consumption. According to descriptive statistics; almost half of the household sources of food were direct from farm production, and the other close to a half of the households reported their source of food to be both direct from farm and purchases using cash, while very few only depend on purchases using cash. Moreover, the result of the Multivariate Regression Analysis Model showed that food consumption in the family is statistically significantly positively related to food consumption in households and land tenure security. The study concludes that a household with CCROs has a wide option of food categories and nutrition necessary for human beings. It was indicated that households with CCROs have consumed a variety of food options from cereal to food such as beans, peas, Cashew nuts beef, Goat, poultry, and Oil.

5.2 Recommendations

This study found out that in the Iringa district majority of households depend on agricultural activities as the main source of food and due to the need for land as a key production resource for households, the study issued recommendations below:

Recommendation to government: the study recommended land policy and practices reform to develop policies and strategies that are tailored and applicable to agriculture development and land ownership rather than current policies that are more theoretical and do not have a direct impact on the livelihood of households in Iringa district. The reformed policy should integrate agriculture activities and land ownership into agriculture sector development strategies which will enhance food security for households. Also, the study recommended the policy developed to take into consideration customary laws as a recognized land tenure system since it is based on the history and tradition of land under communities, this can reduce the land insecurity for many households that are currently engaged in agriculture activities but do not have formal right to the parcel utilizing. Thus, limits productivity but through recognition of customary tenure arrangement it will increase innovation and hence increase food security for household

Recommendation of local administrative institutions: the study recommended that institutions at the district level improve land governance structure that allows land registration easy and simplified compared to the current structure that involves bureaucracy as many institutions are involved. The district office can improve land formalization or make registration affordable allow smooth land transfers that will increase household possession of CCRO and increase agricultural productivity by investing in production processes that increase food production and ensure household food security.

Also, the study recognized several proxy factors that enhance food security in most households in rural areas for example income level of household, education status, land ownership, and infrastructure provided as key factors to the improvement of food production in rural areas. Hence, the study recommended that strategies that enhance agriculture activities through the provision of extensive agriculture services and promote diversification of agriculture activity to allow productivity of food at different levels within rural areas can influence food security.

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