Vol.7 Issue.2 June 2022

RSEP Review of Socio - Economic Perspectives
ISSN: 2149 - 9276
E-ISSN: 2547-9385

Adaptive capacity and nutritional status of households in Cameroon

Yanick Fredy Mvodo[1,•] , François Colin Nkoa[2,*]
[1] *Ph.D. Student, University of Douala, Postgraduate School for Social and Human Sciences, Douala, Cameroon*
[2]*Professor of Economics, University of Yaounde II Soa, Faculty of Economic and Management, Yaounde, Cameroon*

Article History

Received: 20 February 2022 Revised: 18 May 2022 Accepted: 23 May 2022 Available Online: 1 June 2022

Keywords: adaptive capacity, nutritional status, resilience, food security.
JEL classification: I12, D13, I31

Citation: Mvodo, Y.F. & Nkoa, F.C. (2022). Adaptive capacity and nutritional status of households in Cameroon, *Review of Socio-Economic Perspectives*, *Vol 7(2)*, 33-46.

Abstract

To cope with the various shocks that may occur in their lives, households emphasise their adaptive capacity in order to minimise the negative economic consequences they may experience, particularly in terms of food and nutrition security. This behaviour of households is a dimension of their resilience to food insecurity. The objective of this study is therefore to analyse how adaptive capacity promotes the nutritional status of households in Cameroon. Using data from the FSMS 2020 survey and statistical and logistic regression methods, the study reveals that physical and human capital contribute significantly to improving the nutritional status of households in Cameroon. These results therefore call for the strengthening of training and livelihoods to ensure better household nutritional status.

1. Introduction

The recurrent crises in sub-Saharan Africa in general and in Cameroon in particular raise real concerns for the achievement of sustainable food and nutrition security. The root causes of vulnerability to food insecurity and malnutrition are complex and multidimensional. They are linked to a series of interrelated factors such as poverty, health, hygiene, access to basic social services, dietary behaviour, socio-cultural norms, low levels of production, access to markets, inadequate public policies, as well as frequent climatic variations and other shocks, which result in large numbers of people being plunged into a state of near-permanent fragility (FAO, 2016).

An analysis of the impact of Covid 19 was conducted in the ten regions of Cameroon in September 2020. This analysis reveals the following results: firstly, the pandemic has been a real brake on production, affecting 42% of agricultural assets; secondly, it has caused an increase in post-harvest losses and a scarcity of basic foodstuffs; and thirdly, it has increased purchase prices by 3% compared to a normal situation. This situation is exacerbated by the socio-political crisis in the North West and South West regions, the floods and the security crisis due to Boko Haram in the Far-North and the influx of refugees in the East region due to the war in CAR. As a result, an estimated 2.7 million people were in crisis or worse between October and December 2020 (Minader et al., 2020).

An amount of 30 billion CFA Francs has been estimated to cover immediate livelihood needs, which are fourfold: material and technical support to short-cycle food producer organisations; provision of livelihood support to affected households; monitoring of market functionality and evaluation of food stocks; and building physical and monetary seed security stocks (http://www.fao.org/cameroun/fao-au-cameroun/fr/; accessed 04/03/2021).

In order to address this situation, which is continuously deteriorating the state of national food and nutrition security, the formulation and implementation of a national resilience programme is being considered by the

• **E-mail:** yanickmaestro@gmail.com & **ORCID:** https://orcid.org/0000-0002-1009-2338
***E-mail:** fcnkoa@yahoo.fr

DOI: https://doi.org/10.19275/RSEP128
Article Type: Original Paper

government. However, the measurement of resilience is not obvious as it is not directly measurable. It has to be measured by proxy indicators that require a conceptual framework containing specific variables and context, and a particular focus such as resilience to food insecurity. Thus, in this study, we propose to analyse the adaptive capacity dimension of resilience and the household nutritional status dimension of food security by asking the fundamental question: does adaptive capacity promote improved household nutritional status in Cameroon?

The objective of this study is therefore to assess and analyse the contribution of the adaptive capacity of households in Cameroon to their nutritional status. Adaptive capacity is understood here in terms of human, physical and financial capital, while nutritional status is defined in terms of education, health and child nutrition. Thus, using data from the FSMS 2020 survey of MINADER, WFP and FAO, we apply, with reference to the literature, a statistical analysis and regression by a logit model to obtain the results necessary for the analysis.

The study is divided into six sections. After the introduction, the second section provides a literature review. The third section presents the methodology used. The fourth section presents the results which lead to the discussion in the fifth section. The conclusion and recommendations constitute the sixth section.

2. Literature review

There are several approaches to nutritional status in the economic literature, although most often linked to infant and child feeding conditions. There is also a broad conception of the adaptive capacity of households and individuals.

2.1. Nutritional status

The literature review on nutritional status presents the definition and conceptual approach of the notion on the one hand and its factors and implications on the other.

2.1.1. Definition and conceptual approach

Nutritional status is the result of a complex hierarchy of factors that begins with direct exposure to quality food and health care and extends to more indirect interactions with social and economic infrastructures that contribute to a multitude of socio-environmental factors that ultimately contribute to an individual's nutritional status (Hoffman, 2017). The term nutritional security emerged with the recognition of the need to include nutritional aspects in food security. Unlike food, which is primarily defined as any substance that people eat and drink to sustain life and growth, nutrition adds aspects of health services, a healthy environment and care practices. Specifically, "a person is considered nutritionally secure when he or she has an adequate diet and the food consumed is biologically used to maintain adequate performance in terms of growth, stamina, or recovery from illness, pregnancy, lactation, and physical labour"... (Frankenberger et al. 1997).

Nutritional security is considered to be achieved when access to an adequately nutritious diet is combined with an adequate sanitary environment, health services and care to ensure a healthy and active life for all household members (Pangaribowo et al., 2013). The FAO has defined nutritional security as a condition in which all people at all times consume food in sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life, combined with adequate health environment, health services and care (CFS 2012). The term food and nutrition security is used to combine aspects of food security and nutrition security, as well as to emphasise the idea that they are linked. The use of the term 'food and nutrition security' has become standard practice in a number of international agencies such as IFPRI, UNICEF and FAO. Weingärtner (2010) has developed a definition of food and nutrition security as a condition in which adequate food (quantity, quality, safety, socio-cultural acceptability) is available and accessible to all people at all times and used satisfactorily to live a healthy and happy life. As the term food and nutrition security has combined the two security concepts in a more integrated way as a single policy objective, this term is more widely used.

2.1.2. Factors and implications of nutritional status

While food adequacy is a necessary condition for good nutrition, it is not sufficient. There are a number of non-food factors that also influence children's nutritional outcomes. The physical and environmental health of the household and its members and the quality of care the child receives are particularly important (Tiwari et al., 2013). This implies that food is only one of many factors that contribute to good nutrition, and any effort to assess the impact of food security on nutritional outcomes must take into account the effect of these factors.

There are situations where it is appropriate to consider assessing the nutritional status of other age groups besides young children. These include situations where there is reasonable doubt that the nutritional status of young children reflects the nutritional status of the general population. In populations where cultural traditions give

preference to feeding young children, older adults may be more severely affected. Other situations may refer to cases where many older adults or children present to selective feeding programmes or health centres with malnutrition, or there are credible anecdotal reports of frequent malnutrition among adults or adolescents (UNHCR, 2005).

Headey and Ecker (2012) assess a set of food security indicators but do so at a much broader level using cross-sectional validity, nutritional relevance and intertemporal validity lenses. While their analysis and the food security measures they use do not fully overlap with the focus of our work, the spirit of their work, particularly the nutritional relevance component, does come close. In developing countries, infectious diseases such as diarrhoeal diseases and respiratory infections are the main nutrition-related health problems due to unhealthy home environments (Pangaribowo et al., 2013).

Healthy eating throughout life ensures good nutrition and a long life. Indeed, there is a relationship between what people eat and their health. However, most people choose foods for reasons other than their nutritional value. Because food choices are an integral part of people's lifestyles, it is sometimes difficult for them to change their eating habits. Factors that influence food choices include preferences, ethnicity, values, habits, availability, health and nutrition (Nti, 2008). Eating habits, which are influenced by a number of reasons, some of which are listed above, determine the nutritional and health status of people (Krause and Mahan, 1984). Regardless of the factors that influence dietary patterns, adequate dietary intake is essential, as nutritional well-being plays an important role in promoting and maintaining health. Diet can influence the risk of developing certain chronic diseases and plays a role in preventing morbidity and mortality. In addition, the health and nutritional status of the mother, who is primarily the primary caregiver for her children, has been found to affect her ability to care for them effectively (Engel et al., 1997).

At the micro level, malnutrition manifests itself in reduced school attendance (Daniels and Adair 2004), which can lead to lower educational achievement, reduced productivity and reduced lifetime earnings (Alderman 2006). Specifically, Behrman et al. (2004) suggest that malnutrition can have intergenerational impacts as it reduces lifetime earnings by about 12%. Malnutrition, especially in children, negatively affects the formation of various tissues and organs, which interferes with natural biological processes and can have detrimental consequences on the physiological wellbeing of children (Osei, & Lambon-Quayefio, 2021). According to Grantham-McGregor (1999) and Martins et al. (2011), stunting associated with malnutrition can lead to poor mental development and learning outcomes as well as behavioural abnormalities.

2.2. Adaptability

After presenting the definition and the conceptual approach, the literature presents the indicators for measuring adaptive capacity.

2.2.1. Definition and conceptual approach to adaptive capacity

The term adaptive capacity has its roots in the management and sociology of organisations and businesses where it was linked to the ability of organisations to respond to change in their environment (Engle, 2011). Despite the many differences in the field of interpretation (including environment and food security), the concept of adaptive capacity is considered important for facilitating adaptation by both reducing vulnerability and building resilience (Issahaku, D., 2019). In recent decades, research on climate change adaptation has attracted considerable interest, resulting in dominant paradigms of vulnerability and resilience frameworks for climate change adaptation studies (Engle, 2011). Several definitions of adaptive capacity have been cited in the literature. This may be due to the variety of contexts in which the term is applied. Some definitions are context-specific. For example, adaptive capacity can be defined as the institutions, capacities and resources to undertake adaptive actions. This definition is applicable at the national and international levels (Kuriakose, Bizkova, & Bachofen, 2009). Another literature considers adaptive capacity in assessing the inherent characteristics of institutions. Thus, adaptive capacity is seen as the "characteristics of institutions that empower social actors to respond to short- and long-term impacts either through planned measures or by enabling and encouraging creative responses from society both ex ante and ex post". (Gupta et al., 2010). The adaptive response thus varies according to prevailing ecological and socio-economic conditions: this may include local agro-ecology, education levels, gender, income, availability of support systems and services (Deressa et al., 2008). These and other capabilities play a key role in determining how well individuals and communities are able to cope with climate impacts and maintain the functioning of their socio-economic systems (Robeyns, 2005).

Although abundant in the economic literature on climate change analysis, the concept of adaptive capacity is also, but very little, present in the literature on food security. Yet food insecurity, exacerbated by climate hazards, leads to reduced income-earning opportunities, progressive erosion of the household asset base and chronic poverty. The loss of human capital leads to changes in household morphology, including higher dependency ratios and an increased proportion of households headed by women and children. Disaster-affected

households that have experienced changes in family structure and those that have been forced to sell their assets are more vulnerable to risk (Doocy et al., 2005). Adaptive capacity is therefore another important dimension of resilience to food insecurity, measuring the ability of the household to adapt and respond to shocks (Alinovi et al., 2010). It is therefore the ability of a household to adapt to a new situation and develop new livelihood strategies. Having active and educated family members can, for example, mitigate the negative effects of a shock on a household (FAO, 2018). There is therefore a need to strengthen the financial and economic endowments and capacities of vulnerable populations to enable the most exposed groups to withstand both chronic diseases and sudden shocks to food and social security. Indeed, during and after natural disasters, households frequently modify their behaviour through coping mechanisms that aim to avoid liability and/or reduce risk. Adaptive capacity refers to the ability of the individual or household to cope with risks and thus build resilience (Doocy et al, 2005).

2.2.2. Adaptive Capacity Assessments

A multitude of factors contribute to adaptive capacity, both at the individual and household level. Similarly, several methods have been used to assess adaptive capacity. Lockwood et al. (2015) identified some of these approaches as inductive theory, secondary data assessment, self-assessment and future modelling methods. A number of these approaches have led to the development of indices, indicators and subsequently dimensions to be used to measure adaptive capacity. The dimensions of adaptive capacity vary across institutions and disciplines (Issahaku, 2019). In its Third Assessment Report, the IPCC (2001) identified economic resources, information and skills, infrastructure, technology, institutions and equity as key determinants of adaptive capacity. Adger (2003) and Pelling & High (2005), from a political economy and geography perspective, suggest that social capital, trust, organisations and the ability to act together influence adaptive capacity. Brown et al (2010) developed a community capacity self-assessment tool that uses the five capitals framework of rural livelihoods. The aim was to enable local resource users to better manage their environment. The average household education level (years); access to formal education; dependency ratio; household perception of ability to influence the quality of basic services in the community; household perception of ability to influence the decision making process in the community are all dimensions identified by FAO (2018). The variables observed and considered as determinants of household adaptive capacity by Alinovi et al, (2010) are in turn: diversity of income sources (DIV); employment ratio (EMP); average education (EDU) and food ratio (FRA). The diversity of approaches to assessing adaptive capacity and factors stems from the fact that adaptive capacity is an inherent property and can only be quantified using appropriate indicators. These indicators are sometimes context specific, making it difficult to apply a generally accepted methodology across disciplines and contexts. The choice of indicators and the methodology used to achieve them is therefore essential to obtain the validity of the measured indices (Issahaku, 2019).

This study uses Issahaku's (2019) capital approach, which considers physical capital, human capital, financial capital, social capital and access to information as factors in adaptive capacity. But we will focus on the first three types of capital mentioned above. The conceptual framework of adaptive capacity and household well-being thus illustrates the complex nature of adaptation and the potential interactions between the determinants of adaptive capacity in the context of our study.1.1. Use This Style for Level Two Headings

Use this for the paragraph in a section. Use this for the paragraph in a section. Use this for the paragraph in a section. Use this for the paragraph in a section. Use this for the paragraph in a section.

3. Methodology

3.1. Data

The data used in our research come from a survey conducted in seven regions of Cameroon in February 2020. This is the Food Safety Management System (FSMS) survey initiated by the Ministry of Agriculture and Rural Development (MINADER) through the Programme National et Veille et de Renforcement de la Sécurité Alimentaire (PNVRSA), supported by the FAO and the WFP. This survey is intended to monitor household food security in Cameroon. It aims to improve access to information on the nutritional status of households, and to inform and support decision-making by food security actors in the implementation of various food-related projects and programmes.

The construction of the sample therefore responds to the objective of assessing the level of national food security. The sample thus constituted covered the Adamawa, East, North, North West, West and South West regions. The survey covered 34 departments in all six regions, 76 districts. In sum, the survey covered 5038 households, of which 4168 were rural and 870 urban.

Data analysis was carried out using Microsoft Excel and the Statistical Package for Social Sciences (SPSS) version 17. The means, percentages and frequencies of the socio- demographic characteristics of the households

are presented in tables. The binary logistic model with the cumulative distribution function was used. STATA software, version 14, was also used to determine the regression coefficients on household nutritional status.

3.2. Analysis method and tools

3.2.1. Analytical framework of adaptive capacity

Adaptive capacity is an inherent property that requires the use of theoretical frameworks for its assessment (Piya, 2012). Theoretical frameworks provide a set of indicators used to estimate adaptive capacity. This study uses the sustainable livelihoods approach of DFID (1999) and Ellis (2000), which considers livelihood outcomes as a function of access to or ownership of livelihood assets. A concept that emerges from Amartya Sen's (1981) rights approach. This approach proposes that households that possess a sufficient range of rights, assets or capabilities have more opportunities to choose coping strategies to deal with adversity and reduce their risks (Jakobsen, 2011; Ludi & Slater, 2008). The sustainable livelihoods framework has been shown to be applicable in analysing farmers' ability to adapt sustainable agricultural practices in Australia (Nelson et al., 2010). The sustainable livelihoods framework is used to contextualise the complex nature of household livelihoods and identifies five capitals that constitute an individual or systemic asset in the face of climatic adversity: physical, social, financial, human and informational. Physical, financial and human assets are used in the formulation of the variables for this study. The indicators are presented in Table 1.1 with the different annotations they have been subject to. Social and informational capital are not exclusively included in this study due to their absence in the database used.

Early studies on adaptive capacity assigned equal weight to all indicators (Nelson et al., 2005; Vincent, 2004), while some recent studies assign weight to various indices using expert opinion or other mathematical means such as principal component analysis (Abdul-Razak & Kruse, 2017; Defiesta & Rapera, 2014; Piya, 2012). As adaptive capacity is context specific, the study argues that the use of expert opinion in its assessment is invaluable.

Table 1. Adaptive capacity indicators and variables

Indicators	Modalities	Units
Human capital	Level of education of the head of the household	Ordinal value
	Agricultural training and experience	Ordinal value
Physical capital	Access to arable land	Ordinal value
	Cultivated area	Ordinal value
	Agricultural equipment	Ordinal value
Financial capital	Funds and support from family members	Ordinal value
	Access to credit	Ordinal value
	Income diversification	Ordinal value

Source: Authors

3.2.2- Analytical framework of household nutritional status

Food adequacy is not the only necessary and sufficient condition for good nutrition. There are a number of non-food factors that also influence child and household nutritional outcomes (Tiwari et al., 2013). Thus, it can be noted that nutritional status includes indicators that describe the current situation of the household (child nutrition), but also the capacity of the household to improve this nutritional status in the short term (health) and in the medium or long term (education) (http://www.fao.org/3/y5773f/y5773f05, accessed 04/03/2021).

The household nutritional status framework is used to contextualise the complex nature of household food security. It identifies several indicators, the seven best known of which are: child undernutrition, micronutrient deficiency, adult overnutrition, mortality, education, health and productivity. For this study, we use micronutrient deficiency, education and health to assess and analyse the nutritional status of households in Cameroon. These indicators in our study are presented in Table 1.2 along with the different annotations that were made to them. As the other indicators are missing from the database, their use in this research is simply not possible.

Table 2. Indicators and variables of nutritional status

Indicators	**Modalities**	**Units**
Education	All children aged 6-14 in a household are in school	Ordinal value
Health	No chronic illness in the household	Ordinal value
Micronutrient deficiency	Inadequate or inappropriate feeding of children aged 6-23 months	Ordinal value

Source: Authors

3.2.3. Analytical model for logit analysis

The relationship between household coping capacity and nutritional status was modelled using the binary logistic distribution function. Three dependent variables were identified in this model: education, health and nutrient deficiency of children aged 6-23 months. Access to education for children aged 6-14 years in the household, the presence of chronic diseases and the difficulty (lack of food, inappropriate food or lack of means for preparation) of feeding children aged 6-23 months are considered as binary outcomes. The predictor variables are socio-demographic characteristics and indicators of coping skills. The model variables are provided by the conceptual framework of the study.

Table 3. Variables in the logit model

Variables	Measure
Variables dependent on nutritional status	
Education	1=All children aged 6-14 in the household are in school; 0=None
Health	1=There is no chronic disease in the household; 0=No
Nutrition for children aged 6 to 23 months	1=Children's diet is sufficient and appropriate; 0=No
Independent variables	
Age (AGE)	Continuous values
Sex (SEX)	1=Male; 0=Female
Household status (EMS)	1=Permanent resident; 0=No
Household size (MSE)	Continuous values
Education level of the head of household (NED)	1=At least secondary level; 0=No
Agricultural Training and Experience (ATE)	1=Training; 0=No
Agricultural production equipment (EQP)	1=Yes; 0=No
Cultivated area (SUC)	1=More than 2ha; 0=No
Women landowners (FPF)	1=Yes; 0=No
Source of credit (SCR)	1=Formal source; 0=No
Aid (AID)	1=Assistance from at least 2 people; 0=No
Diversity of income sources (DSR)	1=Yes; 0=No

Source: Authors

Both probit and logit models are applicable in situations where the estimated probability of occurrence of a particular outcome lies between 0 and 1 when the value of the explanatory variables changes; and the relationship between the probability values and the explanatory values is not linear. We consider Y as the variable to be predicted (explained variable), and X = (X1, X2... XJ) the predictor variables (explanatory variables). We chose binary logistic regression in reference to the work of Issahaku (2019). Y represents the value of the dichotomous dependent variable taking either the value 0 to present absence, failure, "no" or in this case, an unsatisfactory nutritional state; or the value 1 to present contrary presence, success, "yes" or in this particular case, an adequate nutritional state. X represents the values of the different predictive attributes for each participant or household, which may have discrete or continuous values.

If there are several predictors, the logistic regression equation is represented as follows:

$Y = \beta\ 0 + \beta\ 1X1 + \beta 2\ X2 + \beta\ 3X3 + ... + \beta j\ X\ j + \varepsilon_i$, with j = 1, ..., n (Standard formula).

This linear equation is translated into a logarithmic expression in the logistic regression analysis. In other words, instead of predicting a Y-score, logistic regression predicts the probability of obtaining a certain target value (1 or 0) on Y.

Given the predictor variables provided in Table 3, the logit models empirically indicate that their effect on the outcome variable is given as follows

$Yi = \beta_0 + \beta_1 AGE + \beta_2 SEX + \beta_3 SME + \beta_4 TME + \beta_5 NED + \beta_6 FAE + \beta_7 EQP + \beta_8 SUC + \beta_9 SCR + \beta_{10} AID + \beta_{11} DSR + e_i$

Where

β_0 = the intercept;

β_i = the regression coefficients to be estimated;

e_i = the error term;

A positive logit indicates that as the value of the predictor increases by one unit, the probability of the outcome also increases. A negative logit indicates that as the value of the predictor increases by one, the probability of the outcome decreases.

4. Results

4.1- Descriptive statistics

4.1.1. Socio-demographic characteristics

In our sample of the Cameroonian population, there were more male respondents (75.24%) than female (24.75%). The majority of the respondents were between the ages of thirty-one and fifty, representing 51.88% of the total number of respondents. However, 32.69% of the respondents were between fifty-one and seventy years of age, while those between fifteen and thirty years of age represented 11.15% and the oldest respondents, i.e. those over seventy years of age, constituted 4.26%. It should be noted that the vast majority of respondents, i.e. 85.94%, are permanent residents who have not moved in the three years preceding the survey. Families displaced here represent 12.34% and refugees 1.23% of respondents. Household size reveals that 46.01% of households are made up of five members or less, while those with between six and ten individuals are about 40.53% compared to 13.45% for households with more than ten people.

4.1.2. Household human capital

It can be seen that a good fraction of heads of household have only received a primary level of education (30.90%), although those with secondary education (27.33%) are also in considerable proportion. It should be noted that 6.7% of heads of household have a higher level of education, while the number of literate heads of household and those with no education are 14.23% and 14.47% respectively. On the other hand, the majority of respondents have no agricultural training (52.46%). Many of them responded that they received their agricultural training on the job (30.09%). A few, however, had received occasional training during seminars and workshops (14.19%). Only 1.29% of the respondents were trained in an agricultural school and there were also agricultural engineers (0.51%) and agricultural technicians (1.44%).

4.1.3. Household physical capital

A large majority of households (89.3%) reported that they do not own any agricultural production assets. About a quarter of the households (24.49%) have no hectare of cultivated land, while 35.43% cultivate less than one hectare. In addition, 24.03% of the households surveyed cultivate between one and two hectares, while 8.23% cultivate between two and three hectares of agricultural land. However, 3.27% of households cultivate between three and four hectares and the rest have at least four to five hectares. Very few households (19.80%) have women as landowners.

4.1.4. Household financial capital

The main sources of credit in the study area are community savings and credit associations and relatives and friends. More than half of the households (64.80%) reported accessing credit through other sources, which include neighbourhood shopkeepers and traders. In addition, a large proportion of households (15.5%) obtain credit from relatives and friends, while 10.5% have access to credit from tontines. Only 4.2% have access to bank and similar credits. More than a third of households (35.6%) reported receiving remittances from family members, relatives and aid organisations.

The main livelihood diversification activities of the surveyed communities are agriculture and trade. The majority (85.41%) of the households have only one source of income from their main activities, while 14.58% have several sources of income.

4.2. Relationship between household adaptive capacity and household nutritional status: the regression model

The nutritional status of households is captured here firstly by education, which refers to the presence within the household of children aged 6 to 14 who are not in school. This variable shows that human capital formation is a positive factor in long-term nutrition. Then, the other dimension is health captured by the presence within the family of members suffering from chronic diseases. Poor health is considered in the literature as a reduction in

the individual's productive capacity. Finally, the dimension of children from 6 to 23 months of age is captured here by an insufficiency of the nutrients necessary for the growth of these children. This shows that many families have difficulties in ensuring a healthy diet in quality and quantity for this group of children.

The relationship between adaptive capacity and nutritional status of households was assessed using the logit model with the cumulative distribution function. Table 5 shows the logit analysis for assessing the relationship between adaptive capacity and nutritional status for all households in our population. However, for the sake of precision and consistency, we felt it was important to disaggregate the explained variables between rural and urban households, hence the results presented in **Table 5**.

Table 4. Regression on the overall population

VARIABLES	**Education**	**Health**	**Nutrition**
Age (AGE)	-0.00435	-0.0444***	0.00629
	(0.00358)	(0.00372)	(0.00391)
Sex (SEX)	0.219**	0.168	0.213*
	(0.103)	(0.109)	(0.112)
Household status (EMS)	1.137***	0.279**	0.126
	(0.110)	(0.131)	(0.128)
Household size (MSE)	-0.00802	-0.0342***	-0.00528
	(0.0114)	(0.00956)	(0.0107)
Education level of the head of household (NED)	0.597***	-0.00632	0.282***
	(0.102)	(0.103)	(0.0989)
Agricultural Training and Experience (ATE)	1.128***	-0.198	0.171
	(0.432)	(0.240)	(0.255)
Agricultural production equipment (EQP)	-0.141	0.0406	1.187***
	(0.135)	(0.151)	(0.175)
Cultivated area (SUC)	0.172	-0.231*	-0.210*
	(0.122)	(0.118)	(0.119)
Women landowners (FPF)	-0.0627	-0.332***	-0.133
	(0.108)	(0.107)	(0.113)
Source of credit (SCR)	-0.179	-0.401***	-0.146
	(0.117)	(0.112)	(0.126)
Aid (IDA)	-0.224*	-0.781***	-0.395***
	(0.116)	(0.108)	(0.127)
Diversity of income sources (DSR)	-0.0956	0.118	-0.0438
	(0.0994)	(0.101)	(0.0991)
Constant	0.519***	4.320***	0.425*
	(0.199)	(0.235)	(0.218)
Comments	3,671	5,038	2,730
	(0.116)	(0.108)	(0.127)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors based on FSMS 2020 data and Stata 14 software

The significance of the predictors in the results of the non-specific model (i.e. with non- disaggregated variables) is similar to that of the disaggregated model. The latter model can therefore be referred to as it provides more detail in the study. The results show that not all variables are significant predictors to the same degree of the different dimensions of household nutritional status. For example, age, gender, agricultural education and area cultivated in rural households are significant predictors of the education dimension of nutritional status, while household status and education level of the household head are significant for both urban and rural households in the education dimension. The source of household credit was found to be inversely related to education in the urban area. Age, household size, women's land ownership, source of credit and aid are significant predictors and inversely related to the health dimension for both urban and rural households. However, household status and diversity of income sources significantly favour the health of rural households. The possession of equipment favours child nutrition in both types of household. This child nutrition is reinforced in the urban area by the status of the household and in the rural area by the gender and level of education of the head of household.

Table 6. Population regression with disaggregated data

VARIABLES	Education		Health		Nutrition	
	Urban	Rural	Urban	Rural	Urban	Rural
AGE	0.0125	-0.00662*	-0.0717***	-0.0419***	0.0300**	0.00289
	(0.0128)	(0.00375)	(0.0132)	(0.00388)	(0.0120)	(0.00417)
SEX	0.00852	0.273**	0.314	0.188	0.174	0.238**
	(0.393)	(0.108)	(0.311)	(0.117)	(0.308)	(0.121)
SME	1.958***	0.996***	0.0449	0.253*	1.255***	0.00173
	(0.405)	(0.115)	(0.488)	(0.135)	(0.470)	(0.135)
TME	-0.0125	-0.0118	-0.0752***	-0.0332***	0.0571	-0.0135
	(0.0450)	(0.0115)	(0.0273)	(0.0101)	(0.0352)	(0.0110)
NED	0.683*	0.501***	-0.154	-0.0521	-0.287	0.342***
	(0.353)	(0.108)	(0.301)	(0.112)	(0.269)	(0.111)
FAE	-	0.767*	0.279	-0.435	0.877	-0.0163
		(0.444)	(0.517)	(0.276)	(0.563)	(0.292)
EQP	0.217	-0.130	-0.206	0.0668	1.199**	1.205***
	(0.681)	(0.139)	(0.457)	(0.161)	(0.567)	(0.185)
SUC	-	0.240*	0.969	-0.250**	-0.797	-0.111
		(0.124)	(0.618)	(0.121)	(0.490)	(0.125)
FPF	0.136	-0.0415	-0.720**	-0.270**	0.110	-0.153
	(0.590)	(0.111)	(0.338)	(0.113)	(0.381)	(0.120)
SCR	-1.067***	-0.129	-0.619**	-0.383***	-0.259	-0.121
	(0.374)	(0.127)	(0.277)	(0.123)	(0.294)	(0.143)
AID	-0.157	-0.159	-0.757**	-0.768***	0.108	-0.412***
	(0.472)	(0.121)	(0.364)	(0.114)	(0.426)	(0.135)
DSR	-0.639	0.0255	-0.346	0.230**	-0.678**	0.0617
	(0.396)	(0.104)	(0.320)	(0.107)	(0.305)	(0.107)
Constant	0.796	0.486**	7.136***	4.025***	-1.098	0.569**
	(0.733)	(0.210)	(0.830)	(0.246)	(0.789)	(0.232)
Comments	566	3,002	870	4,168	439	2,291

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors based on FSMS 2020 data and Stata 14 software.

5. Discussion

Undernutrition remains a major problem in sub-Saharan Africa, including Cameroon. In fact, a number of studies have examined the nutritional status and food intake of children and adults in several countries. While many of these studies have reported inadequate nutritional intake and low food security of people for these countries, it is also important to recognise that the context of economic and social factors that are associated with nutritional status, and the way in which these relationships are presented, change over time (Hoffman et al., 2017).

5.1. Household human capital assessment

Human capital was indicated using the level of education of the household head and the agricultural training of the household head. Less than 35% of household heads have at least secondary education. However, the level of education of the head of household is positively and significantly related to the nutritional status in terms of education and nutrition of children aged 6-23 months in rural households. Furthermore, agricultural training is positively associated with education as a dimension of household nutritional status. These results are consistent with those reported by Issahaku, D. (2019) that school enrolment, agricultural training and experience in agricultural production are factors that enhance human capital and raise household nutritional status in Ghana. Moreover, Waswa et al (2015) showed that a programme involving an educational intervention increased dietary diversity in a sample of 207 households in Bondo and Teso South sub-counties in Kenya.

5.2. Household physical capital

Physical capital for this study was indicated by the ownership of agricultural production equipment, the area under cultivation and the ownership of land titles by women. The results of the study indicate that the majority (89.3%) of households do not own agricultural equipment adequate for satisfactory production. However, this equipment is positively and very significantly related to child nutritional status, both in urban and rural areas. More than 80% of households do not have more than 2 ha of cultivated land. However, the positive link between cultivated area and education could be that a large area leads to large production. This production is a source of income to ensure the education of everyone in the household. Conversely, the negative link with health implies that large areas require more work and health is likely to deteriorate. Women's land ownership is negatively related to health, probably for the reason given about the area cultivated in relation to the health dimension of household nutritional status. This is corroborated by Issahaku, D. (2019) who notes that agricultural equipment strengthens the nutritional status of households thanks to the weight it has in the constitution of physical capital which contributes to the adaptive capacities of households. However, these results are in contrast to other studies. Indeed, with regard to maternal autonomy, the more independent a mother is in making decisions about health care, education, food, and having an independent source of income, the more likely her children are to be properly nourished (Ziaei et al. 2015). Land use, described as the sum of all agricultural land cultivated by a household, indicates the productive capacity of the household. However, efficient production would require smaller farm sizes to facilitate maximum resource utilisation. A large farm combined with efficient production could greatly improve household income generation and asset building, which would facilitate adaptation to climate change and variability.

5.3. Household financial capital

In this study, financial capital was indicated by access to credit, aid and the number of income sources. The study found that only 35.6 per cent of households reported receiving remittances from a family member or relative. The study also revealed that more than half of the households (64.8%) reported accessing credit from sources such as shopkeepers and traders in the neighbourhood. Only 15.5%, 10.5% and 4.2% of households used relatives/friends, tontine and banks respectively. We also note that 85.4% of households do not manage to diversify their sources of income. For those households that do, the main secondary source of income is trade. Yet access to credit and aid is negatively related to child health and nutritional status. One might think that non-regularity, dependence and difficulty of repayment are factors that justify a negative impact on the nutritional status of the management. These results are in contrast to the work of Tetteh Anang et al (2015) who show that credit from all sources, formal and informal, contributes to improving the adaptive capacity and nutritional status of populations. The role of informal credit sources in facilitating adaptation may therefore require further investigation. In addition, households in the study area consider relatives and friends to be a reliable source of credit, available to the majority, as financial institutions such as banks are the main source of credit for only 4.2% of all households.

Nabwera et al. in 2017 reported that intensive health and nutrition interventions have reduced the prevalence of undernutrition by 50% in The Gambia, but that more comprehensive and sustained programs are needed to have a more significant and lasting impact on children's health. The adult and household surveys illustrate that many households are food insecure and reveal relationships between the nutritional status of individuals and various

non-food factors. In addition to the factors analysed in this study, many other socio-demographic factors may explain the results presented, including age, gender, status and household size.

Thus, in our study, the results reveal that the age of the head of household is a factor negatively related to the nutritional status of the household in terms of health and education. Male heads of households bring a significant improvement in household nutritional status. The fact that a household has a stable or permanent status favours its nutritional status compared to those who are displaced or refugees. Households with many members are likely to have a poor nutritional status. These results are consistent with several other studies that present the involvement of socio-demographic factors in improving the nutritional status of individuals and households (Kosaka & Umezaki, 2017).

6. Conclusion and recommendations

The study assessed and analysed the contribution of resilience in terms of adaptive capacity to the nutritional status of households in Cameroon. Adaptive capacity is understood here in terms of human, physical and financial capital, while nutritional status is understood in terms of education, health and child nutrition. The data used in our work comes from the FSMS 2020 survey of MINADER, WFP and FAO. With reference to the literature, we used statistical analysis and regression by a logit model to obtain the results necessary for the analysis.

Overall, the nutritional status of households declines as the age of the head of household and the size of the household increases. Also, the fact that a household has access to credit, aid and diversity of financial sources or land ownership for women does not contribute to improving the nutritional status of the household. This result highlights the relevance of the credit and aid that households receive, which is sometimes for the consumption of goods and services. However, permanent residence status, the level of education of the head of the household and all other training that contributes to the strengthening of human capital are variables that contribute to the improvement of the nutritional status of the household. Physical capital improves child nutrition and education.

The main hypothesis of this chapter assumes that there are factors of adaptive capacity that improve household food security in terms of nutritional status. This hypothesis is therefore validated. Indeed, the results show that adaptive capacity factors such as agricultural training, level of education and ownership of agricultural production equipment contribute positively to the construction of household food security levels. However, it should be noted that other factors such as aid and credit for consumption are likely to have a negative impact on household food security.

In sum, as Cameroon is marked by the presence of several crises of various kinds that have a definite impact on the standard of living of the population, particularly on their food security, it is appropriate for the public authorities to adapt and readjust food security policies. Indeed, several international organisations and experts agree that it is preferable to strengthen the resilience of households rather than to provide them with financial and material resources in order to enable them to maintain a desirable standard of living in the face of shocks. Thus, in order to ensure a sustained nutritional status, this study recommends capacity building in terms of training to improve the human capital of each household. It is therefore a question of multiplying and diversifying the training courses that offer the tools and techniques needed to increase production. In addition, the government should place special emphasis on strengthening people's livelihoods. The government should therefore mobilise more resources both internally and through technical and financial partners to finance the various activities related to this household livelihoods plan. Similarly, it should seize this opportunity to address more seriously the weaknesses of Cameroon's agricultural sector, namely: i) low productivity; ii) insufficient conservation and storage infrastructure; iii) opening up production basins and access to the market for agricultural products; iv) adopting climate-smart agriculture; and v) formulating a resilience programme in partnership with all food security stakeholders.

References

Abdul-Razak, M., & Kruse, S. (2017). The adaptive capacity of smallholder farmers to climate change in the Northern Region of Ghana. *Climate Risk Management*, *17*, 104–122. https://doi.org/10.1016/j.crm.2017.06.001

Adger, W. N. (2003). Social Capital, Collective Action, and Adaptation to Climate Change. *Economic Geography*, *79*(4), 387.

Alderman, H. 2006. Long-Term Consequences of Early Childhood Malnutrition. *Oxford Economic Papers* 58 (3): 450–474.

Alinovi, L., D'Errico, M., Mane, E., and D. Romano. (2010). *Livelihoods strategies and household resilience to food insecurity: an empirical analysis to Kenya*. Paper prepared for the Conference on "Promoting Resilience through Social Protection in Sub-Saharan Africa", organised by the European Report of Development in Dakar, Senegal.

Behrman, J., H. Alderman, and J. Hoddinott. 2004. Hunger and Malnutrition. In *Global Crises, Global Solutions*, ed. B. Lomborg. Cambridge: Cambridge University Press.

Bergstrand, J. H. (1985). The Gravity equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *Review of Economics and Statistics*, *9(1)*, 91-101.

Brown, P.., N. R. . J. B. . et al, & Brown . Nelson, R,. Jacobs,B,. et al, P. R. (2010). Enabling natural resource manager to self-assess their adaptive capacity. *Agicultural Systems*, *103*(May), 562–568.

CFS, 2012. Coming to Terms with Food Security, Nutrition Security, Food Security and Nutrition, Food and Nutrition Security, Available at: http://www.fao.org/docrep/meeting/026/MD776E.pdf

Daniels, M., and L. Adair. 2004. Growth in Young Filipino Children Predicts Schooling Trajectories Through High School. *The Journal of Nutrition* 134 (6): 1439–1446.

Defiesta, G., & Rapera, C. L. (2014). Measuring Adaptive Capacity of Farmers to Climate Change and Variability: Application of a Composite Index to an Agricultural Community in the Philippines. *Journal of Environmental Science and Management*, *17*(2), 48–62.

Deressa, T., Hassan, R. M., & Ringler, C. (2008). Measuring Ethiopian farmers' vulnerability to climate change across regional states. *Food Policy*, *806*(October), 32. Retrieved from http://www.ifpri.org/publication/measuring-ethiopian-farmers-vulnerability-climate-change-across-regional-states

DFID. (1999). Sustainable Livelihoods Guidance Sheets. London, UK: Department for International Development.

Doocy, S., Teferra, S., Norell, D., & Burnham, G. (2005). Credit program outcomes: coping capacity and nutritional status in the food insecure context of Ethiopia. *Social science & medicine*, *60*(10), 2371-2382.

Ellis, F. (2000). *2000. Rural livelihoods and diversity in developing countries.* Oxford, UK.: Oxford University Press.

Engle PL, Menon P & Haddad L (1997). Care and nutrition: Concepts and measurements. FCND Discussion Paper No. 18, IFPRI, Washington, D.C. USA

Engle, N. L. (2011). Adaptive capacity and its assessment. *Global Environnemental Change*, *21*(2), 647–656. https://doi.org/10.1016/j.gloenvcha.2011.01.019

FAO (2016). La situation mondiale de l'alimentation et de l'agriculture. Changement climatique, agriculture et sécurité alimentaire. Organisation des Nations Unies pour l'alimentation et l'agriculture. Rome, Italie.

FAO (2018). *Analyse de la résilience en Mauritanie*. Rome. 60 pp. License: CC BY-NC-SA 3.0 IGO.

Frankenberger, T. R., Oshaug, A., and Smith, L. C., 1997. *A definition of nutrition security*. CARE Mimeo.

Grantham-McGregor, S., and S. Walker. 1998. *Health and Nutritional Determinants of School Failure, Nutrition, Health and Child Development Research Advances and Policy Recommendations*. Washington, DC: PAN American Health Organization.

Gupta Termeer, C., Klostermann, J., Meijerink, S., Brink, M. V., Jong, P., J. (2010). The Adaptive Capacity Wheel: A method to assess the inherent characteristic of institutions to enable the adaptive sapacity of Society. *Environmental Science and Policy*, 459–471

Headey, D., and Ecker, O., 2012. Improving the Measurement of Food Security, IFPRI Discussion Paper 01225, International Food Policy Research Institute, Washington, D. C.

Hoffman, D., Cacciola, T., Barrios, P., & Simon, J. (2017). Temporal changes and determinants of childhood nutritional status in Kenya and Zambia. *Journal of health, population and nutrition*, *36*(1), 1-13.

Issahaku, D. (2019). *Exploring the Link between Adaptive Capacity and Nutritional Needs of Low-Income Households in Karaga District of the Northern Region of Ghana* (Doctoral dissertation, University of Ghana).

Jakobsen, K. (2011). Using a livelihood asset-based approach for measuring risk-management abilities and adaptation policy targeting. *A Paper Presented at the ICARUS II Conference, May 5-8, 2011 at University of Michigan, USA, Retrieved January 22, 2012*.

Kosaka, S., & Umezaki, M. (2017). A systematic review of the prevalence and predictors of the double burden of malnutrition within households. *British Journal of Nutrition*, *117*(8), 1118-1127.

Kuriakose, A., Bizkova, L., & Bachofen, C. (2009). Assessing Vulnerability and Adaptive Capacity to Climate Risks.

Lockwood, M., Raymond, C. M., Oczkowski, E., & Morrison, M. (2015). Measuring the dimensions of adaptive capacity: A psychometric approach. *Ecology and Society*, *20*(1). https://doi.org/10.5751/ES-07203-200137

Ludi, E., & Slater, R. (2008). The poverty-wellbeing platform Using the Sustainable Livelihoods Framework to understand and tackle poverty. *Briefing Note for the Poverty–Wellbeing Platform*.

Martins, V., et al. 2011. Long-Lasting Effects of Undernutrition. *International Journal of Environmental Research and Public Health* 8 (6): 1817–1846.

MINADER et al., 2020, *Analyse cadre harmonisé « Identification des zones à risque et des populations en insécurité alimentaire et nutritionnelle »*. Yaoundé, Cameroun.

Nabwera, H. M., Fulford, A. J., Moore, S. E., & Prentice, A. M. (2017). Growth faltering in rural Gambian children after four decades of interventions: a retrospective cohort study. *The Lancet Global Health*, *5*(2), e208-e216.

Nelson, R., Kokic, P., Crimp, S., Meinke, H., & Howden, S. M. (2010). The vulnerability of Australian rural communities to climate variability and change: Part I- Conceptualising and measuring vulnerability. *Environmental Science and Policy*, *13*(1), 8–17. https://doi.org/10.1016/j.envsci.2009.09.006

Nelson, R., Kokic, P., Elliston, L., & Jo-Anne, K. (2005). Structural Adjustment: A Vulnerability Index for Australian Broadacre Agriculture. *Australian Commodities: Forecasts and Issues*, *12*(1), 171–179.

Nti, C. A. (2008). Household dietary practices and family nutritional status in rural Ghana. *Nutrition research and practice*, *2*(1), 35.

Osei, R. D., & Lambon-Quayefio, M. P. (2021) Effects of Long-Term Malnutrition on Education Outcomes in Ghana: Evidence from a Panel Study. *The European Journal of Development Research*, 1-21.

Pangaribowo, E. H.; Gerber, N.; Torero, M. (2013) : Food and nutrition security indicators: A review, ZEF Working Paper Series, No. 108, University of Bonn, Center for Development Research (ZEF), Bonn

Pelling, M., & High, C. (2005). Understanding adaptation: What can social capital offer assessments of adaptive capacity? *Global Environmental Change*, *15*(4), 308–319. https://doi.org/10.1016/j.gloenvcha.2005.02.001

Piya, L. of A. C. and A. P. in R. to C. C. and E. among the C. H. in R. M.-H. of N. (2012). Comparison of Adaptive Capacity and Adaptation Practices in Response to Climate Change and Extremes among the Chepang Households in Rural Mid-Hills of Nepal. *International Association of Agricultural Economists (IAAE) Triennial Conference*, *18*(4), 18–24.

Robeyns, I. (2005). The capability approach: a theoretical survey. *Journal of human development*, *6*(1), 93-117.

Tetteh Anang, B., Sipiläinen, T. A. I., Bäckman, S. T., & Kola, J. T. S. (2015). Factors influencing smallholder farmers' access to agricultural microcredit in Northern Ghana. *African Journal of Agricultural Research*.

Tiwari, S., Skoufias, E., & Sherpa, M. (2013). *Shorter, cheaper, quicker, better: Linking measures of household food security to nutritional outcomes in Bangladesh, Nepal, Pakistan, Uganda, and Tanzania*. The World Bank.

UNHCR (2005): Measuring Mortality, Nutritional Status and Food Security in Crisis Situations: THE SMART PROTOCOL Version 1. Final Draft. https://www.unhcr.org/45f6b2c42.pdf

Vincent, K. (2004). Creating an index of social vulnerability to climate change for Africa. *Tyndall Center for Climate Change Research.*, *56*(August), 41. https://doi.org/10.1016/j.gloenvcha.2011.09.018

Waswa, L. M., Jordan, I., Herrmann, J., Krawinkel, M. B., & Keding, G. B. (2015). Community-based educational intervention improved the diversity of complementary diets in western Kenya: results from a randomized controlled trial. *Public health nutrition*, *18*(18), 3406-3419.

Weingärtner, L., 2010. The Concept of Food and Nutrition Security, in K. Klennert (ed.), *Achieving Food and Nutrition Security: actions to meet the global challenge – A training course reader (3rd Edition)*, Inwent, Bonn.

Ziaei, S., Contreras, M., Blandón, E. Z., Persson, L. Å., Hjern, A., & Ekström, E. C. (2015). Women's autonomy and social support and their associations with infant and young child feeding and nutritional status: community-based survey in rural Nicaragua. *Public health nutrition*, *18*(11), 1979-1990.