

Effect of Women Empowerment in Agriculture on Household Food Security Index in Benin

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Abstract: In Benin, the agricultural sector occupies at least 70% of the labour force, contributes nearly 36% of GDP formation and provides about 88% of Benin's export earnings (MALF, 2018). The study on the Comprehensive Food Security and Vulnerability Analysis (CFSVA, 2017) showed that 10% of the population investigated were food insecure. Women represent 51.2% of the population in Benin according to the fourth General Population and Housing Census (RGPH4, 2013). But there is slightly more food insecurity among female-headed households (12%) than their male counterparts (9%), especially in rural areas (CFSVA, 2017). In solving the problem of food insecurity among women in Benin, this research examined the effect of women empowerment in agriculture on household food Security in Benin. This research aims also to determine factors that affect household food Security in Benin. The data used comes from the Global Analysis of Vulnerability and Food Security survey (CFSVA, 2017). The results of the logistic regression model estimation show that the factors that affect significantly household food Security Index in Benin are: women's empowerment index in agriculture, level education, urban rural and land size. The results show also that women's empowerment index in agriculture is positively correlated with food security index. Thus, the likelihood of a household being food security increases when women's empowerment in agriculture increases. Women's agricultural empowerment increases the household food security index by 3.97 percentage points. The results point to the very important role of women's agricultural empowerment in solving food insecurity in rural Benin.

Keywords: Benin, Food Security, Women Empowerment in Agriculture

1. Introduction

Political actors and researchers recognize that the agricultural sector contributes to food security, poverty reduction and growth in many developing countries [19, 56]. For example, the research written by Haggblade and Gabre-Madhin (2010) show that in sub-Saharan Africa, agriculture remains the main source of employment with 65% of full-time jobs and 25-30% of Gross Domestic Product (GDP) [26]. Numerous studies that have analysed national policies and programmes to address food needs in developing countries highlight the important role of women in agricultural production and food security [10, 19]. Depending on the state of food and agriculture [18], reducing the constraints faced by women farmers could increase farm yields by 20-30% and increase total agricultural production in developing countries by 2.5 to 4%, which would have a significant impact on food availability.

Agricultural feminization is prevalent among Sub Sahara Africa (SSA) low income countries. Most of the residents in low income countries still live in rural areas and agriculture hires more than half of the labor force. While the share of female employment in agriculture exceeds the share of male employment, lack of land ownership, credit, water and other production inputs often limits women's productivity and leaves them in extreme poverty [11]. Feminization of poverty partially can be explained by agricultural feminization. Although the agricultural sector's share in employment shrinks during urbanization, the relative proportion of women working in agriculture increases [32]. Croppenstend et al. (2013) suggest that lack of agriculture production inputs, such as, land ownership, fertilizer, and credit, water etc., explains the gender productivity gap [11]. Here, the empowerment of women in agriculture is justified by the practice of irrigation cultivation, access to land, the acquisition of organic fertilizers, chemical fertilizers and

seeds. So, in this of our study, we are interested in farm households that have these agricultural assets.

On the other hand, women's specific incomes, whatever their nature (donations collected, income from dependent or independent activity) are positively associated with food diversity. Thus, and more generally, Lourme-Ruiz (2017) shows that in this context, and as Malapit et al. (2015) wrote in the case of Nepal, women's "empowerment" mitigates the negative effects of low agricultural diversity on the nutrition of women and children [33, 35]. In addition, if women are offered better quality jobs, development outcomes will be affected, according to the International Finance Corporation (IFC), especially as women spend their income on health, education and children's nutrition. However, in sub-Saharan Africa, where women make up nearly 43% of the labour force, nearly two-thirds of these women are employed in agriculture and, for the most part, as caregivers.

In Benin, agriculture is of strategic weight in the social and economic tissue of the country, in terms of contribution to jobs creation, income generation and the creation of goods and services. More than 60% of the male workers and 36% of the female workers are actually involved in an agricultural profession. In Benin, the agricultural sector occupies at least 70% of the labour force, contributes nearly 36% of GDP formation and provides about 88% of Benin's export earnings [34]. In Benin, the rural environment, which occupies more than 80% of the labour force and whose living conditions remain difficult, about 56% of the female population lives in rural areas. Significant inequalities play against women in agriculture, particularly in several dimensions: - land ownership: 87% of land acquisition for men compared to 13% for women - access to credit: women have access to credit less access to "traditional" credit, often dependent on the existence of a land collateral, - the division of labour: it is estimated that women provide 60-80% of agricultural work and that they outnumber men [17], - access to agricultural equipment, including those related to the irrigation.

Food insecurity remains a concern in Benin. The study on the Comprehensive Food Security and Vulnerability Analysis [8] showed that 10% of the population investigated were food insecure. About 74% of households in food insecurity belong to the poorest household groups in the population. They spend more than 65% of their budget on their food costs [8]. Rural households are more affected by food insecurity (12% moderate and 1% severe) than urban households (7% moderate). There is slightly more food insecurity among female-headed households (12%) than their male counterparts (9%), especially in rural areas [8]. In addition, women's socio-economic status remains vulnerable. In fact, 27.59% of female-headed households are financially poor. Their non-monetary poverty index is 39.87%, or 1.4 times that of male-headed households [30]. The proportion of the rural poor is 38.4%, compared to 29.8% in urban areas according to the results of the EMICoV surveys in 2009 and 2011 [30].

In addition, this research will provide information to the Government of Benin, which has recently been jointly

involved with the World Food Programme (WFP) as part of an initiative called the National Zero Hunger Strategic Review by 2030 [55]. The main objective of this national strategic review is to facilitate implementation and progress towards achieving SDG 1 and 2 for the elimination of hunger and improved nutrition in Benin that require a better living conditions. We are interested in this article on the role of women in agriculture in Benin. Women account for 51.2% of the national population according to the Fourth General Census of Population and Habitat (RGPH 4) and in the agricultural sector 35.1% of women's assets nationally according to the Typology Report [9]. Removing barriers that prevent women from becoming more effective women farmers could help many citizen in Benin.

The research questions to which we will try to provide answers in this article are: What are the factors that affect household food Security Index in Benin? And What is the effect of women empowerment in agriculture on household food security in Benin? The main objective of this study is to make an analysis of the effect of women empowerment in agriculture on household food Security in Benin. The specific objectives of this research in relation to the above-mentioned research questions are: i) To determine factors that affect household food Security Index in Benin and ii) To estimate the effect of women empowerment in agriculture on household food Security Index in Benin.

The sections that follow present the literature review followed by the research methodology. Then, the presentation of the results. Finally, the conclusion and the political implications.

2. Literature Review

The literature review is divided into two parts: the conceptual, theoretical review and empirical review.

2.1. Conceptual

We review here the definition of certain concepts related to our research theme.

Food security:

Food security refers to access by all people at all times physically, socially and economically to enough, sufficient, safe and nutritious food that meets their dietary needs and food preferences to maintain healthy and active life and food insecurity is the lack of this access [16]. Food security is not narrowly defined as whether food is available, but whether the monetary and non-monetary resources at the disposal of the population are sufficient to allow everyone access to adequate quantities and qualities of food [50]. The concept of food security is built on four (04) pillars (i) Food availability: sufficient quantities of food available on a consistent basis. (ii) Food access: having sufficient resources to obtain appropriate foods for a nutritious diet. (iii) Food utilization: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation to derive sustenance food and (iv) Food stability: the need to access food in both short and long term.

Food Security Index:

The Consolidated Food Security Indicator Approach (CARI) approach was developed by World Food Programme to understand food security in all its dimensions. This approach allows food security indicators to be combined in a systematic and transparent manner in order to establish an explicit classification of households. The Food Security Index examines the fundamental issues of food accessibility, availability, quality and security. It therefore combines this ensemble of food security indicators into a single indicator called the Food Security Index, which presents the overall status of the population's food security (Benin- CFSVA - Report-2017, Page 21 and 24). This composite (or synthetic) food security score combines proxy indicators of food security and takes into account the two key dimensions of food security and the livelihood-based survival strategy indicator: (i) short-term state, for which the food consumption score is the key indicator, (ii) long-term access whose adaptability is measured against the share of food expenditure (an indicator measuring economic vulnerability) and (iii) asset depletion, adaptation strategies and/or household asset base (the indicator of survival strategies based on livelihoods), (Benin- CFSVA -Report-2017, Page 21 and 24).

Based on CARI, each household surveyed is classified according to a composite food security index (Food Security Index) in four (04) categories: food security, limit food security, moderate food insecurity or severe food insecurity. Here, in our study, we categorize households into two (02) groups. The first group consists of food security and food security limit. The second group consists of moderate food insecurity and severe food insecurity. The household belonging to the first group is in a state of food security and the household belonging to the second group is food insecure.

Women empowerment in agriculture:

Agricultural empowerment is justified here by several agricultural achievements that farmer's women own such as: land, irrigation systems, seeds, organic fertilizers and chemical fertilizers. All these agricultural assets possessed by women are captured by a single variable called women empowerment in agriculture.

2.2. Theoretical Review

Women make essential contributions to agriculture and rural livelihoods. While their access to productive resources, such as land and capital, is often constrained, yet, women play a large role in food crop production [10]. In addition, women are widely recognized as the face of agriculture, especially among smallholder farmers [54]. As a means, gender-based constraints affect structure and relationships along the value chain [54]. As a result, farms run by women have, on average, lower yields than those operated by men [57]. Productivity will increase if women's skills are fully exploited. Empowering rural women to produce more food for local consumption and local markets is believed to be the best path to reduce household vulnerability to poverty and food insecurity by increasing agricultural incomes and food

availability [6]. This argument has been advanced because women play key roles in the achievement of all 4 pillars of food security in rural areas, as producers of food, income earners and caretakers of household food and nutrition security [7, 24]. There is growing evidence that investments in women's empowerment contribute to improved broader development outcomes related to health, education, poverty reduction, reducing vulnerability to food insecurity and economic growth [37]. By empowering women in agriculture, rural households can have sustainable ways of feeding themselves and get income from selling the surplus produced, thereby becoming less vulnerable to both poverty and food insecurity [2]. Women's 'empowerment in agriculture' is one of the most important dimensions of empowerment for rural women as rural households are largely dependent on agriculture for their livelihoods which, in turn, is crucial for reducing household vulnerability to food insecurity [29]. Women contribute the bulk of hours and do most of the work in agriculture [4, 23]. When women farmers can access the resources they need, their production increases, making it less likely that their families are hungry and malnourished [28].

Women are restricted in their access to productive resources such as land, agricultural inputs, and extension services. Particularly land, a major input in agricultural production, is disproportionately controlled by men in all regions of the world [12, 44]. Abrahamsson (2013) shows that in Zambia the difference between men and women in access to land, is structural and is the result of unequal access to resources, which have given men more power and influence [1]. Savath et al. (2014) observe the importance of land as an essential asset for rural livelihoods and nutritional security because of its importance for paving the way for the wellbeing of the households [49]. In Nicaragua and Honduras, Katz and Chamorro (2002) found that families spend more on food when the woman of the house own land [31]. A study in Ghana showed that when women own a larger share of the household's farmland, families allocate a larger proportion of their household budget to food [14]. Furthermore, when women own land, their food purchasing decisions are likely to benefit the household's food security and their children's nutritional status [56]. Santos et al. (2013) indicate that land rights have a direct link to the increasing food production and food security of the households [48]. Mutangadura (2005) noted that water and land are the most fundamental resources to women's' living conditions economic empowerment and to some extent, their struggle for equity and equality [40]. In most districts, men-headed households act as employers within the agriculture sector while women-headed households are largely employees [23]. Poor women often work in farming jobs for income [4]. McArthur and McCord (2017) estimate the role of agronomic inputs in increasing grain yields [38]. They find fertilizer, improved seeds and water as the main drivers of yield growth. Rhoades (1997) concluded that the increase in food production needed in developing countries should come mainly from irrigated land [46]. Numerous empirical studies across the world have

shown that irrigation has a positive impact on household food security and poverty [13, 25, 36].

2.3. Empirical Review

In Africa, women are known to produce up to 80% of the food [39]. Yet, when it comes to agricultural inputs and services, the share going to women is meagre: they receive only 7% of agricultural extension services, less than 10% of the credit offered to small-scale farmers, and own only 1% of the land [52]. In this context, women are often found concentrated in subsistence agriculture and unpaid farm work, and excluded from more lucrative agricultural opportunities such as cash crop production. Men-headed households hold more than twice the size of women-headed households' land. The smaller land sizes of most women-headed households impede commercialization and prevent the use of land as collateral in credit [23]. Even when women-headed households have land, their level of asset depletion through sales is much higher than men-headed households', because women-headed households lack viable income to meet their basic needs and resort to selling land [23]. Data analyzed by the OECD Development Centre show that countries where women lack rights or opportunities to own land have on average 60% more malnourished children than countries where women have some or equal access to land [41]. Women's land rights are found to promote development by empowering women, increasing productivity, and improving welfare [5]. A preliminary study of a land purchase program in the Indian state of Andhra Pradesh, which provided beneficiaries with plots of land of up to one acre, found that beneficiary households experienced significantly higher levels of food security: 76% of beneficiary households reported having two meals a day, compared to only 50-57% of non-beneficiary households [27]. In Nepal, research demonstrated that the likelihood that a child is severely underweight is reduced by half if the child's mother owns land [5].

It has been reported that if women had the same access as men to productive resources such as land, credit, fertilizers, new technologies and extension services etc, they could increase their farm yields by 20-30%. This would have led to increased total agricultural production in developing countries, such as Benin, from 2.5 to 4% [57, 20]. In real sense, this increase could result in a 12% to 17% reduction in the number of people suffering from hunger in the world that is between 100 and 150 million people [57, 20, 39]. As a result, women's access to arable land in quantity and quality, as well as the strength and extent of land rights, have a significant impact on the current and long-term food and economic well-being of rural households. In Bangladesh, accounting for potential endogeneity of empowerment, Esha et al. (2014) found that increases in women's empowerment in agriculture are positively associated with calorie availability and dietary diversity at the household level. In rural Msinga areas of KwaZulu-Natal, Stanley et al. (2015) have found that women's empowerment in agriculture reduces the likelihood that their households will be

vulnerable to food uncertainty [51]. Given that irrigated crop yields are double or more of comparable rainfed yields on the continent, irrigation development is considered by many as an important cornerstone for agricultural development in Africa. Irrigated area as a share of total cultivated area is estimated at only 6% for Africa, compared with 37% for Asia and 14% for Latin America [22]. Rudolf et al. (2014) showed a positive impact of irrigation on daily per capita caloric intake, with both groups of irrigating farmers realizing similar improved levels of caloric intake over farmers that did not participate in the irrigation scheme [47].

These results highlight the need to integrate women more into the process of developing economic activities, given its involvement in the dynamics of agricultural and economic growth. It is in this context that all the problems that women face as women farmers must be managed, given the wide variety of factors that hinder women's equitable participation in the [42].

3. Research Methodology and Data

This section present the database used in the estimates, the research methodology and the definition of the variables used in this research.

3.1. The Data

To achieve the first objective, we will use data from the Global Vulnerability and Food Security Analysis (CFSVA) survey held in 2017. The survey focuses on information on areas such as demography and education, migration, household housing and equipment, food consumption and food sources, source of income and livelihoods, credit and expenditure, agriculture, livestock, shocks and household survival strategies, transportation and communication. It is a national, departmental and resident-based survey. For the purposes of this study, we will limit the sample to households that farmed during the last crop year 2016. About 6,502 households farmed in the last campaign before the survey. We focus on farm households where women in the household own such as: land, irrigation systems, seeds, organic fertilizers and chemical fertilizers (1,765) and those who own not (4,737).

3.2. Modelling the Effect of Women Empowerment in Agriculture on Household Food Security Index

Stanley et al. (2015) have used also the binomial logit model to evaluate the impact of women's empowerment in agriculture on household vulnerability to food insecurity [51]. Following this lead, this study used the logit model and as part of our binary logistic regression, our dependent variable: the Food Security Index is a binary variable which takes a value of 0 for vulnerable households to food insecurity (food insecurity) and 1 for non-vulnerable households to food insecurity (food security) [15].

The cumulative logistic probability model was specified by [43] as:

$$P_i = F(Z_i) = \frac{1}{1 + e^{-(\alpha + \sum \beta_i X_i)}} \quad (1)$$

where P_i is the probability that a household:

- 1) to being food security,
- 2) given X_i (the explanatory variables); α and β_i are parameters to be estimated.

For ease of exposition, the probability that a given household is to being food security is expressed as:

$$P_i = \frac{1}{1 + e^{-(Z_i)}} \quad (2)$$

And the probability that a given household is to being food insecurity is $1 - P_i$:

$$(1 - P_i) = \frac{1}{1 + e^{Z_i}} \quad (3)$$

And thus,

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} \quad (4)$$

is the ratio between the probability that a household is to being food security to the probability of that it is to being food insecurity.

The log odds of the probability that a household is to being food security is given by:

$$\text{Log} \left(\frac{P_i}{1 - P_i} \right) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (5)$$

If the disturbance term μ_i is taken into account the logit model becomes:

$$Z_i = \alpha + \sum_{i=1}^k \beta_i X_i + \mu_i \quad (6)$$

With $Z_i = (Y \neq 0 / X_i)$ or $Z_i = (Y = 1 / X_i)$.

Y_i is the dependent variable (the outcome variable).

3.3. Variable Definition and Hypothesis

Descriptions of the variables hypothesised to influence

vulnerability of households to food insecurity and included in the empirical model are given in the next table. These variables include agricultural forms of women's empowerment in addition to other household socio-economic characteristics. A household's socio-economic characteristics that influence food security include household size, age of the head of the household, the sex of the head of the household, education level and the residence of milieu [3].

Since women in rural areas are largely dependent on agriculture for their livelihoods [29], households' vulnerability to food insecurity is greatly influenced by their levels of empowerment in agriculture. Women's empowerment in agriculture include their access to agricultural inputs as that affect agricultural production. All these assets of women's empowerment influence sustainable agricultural productivity and reduce vulnerability of household to food insecurity [45].

Women's access of and control over physical/material assets were hypothesised to be negatively associated with the likelihood of a household becoming vulnerable to food insecurity because such assets are crucial for the pursuit of sustainable farm and off-farm livelihood strategies. These assets include ownership and control over land and the superficies of land as well as the goods and services produced from them [53].

Women's empowerment index in agriculture in this model is defined as women's empowerment in agriculture and captured by the practice of irrigated cultivation, access to land, the acquisition of organic fertilizers, chemical fertilizers and seeds. Therefore, the treatment variable is women empowerment in agriculture in the household which takes the value of 1 and the value of 0 for women not empowerment in agriculture in the household.

The dependent variable of household food security (the outcome variable) is "the food security Index".

We present the description of the variables that are used in this research in Table 1.

Table 1. Description of the variables.

Variables	Description	Unit
The outcome variable		
Food Security Index	The food security index brings together proxy indicators of food security and takes into account the two key dimensions of food security and the livelihood-based survival strategy indicator: (i) short-term state, for which the food consumption score is the key indicator, (ii) long-term access whose ability to adapt is measured in relation to the share of food expenditure and (iii) depletion of assets, and adaptation household asset base.	0= Food insecurity and 1= Food security.
The treatment variable		
Women's empowerment index in agriculture	The empowerment of women in agriculture is justified by the practice of irrigation cultivation, access to land, the acquisition of organic fertilizers, chemical fertilizers or/and seeds.	0=Women not empowerment in agriculture and 1= Women empowerment in agriculture
The explanatory or controls variables		
Age	The age of the head of household	Years
Education level	The level of education of the head of household	0=None and literacy, 1=Primary, 2= At least Secondary, 3=Arabic curriculum and koranic school and 4=Other
Sex	The sex of the head of the household	1=Male and 0=Female
Marital_status	The marital status of the head of the household	1= Single & married, 2=Separated & divorced and 3=Widowed & free union
Urban_rural	The residence of milieu	1=Urban and 2=Rural

Variables	Description	Unit
Household_size	The number of members in the household	Number of persons
Land_size	The superficies of land	1= Less than 1 hectare to 1.99 ha and 2= 2 hectares and more

Source: Using data from CFSVA (2017).

4. Results and Discussion

This section presents the results of descriptive statistics and the effect of the effect of women empowerment in agriculture on household food Security in Benin.

Table 2. Statistiques descriptibles.

Variables	All sample (6,502)		Sample in which women's non empowerment in agriculture (1,765)		Sample in which women's empowerment in agriculture (4,737)		Mean-comparison Test
	Mean	SD	Mean	SD	Mean	SD	t-test
Women's empowerment index in agriculture	0.729	0.444	-	-	-	-	
Food Security Index	0.878	0.327	0.843	0.364	0.891	0.311	-0.048***
Age	46.466	14.119	45.994	14.452	46.641	13.990	-0.647*
Sex	0.890	0.312	0.896	0.305	0.888	0.315	0.008
Education level	1.452	0.755	1.483	0.746	1.441	0.758	0.042**
Urban rural	1.741	0.438	1.738	0.440	1.742	0.437	-0.004
Marital status	1.143	0.500	1.165	0.528	1.135	0.489	0.030**
Household size	10.374	5.941	10.651	6.163	10.271	5.854	0.380**
Land size	1.608	0.488	1.459	0.498	1.664	0.473	-0.205***

La significativité des différences en moyenne est indiquée avec *** p<0,01, ** p<0,05, * p<0,10.

Source: Using data from CFSVA (2017).

The results of the descriptive statistic presented in table 2 clearly show that the variable women's empowerment index in agriculture is negatively associated with variables such as education level, marital status and household size. On the other hand, variables such as food security index, age and land size are positively associated with women's empowerment index in agriculture. The food security index is higher in the rank of women's empowerment in agriculture than women's non empowerment in agriculture. Women's empowerment in agriculture are older and have fewer people in their households than women's non empowerment in agriculture. There are more women's empowerment in

agriculture in rural areas. The significance test of the differences on average between women's empowerment in agriculture and women's non empowerment in agriculture and explanatory variables shows that the food security index and land size are significant at 1%, age is significant at 10%; education level, marital status and household size are significant at 5%. On the other side, sex and residence of milieu are not significant.

We present the results followed by the discussion of the effect of women empowerment in agriculture on household food Security Index in Benin. The results of the logistic regression model estimation are reported in Table 3.

Table 3. Effect of women empowerment in agriculture on household food Security Index.

Logistic regression				
	Food Security Index			
	Coefficient	Stand. Error	P> z	Marginal effects (dy/dx)
Women's empowerment index in agriculture	0.3785***	0.0828	0.000	0.0397***
Age	0.0016	0.0028	0.569	0.0002
Sex	0.2160	0.1339	0.107	0.0227
Education level	0.3155***	0.0621	0.000	0.0331***
Urban rural	-0.4089***	0.0962	0.000	-0.0429***
Marital status	-0.0952	0.0819	0.245	-0.00999
Household size	0.0103	0.0065	0.112	0.0011
Land size	0.3438***	0.0819	0.000	0.0361***
Constant	1.2023***	0.3244	0.000	
Number of observations	6,502			
Prob > chi2	0.0000			
Pseudo R2	0.0236			
Log likelihood	-2350.3145			

Note: Niveau de significativité est indiqué avec *** p<0,01, ** p<0,05, * p<0,10.

The estimates made it possible to retain from the analysis of table 3 four (04) explanatory variables whose coefficients

are all significant at 1%: Women's empowerment index in agriculture, level education, urban rural and land size.

The results show also that the factors that affect household Food Security Index in Benin are: women's empowerment index in agriculture, level education, urban rural and land size.

Analysis of the estimated coefficient of women's empowerment index in agriculture shows that women's empowerment index in agriculture is positively correlated with food security index. Thus, the likelihood of a household being food security increases when women's empowerment in agriculture increases. The results of some research are consistent with our results. In Bangladesh, accounting for potential endogeneity of empowerment, Esha et al. (2014)] found that increases in women's empowerment in agriculture are positively associated with calorie availability and dietary diversity at the household level [15]. In rural Msinga areas of KwaZulu-Natal, Stanley et al. (2015) have found that women's empowerment in agriculture reduces the likelihood that their households will be vulnerable to food uncertainty [51]. By empowering women in agriculture, rural households can have sustainable ways of feeding themselves and get income from selling the surplus produced, thereby becoming less vulnerable to both poverty and food insecurity [2]. Women's 'empowerment in agriculture' is one of the most important dimensions of empowerment for rural women as rural households are largely dependent on agriculture for their livelihoods which, in turn, is crucial for reducing household vulnerability to food insecurity [28, 29]. Women's agricultural empowerment increases the household food security index by 3.97 percentage points.

The results estimates show also that land size are significant at 1% and positively influence the household food security index. Thus, the likelihood that a household is in a state of food security increases as the area of land sown increases. OECD work in 2012 confirmed this result by showing that countries where women have the opportunity to own land, their children are better fed, which improves and increases the household food security index [27]. Allendorf's roadworks in 2007 also consistent with this result by demonstrating that the probability of a child suffering from severe food deficiency is halved if the child's mother owns land. In addition, Doss in 2006 also showed that when women own a larger share of farmland in the household, families allocate a larger share of their family budget to food. On the other hand, when the women in the household own land, families spend more on food, reducing the household's vulnerability to food insecurity by increasing agricultural income and food availability [6, 31]. The area of land sown increases the household food security index by 3.61 percentage points.

The estimates also revealed that the education level is significant at 1% and positively impacts the household food security index. Thus, the probability that a household is food security increases when education level of the woman in the household increases. Investments in education are needed to break the vicious cycle of food insecurity and malnutrition. The Food and Agriculture Organization of the United Nations (FAO) supports the significant contribution that education can make to countries' efforts to achieve food security and build a healthy society. Eating habits are

assimilated early and education can play an important role in promoting healthy and sustainable diets [20]. Women's level of education increases the household food security index by 3.31 percentage points.

The results showed that the residence of milieu (Urban rural) is significant at 1% and negative. Thus, the likelihood of a household being food security decreases in rural areas. This result proves that rural areas are more vulnerable to food insecurity than urban areas. Across all countries, people living in rural areas are most at risk of food insecurity due to limited access to food resources [21]. Rural areas reduce the household food security index by 4.29 percentage points.

5. Conclusion and Policy Implications

This paper analyzed "effect of women empowerment in agriculture on household food Security Index in Benin". The results show that the factors that affect household food Security Index in Benin are: women's empowerment index in agriculture, level education, urban rural and land size. The results show also that women's empowerment index in agriculture is positively correlated with food security index. Thus, the likelihood of a household being food security increases when women's empowerment in agriculture increases. Women's agricultural empowerment increases the household food security index by 3.97 percentage points. In light of our results and in order to improve the level of household food security in Africa and more specifically in Benin, policy makers should promote and encourage the agricultural empowerment of women, especially in rural areas, through the establishment of communication systems with the intention of reducing gender inequalities in access to agricultural inputs, access to land and irrigation systems. Second, they must also implement institutional reforms favorable for women for the acquisition of land of large size. Finally, they must also encourage and promote women to education by reducing gender discrimination in access to education through formal government policies and increasing educational investment, supporting women to progress in education.

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