Full Length Research Paper

Integrating nutrition in agriculture extension information and services and its implications for rural household food security in the Bamboutos division, West region of Cameroon

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The integration of nutrition into agricultural extension programs is increasingly used as a tool to curb food insecurity in developing countries. Inassessing the extent to which integrating nutrition into agricultural extension information and services affects smallholder household food security status in Bamboutos division, the household Food Consumption Score (FCS) was estimated and used as indicator for food security. Descriptive statistics tools and a multinomial logistic regression were used to analyse data collected from 150 randomly selected smallholder farmers receiving agricultural extension information and services. The results indicated that nutrition aspects are not adequately integrated into agricultural extension information and services in the studied area as only 45% of surveyed smallholders receive advices on nutrition from their extension agents. Also, judging from the FCS coefficients, 12.16% of the studied population are in state of food insecurity, 55.41% are vulnerable to food insecurity and 32.43% are food secure. The regression analysis revealed that integrating nutrition into agricultural extension information and services positively drive smallholder household food security status by improving on the FCS. Hence,nutrition aspect should be adequately integrated into the agriculture extension and education policies of the state as a tool for improving food security status in rural settings.

Keywords: *Food security, Agricultural Extension Information and services, smallholder, food consumption score, Bamboutos,*

INTRODUCTION

Cameroon has great agricultural potential and the country's vast tracts of arable land, climate and agro-ecological conditions favour a wide variety of crops (WFP and FAO, 2011). Thanks to the country's agro-ecology, major crops peculiar to most African countries such as rice, wheat, barley, maize, cassava, potatoes, plantains/bananas, yams and also cocoa and coffee are produced in the country (Besong et al., 2009). The livestock sub-sector plays a significant role in the agricultural sector and Cameroonian economy as a whole (Ngalim, 2015). The main livestock products in the country include cattle beef, pork, chicken, and diary (Ngalim, 2015).

However, food and livestock production in Cameroon are still largely in the hands of smallholder farmers who make up about 70 % of the farming

population (INS, 2010). Cultivation practices continue to be characterized by the use of basic tools, small farm size, low capital input, high labour inputs, limited control of plant pests and diseases, and low yields (MINADER, 2005; 2006) thereby exposing the population to risks of food insecurity, hunger and malnutrition.

At any given time, at least 30% of the Cameroonian households in both rural and urban areas remain vulnerable to food insecurity (WFP and FAO, 2011) and undernourishment although relatively moderate in the country with 15% is the major cause of child mortality (Fonteh, 2017).

The WFP and FAO in the 2011 Cameroon Comprehensive Food security and Vulnerability Analysis (CFSVA)report hold that in rural areas, 9.6% of households are considered food insecure; a further 10% of rural households are in a state of 'relative' food insecurity; in both the rural and urban areas, slightly more than 30% of households are vulnerable to food insecurity. Farmers, daily labourers, small livestock breeders, hunters and fishermen constitute the main food insecure households in rural areas. The food insecurity prevalence in rural Cameroon in 2011 stood at 50.4%, where 30.3% were vulnerable to food insecurity, 10.5%, 7.4% and 2.2% in state of relative, moderate and severe food insecurity respectively (WFP and FAO, 2011).

The 2017 Comprehensive Food Security and Vulnerability Analysis by the WFP revealed that about 16% of households in Cameroon are estimated to be food insecure (3.9 million people), including 1% that are severely food insecure (approximately 211,000 people). The Far North region tops the list of food insecure regions with 33.7% of food insecure households, followed by North West and West regions with 18.1% and 18% of food insecure households respectively, and the list is completed by Adamawa (15.4%) and Nord (15.3%).

In 2017, more than a fifth of rural households (22%) were food insecure compared to 10.5% of urban households. Approximately 22% of households had inadequate food consumption, including 18% with borderline and 3% with poor food consumption. The situation appeared to be worse than those highlighted by the 2011 CFSVA, with a 35% increase of rural households consuming inadequate diets (WFP and FAO, 2017). These statistics illustrate the pathetic picture of the nutritional situation prevailing among the Cameroonian population and it is a reflection of the fact that nutrition has never been adequately integrated into the health, agriculture, education and socio-economic policies of the state (Fonteh, 2017).

Callens and Gallagher, (2003); Suvedi and Kaplowitz, (2016)and FAO, (2017) posits that a growing number of studies stress the important role and potential of' agricultural information and extension services in improving nutrition outcomes. Therefore, introducing nutrition into agricultural information and extension services could help reduce the exposure of farm households to food insecurity.

The study is therefore intended to determine the extent to which nutrition has been integrated in agriculture extension information and services, estimate the food security status prevailing among smallholder households and assess the extent to which integrating of nutrition in agriculture extension services can help improve smallholder household food security status.

LITERATURE REVIEW

The WFP and FAO (2017) hold that food insecurity in Cameroon is driven by outdated agricultural practices and rural poverty; poor transport network and malfunctioning markets; dependency on international markets for food imports and household vulnerability to high food prices; recurring natural adversities; low education levels; illness and lack of health infrastructures.

On the other hand, Tanankem and Fotio (2016) noted that the incidence of food insecurity in rural area is about 33.8%; hold that region of residence, landless status of the household, and household-head's age are positively related to household food insecurity. In the same light, Abdullah et al. (2017) found that age, gender, education, remittances, unemployment, inflation, assets, and disease are important factors determining household food insecurity.

Agada and Igbokwe (2016) posit that culture plays a great part in shaping households' food security status through its effects on the number of meals consumed per day, household food choices, agricultural decision making, cropping system, division of labour, land acquisition, control over household income and preference in household food sharing. In the same light, Alonso (2015); Wanbua (2014)came to the conclusion that culture, religion and traditional knowledge drive food security by shaping local diets, food preferences, intra-household food distribution patterns, child feeding practices, food processing and preparation techniques as well as health and sanitation practices.

Nkonya (2009) posits that in many countries agricultural extension is a pro-poor public investment which yield positive results such as the case of Uganda where the same author found out that increase in extension visits reduces poverty, child stunting and underweight among children below five years of age.However, there are some challenges related to the integration of nutrition into agricultural information and extension such as; the ineffective training received by agricultural education and extension workers which hinder their ability to effectively conduct nutrition

sensitive agricultural information and extension services (FAO, 2017); the unclear organizational mandates of the agricultural extension and advisory agents which makes it challenging to develop a national strategy to mainstream nutrition; lack of collaboration and communication between health extension workers and agricultural extension and' advisory workers; and limited resources such as limited funds, time, material and insufficient personnel (Fanzo et al., 2013).

Given the delicate prevailing food security situation in Cameroon and the vital role integrating nutrition in extension and advisory services could play in alleviating the situation as highlighted by FAO (2017); Fonteh (2017) and Kuria (2014), this study comes in to assess the extent to which integrating nutrition in agricultural extension could help improve rural household food security status with the use of an objective measure of food security as well as econometric methods of data analyses.

METHODOLOGY

Area of Study

The study was conducted in Bamboutos division, one of the eight administrative divisions of the West region where the rural population comprises 78% of the total population. The area was selected for the study due to the predominance of agriculture as the main economic activity in the region and the fact that numerous agricultural extension programs have been implemented in the division starting with the Training and Visit system that was pilot tested in the division in 1988 under the National Agriculture Training Program (Tchuamo and Steel, 1997).

Data collection process

The survey was conducted in May 2018. During the process, a multi-stage purposive sampling technique was used to select respondents. At the first stage, a list of producer organisations (POs) who have been receiving extension services for at least 3 years in the division was elaborated by the agricultural extension officials of the area. At the second stage, 17 POs among which 15 common initiative groups and two cooperative societies were selected in Mbouda, Babadjou and Batcham subdivisions. At the end of the process, 150 smallholder farmers belonging to these POs provided answers to the questionnaire drafted for the purpose of the study.

Method of Data Analysis

The analytical tools adopted in this study were descriptive and econometric. In order to determine the extent to which nutrition has been integrated in agriculture extension information and services, respondents outlined the various extension information and services provided to them by the extension agents.

To estimate the food security status prevailing among smallholder households, the food consumption score (FCS) for each of the surveyed households was estimated as indicator for food security following the approach recommended by the WFP (see appendices 1 & 2). Later, the households based on their respective FCS were classified as food secure, vulnerable to food insecurity or food insecure.

In order to assess the extent to which integrating of nutrition in agriculture extension services could help improve smallholder household food security status, a multinomial logistic regression estimated with the Maximum Likelihood Estimation method was used. Here, the parameter *integrating nutrition in agriculture extension information and services* was estimated by a dummy variable with respondents who receive advice on nutrition from the extension officials on one hand and those not receiving the service on the other hand.

The model used in this study is an adaptation from that used by Njimanted, *et al.*(2014). The model shows the relationship between extension information and services and food security and is expressed using equation (1).

$$FS_i = \mu_0 + \lambda_i INE_i + \delta_i SHC_i + \varepsilon_i \quad \text{....................................(1)}$$

Equation (1) is the reduced form of the model estimated in the study where:

FS_i represents smallholder household i's food security status (*Fs*) with three modalities (poor, borderline and acceptable food status);

IN*E* the integration of nutrition into extension captured by advice on nutrition and feeding (Anf) and advice on output management (Aom);

Whereas λ_i is the coefficient indicating the incidence of IN*E* on FS;

SHC_i represents the smallholder households' characteristics (household heads' gender, age, level of education, household size, output level and proportion of farm output consumed at home), δ_i the coefficient indicating the effect of SHC on households' food security status and ε_i is the error term of the model.

Introducing the different variables in the model, equation 2 is obtained.

$$FS_i = \mu_0 + \lambda_1 Anf + \lambda_2 Aom + \delta_1 Gen + \delta_2 age + \delta_3 Led + \delta_4 Hhs + \delta_5 Olev + \delta_6 Pfoc + \varepsilon_i \quad \text{.............................(2)}$$

Equation 2 is the multinomial Logit model (MLM) used to

generate estimators measuring the relative risk ratio (RRR) for having a particular food security status.

RESULTS

Socio Economic profile of surveyed smallholder households

The socio-economic characteristics retained for this study include; gender, age, marital status, level of education, household size and head of household main economic activity.

Respondents and gender

A slight majority (52.7%) of the respondents were men and 47.3% were women.

Age range

Most of the surveyed smallholder households were within the age range of 40 to 50 years (40.57%). This was followed by those below 40 years (21.62%) those between 51 and 60were 20.27% of the sample meanwhile those above 60 years constituted 17.57%.

Marital Status

Most of the smallholder heads surveyed are married (82.43%) whereas 17.57% are either single, widows or widowers

Respondents' Level of Education

The findings of the study reveal that about 89% of smallholder heads surveyed have undergone formal education. Wherein, 37.84% have primary education, 43.24% secondary education and 08.11% received higher education. However, 10.81% of the smallholder heads did not receive any formal education..

Household Size/Number of dependents

Smallholder household size appear to be relatively large. About 25.69% of surveyed smallholder households have less than 5 persons, 62.16% consist of 5 to 9 persons and 12.16% have more than 9 members. Hence, about 74% of respondents have household sizes of 5 persons and above.

Respondents' Main economic activity

Agriculture appears to be the main economic activity in the area given that 82.43% of respondents have agriculture as their main source of income, whereas 10.81% rely on trade and 6.67% rely on other activities like teaching and driving.

Extent to which nutrition is integrated in Agriculture extension

The results presented in table 1, show that 90.54% of the surveyed smallholders receive training on production techniques from the extension agent. This training for crop producers is focused on activities such as the choice of the crops to be cultivated, the appropriate seeds to be used, appropriate fertilizer and phytosanitary products to be used and the application of these products in the farm as well as the appropriate period to conduct each of the activities. Whereas for those involved in animal breeding the training involves adequately feeding the animal, ensuring the environment in which the breeding occurs respects the standard norms and curbing potential diseases that may attack the animal.

Secondly, 89.19% of surveyed small holders receive training on management techniques which are intended to the development of their basic managerial and accounting skills. This training involves the importance of drafting and how to draft balance sheets and income statements to determine the net worth of the farm household in terms of assets and liabilities and the net farm income realised by the farm household; the procedure of depreciating farm equipment and the importance of providing for depreciation of farm equipment.

Also, 83.78% of smallholders receive on-farm visits which are generally aimed at monitoring the application of the advices provided by the agent and the effective usage of the infrastructures and/or equipment partially financed by the extension program.

The results in table 1 also indicate that 82.43% of smallholders receive advice on how to manage their farm produce. This service involves advice on the adequate methods of storing the said produce or transforming them in order to avoid the possibility of it being wasted due to perishability.

Moreover, it is indicated that 78.38% of smallholders receive support in acquiring inputs. This support appears in the form of advice on the adequate farm inputs for the crop under cultivation or adequate animal feed and related needs and in the form of subsidies for the purchase of farm equipment and tools.

In addition, 62.16% of smallholders have received support for the acquisition of infrastructures

Table 1: Types of extension information and services received by the smallholders

Extension and advisory services	Beneficiaries of the service	Percentage
Training in production techniques	134	90.54%
Training on management techniques	132	89.19%
On-farm visits	124	83.78%
Advice on farm produce management	122	82.43%
Support in acquiring inputs	116	78.38%
Support in acquiring infrastructures	92	62.16%
Advice on feeding and nutrition habits	66	44.59%
Support in marketing farm produce	22	14.86%

Source: Field results 2018

such as buildings for the rearing of animals, warehouses adapted for the storage of farm produce, water points, maize cribs amongst others. It should be noted that with this service, the extension program partially finances the acquisition of the infrastructure by supporting 70% of the total cost.

Advice on nutrition and feeding habits was received by 44.59% of the surveyed smallholders. This service dwells with schooling the smallholder farmers on the importance of feeding adequately and providing a balanced diet for the entire household.

Finally, 14.86% of respondents receive support in marketing farm produce. The extension agents assist farmers find customers for their produce and
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increase their bargaining power by organising group sales.

Smallholder household food security status (FCS) in Bamboutos division

According to table 2, a minority of smallholder households have an acceptable FCS (32.43%) and can be considered to be food secure whereas 55.41% of the smallholder households surveyed have a borderline FCS and can be considered as being vulnerable to food insecurity and 12.16¨% of smallholder households have a poor FCS and constitute the food insecure households

Table 2: Smallholder household food security status

FCS value for high oil/sugar diets	Percentage of respondents	Household food security status
<28	12.16	Poor/food insecure
28.5 to 42	55.41	Borderline/vulnerable
>42	32.43	Acceptable/Food secure

Source: Field results 2018

Integrating nutrition into agricultural extension and food security status

Based on the results in table 3, as the household heads age increases by 1 year the probability or relative risk ratio of having poor FCS rather than having a borderline FCS reduced by 0.99 units whereas the probability or relative risk ratio of having an acceptable FCS food consumption score against the base category of borderline FCS increases by 1.05 units. Of these two categories, only that of the acceptable FCS category is statistically significant at 5% error margin.

The household head's level of education is also found to significantly affect the household's food security status. The coefficient for primary education level holds that the probability or relative risk ratio of being food insecure rather than having a borderline food status is 0.077 times lower for household heads who have undergone primary education as compared to those who had no formal education. On the other hand, the coefficient for university level indicates that the relative risk ratio in favour of being food secured (having an acceptable FCS) rather than being vulnerable to food security is 16.13 times greater for households whose

Table 3: Econometric results estimated using the multinomial logit technique

Explanatory variable	Food insecure Poor (FCS<28)		Vulnerable Borderline=ref (42≤FCS≥28.5)	Food secured Acceptable (FCS>42)	
	RRR	Z-statistic		RRR	Z-statistic
Gender	2.651939	0.96		0.9300695	0.14
Age	0.9961035	0.18		1.058013**	2.46
Level of education (None=ref)					
Primary	0.0768077**	2.01		0.3418792	1.19
Secondary	0.5673842	0.56		3.12568	1.31
Higher	2.409703	0.64		16.12962***	2.91
Household size	1.010693	0.07		1.159464*	1.88
Output level (Low=ref)					
High	5.61e-08***	25.87		0.6288724	0.92
Proportion of output consumed at home	1.041314**	2.52		1.038692***	3.13
Advice on nutrition	1.47839	0.62		2.988846**	2.00
Advice on output management	8.415396***	2.72		2.200271	1.15

Number of observations	=	148
Wald chi2(20)	=	2776.37
Prob > chi2	=	0.0000
Pseudo R2	=	0.3048

Source: Field results 2018 (Computed by authors using STATA 13)
Note: The Z-Statistic indicates the level of significance of the estimated coefficients: *significant at 10%, ** significant at 5% and *** significant at 1%.

heads have undergone university as compared to those who had no formal education.

The household size exerts a positive influence on food security with a coefficient of 1.16 which is significant at 10% level for the food secure group and implies that the relative risk ratio for being food secure rather than being vulnerable to food security increases by 1.16 as household size increases by one additional member.

Having a high output level increases the probability of being food insecure by 0.0000000561 and increases the probability of being food secure by 0.63. However, only that of being food insecure is significant but the value of the relative risk ratio is approximately equal to zero.

A one percent increase in the proportion of farm output consumed at home increases the probability of being food insecure by 1.04 and of being food secured by 1.04against the base category of having a vulnerable

to food insecurity status. Both categories are statistically significant at 5% and 1% error margins respectively.

Advice on nutrition increases the probability of being food insecure by 1.47 and the probability of being food secured by 2.99 as compared to the base category of being vulnerable to food insecurity. However, of these probabilities only that of being food secured is significant at 1% error margin.

The probability of being food insecure for households receiving advice on output management rather than being vulnerable to food insecurity is 8.42 times greater than that of those who don't receive the said service whereas the probability of being food secured rather than being vulnerable to food insecurity for the same set of persons is 2.2 times greater. Of these probabilities only that of being food insecure is statistically significant.

DISCUSSIONS

The surveyed smallholder households are mainly headed by men (52.7%) andcan be attributed to the fact that men in the area are generally considered as the main bread winners for the household, they have control over almost all the household resources and are the main decision makers.

Also, only 10.81% of the smallholder household heads did not receive any formal education. This implies that a large majority of them are educated enough to understand the importance of ensuring an acceptable food security status for their households and the part extension services can play.

About 74% of smallholder households have a size of 5 persons and above. This implies that the households are large enough to provide labour for the farming activities on one hand but may have a high dependency ratio if these persons cannot contribute actively in the production process.

Results also show that the surveyed smallholder farmers receive eight different extension services from the agricultural extension programs in the Bamboutos division. These services include; training in production techniques; training on management techniques; on-farm visits; advice on farm produce management; support in acquiring inputs; support for the acquisition of infrastructures; advice on nutrition and feeding habits; and support in marketing farm produce.

These results indicate that a majority of smallholders do not receive advice on nutrition implying nutrition is not adequately integrated in agricultural extension. Hence, as noted by Fonteh (2017), nutrition has never been adequately integrated into the health, agriculture, education and socio-economic policies of the state. Also, the low level of advice on nutrition can be attributed to the ineffective training received by agricultural education and extension workers as stated by FAO, (2017); the unclear organizational mandates of the agricultural extension agents; lack of collaboration and communication between health extension workers and agricultural extension workers; and limited resources available to the extension workers (Fanzo et al., 2013). Hence, more efforts should put in place to introduce and strengthen nutrition into agricultural extension schemes as prescribed by FAO (2017).

Estimating the food security using the FCS indicates that 55.41% smallholder households (55.41%) have a borderline FCS and can be considered as being vulnerable to food insecurity and 12.16¨% of smallholder households have a poor FCS and constitute the food insecure households. This implies that a majority of

smallholder households are vulnerable to food insecurity. These smallholders have inadequate knowledge on the composition of a balanced diet and they have little knowledge on the nutritive value of the foods they grow and consume. This result is similar to those obtained by Kuria (2014).

Of the 8 variables included in the regression model, 7 of these variables significantly affect the smallholder households' food security status.The likelihood of being food secure increases as the household head's age increases which is in contradiction with that of Tanankem and Fotio (2016) who at a national scale study rather found out that household-head's age are positively related with household food insecurity in Cameroon. However they are in line with the findings of Ma-Azu (2015); Arene and Anyaeji, (2010) whose studies revealed household head age to be the most significant factors determining food security.

Household head's level of education significantly affects its food security status and this result corroborated those of the WFP and FAO (2017) who hold that food insecurity in Cameroon is driven by low education levels; Abdullah et al. (2017) whose findings revealed education is among the important factors determining household food insecurity; Ma-Azu (2015) and Haile et al. (2005) who found out that education positively affects food security.

Household size exerts a positive influence on food security which contradicts Amaza et al. (2006) who held that food insecurity increases with the increase in the number of family members and vice versa. However, the result is in line with those of Ma-Azu (2015); Maguswi (2011) and Haile et al. (2005) who all came to the conclusion that household size is important in contributing to food security among households.

Integrating nutrition in agricultural extension through advice on nutrition increases the likelihood of having an acceptable FCS making the household food secure. This is in line with the observation made by Agbamu (2005) who holds that extension and advisory services have also been used to address food insecurity in many parts of the world.

CONCLUSION AND RECOMMENDATIONS

This study aims at assessing the extent to which integrating nutrition into agricultural extension affects smallholder household food security status in Bamboutos division. On the basis of the results obtained, it appears that smallholder households who regularly receive extension services are mainly men,

relatively young with a secondary level of education on the average and whose main activity is agriculture.

It appears that nutrition is not adequately integrated into the agricultural extension services in spite of the huge financial and material means invested by the government, given the relatively low proportion of respondents who receive advice on nutrition and feeding from their extension agents. Moreover, in spite of the fact that few smallholder households are in situations of food insecurity, a large majority of these households remain vulnerable to food insecurity.

Integrating nutrition into agricultural extension play a great role in improving the smallholder households' food security by improving the likelihood of being food secured for those receiving advice on nutrition and feeding. Hence, more efforts should be taken to make nutrition a key component and target of extension programs and adequately integrate nutrition into the health, agriculture, education and socio-economic policies of the state.

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APPENDIX:

Calculating the Food Consumption Score (FCS)

The food consumption score (FCS) is a composite score used as an indicator of substitution of food consumption and thus of access to food. The FCS is a proxy indicator that reflects the amount (kcal) and quality (nutrients - nutritional importance) of the diet. It is based on a 7-day recall of the types / groups of foods (diversity) and frequency of consumption (Ndiaye, 2014; Vhurumuku, 2014). The FCS is obtained through calculations by taking into account the food consumed classified in group with a specific dietary weight as presented in table 4.

Table 4: Food groups and their weight in the Food Consumption Score (FCS)

Food items	Food Group	Weight in FCS	Number of days consumed within the last 7 days (B)	Score (A×B)
Rice, pasta, bread / cake and / or donuts, sorghum, millet, maize, Potato, yam, cassava, sweet potato, taro and/or other tubers	Cereals and Tubers	2	----	----
Beans, cowpeas, peanuts, lentils, nut, soy, pigeon pea and / or other nuts	Nuts	3	----	----
carrot, pumpkin, orange sweet potatoes, and other vegetables Fruits	Vegetables	1	----	----
	Fruits	1	----	----
Goat, beef, chicken, pork, ish, including canned tuna, escargot, and / or other seafood Milk and other dietary products	Meat and fish	4	----	----
	Milk	4	----	----
sugar, honey, jam, cakes, candy, cookies, pastries, and other sweet (sugary drinks)	Sugar	0.5	----	----
vegetable oil, palm oil, shea butter, margarine, other fats / oil	Oil	0.5	----	----

NB : ∑(A×B)= FCS

Source : Ndiaye, 2014 ;Vhurumuku, 2014

After calculating the FCS, its value must be interpreted and this is done following certain rules. The interpretation rules of the FCS are presented in Table 5.

Table 5: Food Consumption Score thresholds

FCS value	FCS value for high oil/sugar diets	Household food security status	Interpretation
<21	<28	Poor	Inadequate quantity and quality
21.5-35	28.5 to 42	Borderline	Inadequate quality
>35	>42	Acceptable	Adequate feeding

Source : Ndiaye, 2014 Vhurumuku, 2014

The use of FCS as an indicator of food security is advantageous in the sense that it provides key information on household food consumption; it is easy to collect and calculate; it takes into account the nutritional value of the food consumed by the household; and it is comparable in time and space. However, this indicator is criticised on the ground that the score reflects only one week's consumption but does not capture seasonal variations; it does not measure the food "deficit" and does not capture food consumption within the household (between members); and it does not measure consumption outside the household, which is important in urban areas (Ndiaye, 2014; Vhurumuku, 2014).