International Journal of
Entrepreneurial Development, Education and Science Research
p-ISSN: 2360-901X | e-ISSN: 2360-9028

IJEDESR

April, 2024
Vol. 8, No. 1

Food Security, Income Per Capita and the Prevalence of Undernourishments in the Economic Community of West African States (ECOWAS)

[1]Innocent Chile Nzeh, [2]Chizoma Olivia Osuagwu, [3]Obiageli Joy Oparaojiaku, [4]Chibundu Emeka Ikechi, & [5]Uchechi Mercy Nwokorie

[1]Department of Cooperative and Rural Development,
[2,3&5]Department of Agricultural Economics,
University of Agriculture and Environmental Sciences Umuagwo, Imo State, Nigeria.
[4]Agriculture and Rural Development Department, Ohaji-Egbema Local Government Council

Article DOI:
10.48028/iiprds/ijedesr.v8.i1.11

Keywords:
Undernourishments, Food security, Per capita income, Food production index

Abstract

Undernourishment is endemic in countries where both food deficiency and low income co-exist, and this is the bane of the countries in the sub-Saran African countries. In this present study, the focus is to examine whether food security and income level reduce the prevalence of undernourishments in the ECOWAS countries. This study used annual data series that covered the period from 2012 to 2020 and under the framework of panel random effect model. Results of the study revealed that while food access and per capita income had negative and significant impact on the prevalence of undernourishments, the impact of food availability was negative but none-significant. Also, while food importation had a none-significant positive impact on the prevalence of undernourishments, the impact of food production index was negative but none-significant. Consequently, the study recommends that there is need for the governments in the ECOWAS countries to formulate policies to improve food production through incentivizing small-holder farmers. It is equally needful to address the issue of income inequality, while food importation should be limited to foods that have nutritional values and which can also be affordable.

Corresponding Author:
Innocent Chile Nzeh - ORCID: 0000-0002-3131-9036

Chizoma Olivia Osuagwu - ORCID: 0000-0002-9549-480x
Obiageli Joy Oparaojiaku - ORCID 0009-0006-5617-2364
Chibundu Emeka Ikechi - ORCID: 0009-0009-1816-0911
Uchechi Mercy Nwokorie - ORCID: 0009-0001-2897-9754

Background to the Study

The term food security was conceptualized by the FAO (2006) "as a condition, in which everyone at all times, both physically and economically, has access to sufficient, safe and nutritious food to meet their daily nutritional needs according to their preferences". The FAO noted four dimensions through food security can be viewed, namely: access, stability, utilization and availability. While the availability point of view looks at food security in terms of food supply, the access viewpoint considers food security from the angle of food price's affordability. On the opposite end, the FAO, the International Fund for Agricultural Development (IFAD) and the World Food Programme (WFP) have conceptualized food insecurity "as a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life". In recent times also, the term nutrition security has gained traction as it lays emphasis on consistent access, affordability and availability of foods and beverages that enhance people's well-being (Mozaffarian, Fleischhacker & Andrés, 2021). Limiting food security to access to food has been criticized because it does not take into cognizance the quality of food accessed and consumed (Burchi, Fanzo & Frison, 2011). The study further noted that nutritionists and scholars have criticized the use of hunger statistics to define food security as it emphasizes only caloric intake which does not take into cognizance the multi-dimensional idea of food security.

The sub-Saharan African countries have been grappling with the scourge of poverty over the years which manifests in low income, food insecurity and malnutrition. As observed by the Food and Agricultural Organization (FAO, 2010), at the global level, around 795 million people lacked access to adequate food for a healthy and active life in the year 2010. The report noted that the majority of these people live in sub-Saharan Africa. Undernourishment is one major problem faced by the sub-Saharan African countries as it affects the health and life span of the inhabitants. Hrammeh, Hamid and Rohana (2019) noted that over the past decade, the number of children suffering from malnourishment in sub-Saharan Africa has increased from 5.5 million to 30 million, giving rise to the death of over 3.5 million children under age five every year. The FAO (2009) defined undernourishment as a term that has to do with insufficient food intake to regularly achieve dietary energy requirements. In addition, the FAO defines hunger as the consumption of less than 1,600-2,000 calories per day. Malnourished people are commonly described as those who suffer under-nutrition as their diet does not contain adequate calories for growth and maintenance and micronutrients.

There is need for drastic efforts to ensure the ugly trends bedeviling the sub-Saharan African countries are put in check. Fortunately, the sustainable development goals (SDGs) developed in 2015 and which aims to end hunger by 2030 contain agenda which are crucial in addressing the problems facing the sub-region. Achieving goals 1-6 of the SDGs which include no poverty, zero hunger, good health and wellbeing, quality education, gender equality and clean water and sanitation is therefore very paramount in surmounting malnutrition and diseases. Ensuring food security in particular holds the key to reducing the menace of the prevalence of undernourishment as it has been found to

tackle hunger (Fernandes & Samputra, 2022). The central issue in addressing the challenges of food security therefore lies in the right approach to be adopted. Burchi *et al.* (2011) observed that there are limitations in the traditional and most commonly adopted food approaches to address food security which relies more on food availability. In particular, the study observed that the traditional approach focused only on agriculture and nutrition without considering other factors such as socio-economic factors. To improve nutrition and health through food security there is need to simultaneously address the socio-economic problems such as poverty (Bouis & Welch, 2020; Rouse & Davis, 2004).

In this study, the focus is to investigate the role of food security and income level in addressing the menace of the prevalence of undernourishments in the Economic Community of West African States (ECOWAS). This is justified on the grounds that without the knowledge of the roles of income and food security in addressing the prevalence of undernourishments, policies meant to tackle the menace of undernourishments may play down the effects of income level and food security in the economic bloc. Four measures of security have been identified in literature, namely: food availability, food access, food utilization and food stability. Two of these measures namely: food access and food availability were used in the study. On grounds of data availability, seven ECOWAS countries were selected, namely: Nigeria, Ghana, Senegal, Cote d'Ivoire, Benin, Mali and Sierra Leone. The focus of this paper on the ECOWAS is because, being a poor sub-region in Africa; the countries comprising it are as well food deficient as indicated by the 2023 FAO rating (see appendix I below). The short supply of food from domestic sources coupled with low income means that these countries are faced with hunger and malnutrition. The question the paper seeks to address is if income per capita and food security are able to reduce the prevalence of undernourishments in the selected ECOWAS countries. The study adopted a macro-level study which uses variables that represent the country as a whole in order to use the results to simulate policies that cover the wider economy.

Some Stylized Facts

The role of income level in achieving food security and thus enhancing nourishments can never be over-emphasized because as household income rises, their potential to obtain food rich in nutrition increases. In this study, attempt is made to split the ECOWAS countries included in the paper into income groups, namely: lower middle-income countries and low-income countries as rated by the World Bank. The essence of this is to provide a clue on the link between income disparity, undernourishments and food security. First, the study made a comparison of the GDP per capita in the countries that fall in these income groups. Starting with the trend in GDP per capita in lower middle-income countries in Table 1, evidence shows that from 2012 through 2016, Nigeria's GDP per capita was highest. However, beginning from 2017 Cote d'Ivoire's GDP per capita was highest and the country's GDP per capita remained the highest all through the sample period. The country with the least GDP per capita among the lower middle-income countries is Senegal. For low-income countries, information in Table 2 shows that

the country with the highest GDP per capita within the sample period is Benin and this was followed by Mali, except in 2020 when the GDP per capita for Sierra Leone was higher than that of Mali. It is thus noted that the GDP per capita is higher in the lower middle-income countries compared to the low-income countries.

Table 1: Trend in GDP Per Capita in Lower Middle-Income Countries in ECOWAS

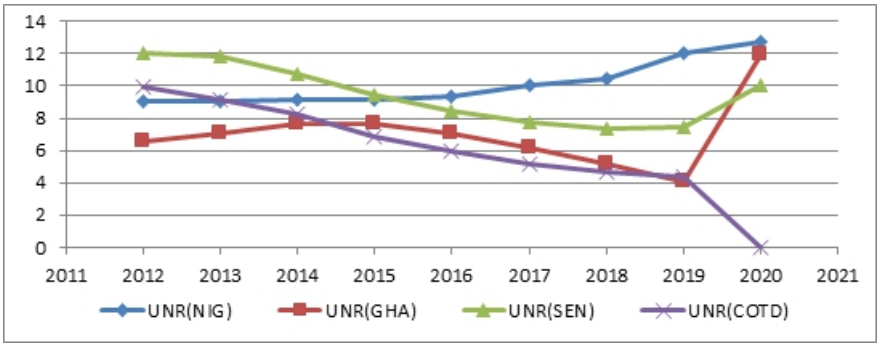
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
NIG	2728.02	2976.7	3200.9	2679.5	2144.8	1941.9	2125.8	2204.2	2074.6
GHA	1536.6	2282.4	1942.9	1711.3	1900.4	1998.7	2180.0	2167.9	2176.6
SEN	1334.7	1391.5	1417.1	1238.1	1290.8	1385.2	1484.2	1462.4	1490.2
COTD	1649.302	1903.054	2124.02	1941.566	1980.878	2076.14	2275.4	2238.8	2288.11

Table 2: Trend in GDP Per Capita in Low Income Countries of ECOWAS

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
BEN	1214.3	1251.5	1041.7	1049.8	1095.3	1194.4	1170.9	1237.9	1319.2
MAL	753.4	778.8	818.4	723.5	750.1	795.7	856.4	840.2	822.9
SRL	733.9	762.3	767.4	632.1	665.9	711.2	779.2	772.2	833.2

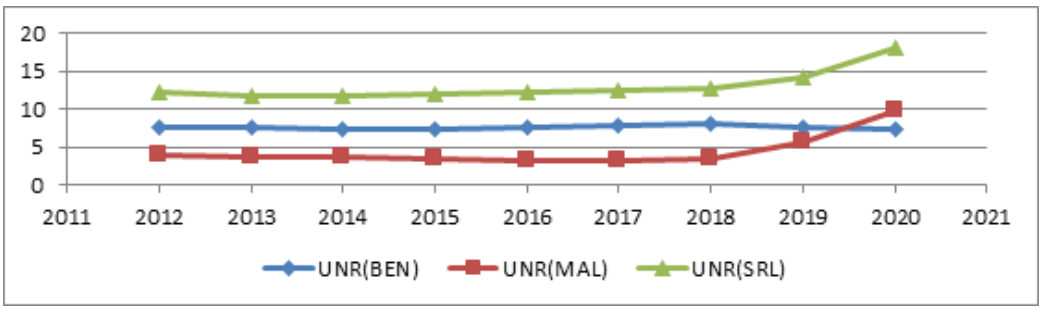
Having compared the countries on the basis of per capita income, the paper now compares them based on the prevalence of undernourishments. In Figure 2, the trend in the prevalence of undernourishments in the lower middle income countries reveal that from 2012 through 2015, the prevalence of undernourishments was highest in Senegal compared to the other countries in the income group. However, from 2016 and all through the sample period the prevalence of undernourishments became highest in Nigeria. Also, while Ghana had the least prevalence of undernourishments from 2012 through 2014, Cote d'Ivoire had the least prevalence of undernourishments from 2015 till the rest of the sample period. Judging this situation against the income level, Senegal which has the least GDP per capita is found to have the highest prevalence of undernourishments from 2012 through 2015. In another vein, Cote d'Ivoire which has the highest GDP per capita beginning from 2017 and all through the sample period has the least prevalence of undernourishments from 2015 till the end of the sample period. Also, Ghana whose GDP per capita within the period was the third highest has lower prevalence of undernourishments. However, Nigeria's case presents a curious scenario as it has the highest prevalence of undernourishments beginning from 2016 and all through the sample period notwithstanding that the country's GDP per capita was the highest from 2012 through 2016. It would not be out of place to attribute this development to high level of income inequality. In any society where income is highly skewed in favour of a few, the masses often experience abject poverty which manifests in diverse forms such as the inability to provide quality food and other basic needs.

Figure 1: Trend in the Prevalence of Undernourishment in Lower Middle-Income Countries in ECOWAS



In Figure 2, evidence shows that Sierra Leone has the highest prevalence of undernourishments throughout the sample period compared to others in the low-income countries. Of the three countries sampled that fall in this income group, Sierra Leone has the least per capita income and little wonder it has the highest prevalence of undernourishment. The country's case is a clear case of lower income been associated with malnourishments. However, Benin republic which has the highest income per capita among the group has the second highest prevalence of undernourishments while Mali with the second highest income per capita has the least prevalence of undernourishments. The manner in which income is distributed in these countries could be among the reasons for the disparity and also the nature of food consumed by the inhabitants of the countries.

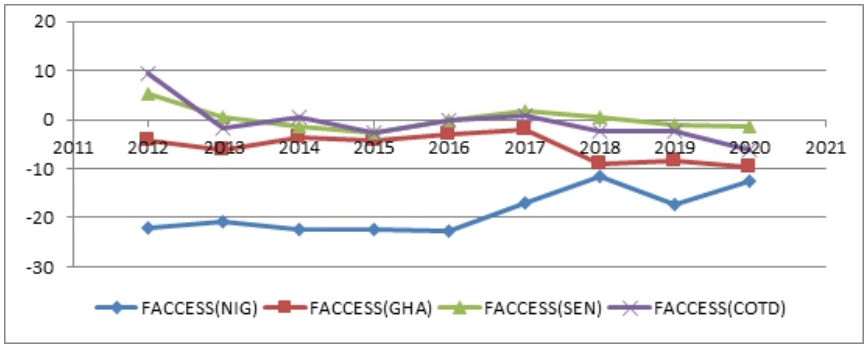
Figure 2: Trend in the Prevalence of Undernourishment in Low Income Countries in ECOWAS



Income level also determines to what extent people can afford food. This much accounts for the reason why the study examined the trend of food access in the two income groups. Beginning from the middle-income countries, evidence in Figure 3 indicates that the trend in food access is higher in Cote d'Ivoire and Senegal within the sample period. Between 2012 through 2017, the trend for Cote d'Ivoire was highest but from 2018 and throughout the sample period, the trend for Senegal was the highest. The case of Cote d'Ivoire is a clear indicator that higher income is associated with food access. However,

Senegal presented a surprising outcome as the country is rated the least in terms of income per capita as shown in Table 1. The high trend in food access in Senegal proves that beyond income level, other factors could enhance food access. The trend in food access for Nigeria is equally low despite the country having the highest income per capita compared to others in the income group. Nigeria imports a large portion of its food needs which means that food price movement is influenced by fluctuations in the exchange rate. Food production in the country is also hampered by many factors and all these conspire to reduce food access. As revealed in a study by Nzeh, Ogwuru, Okolie and Okolie (2023) food prices in Nigeria is upwardly sticky, meaning that once the prices go up, they hardly reduce.

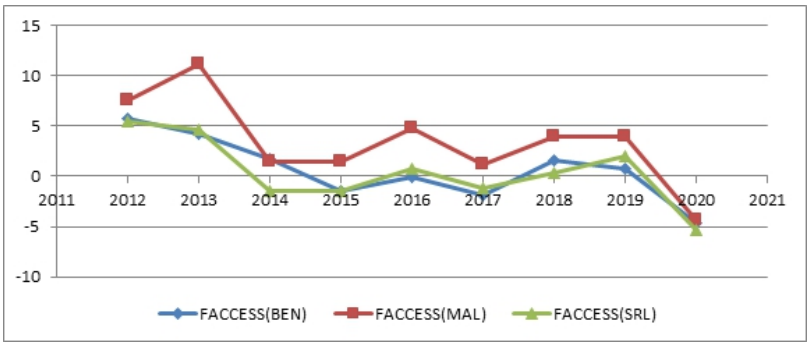
Figure 3: Trend in Food Access in Lower Middle Income Countries in ECOWAS



Note: FACCESS = food access

The trend in food access in low-income countries in Figure 4 indicates that the trend for Mali was the highest all through the sample period. Of the three countries sampled in this group, Mali is the second largest in terms of income per capita. The trend for Sierra Leone which has the least income per capita among the group is also found to be low. Surprisingly, the trend for Benin which has highest income per capita happens to be low. If this is compared to the trend in the prevalence of undernourishments in the country, one will conclude that income level play's little role in Benin republic.

Figure 4: Trend in Food ACCESS in Low Income Countries in ECOWAS



Theoretical and Conceptual Issues

In literature, the impact of food insecurity on health has found both conceptual and theoretical viewpoints. Rose (1999) was of the view that the channel through which food insecurity affects people's health is through its impact on total caloric intake, diet quality and nutritional status. Low-income individuals face food insecurity and other life necessities which are competing with one another, and these are associated with poorer access and adherence to general medical treatment the moment they become sick. Whitaker, Phillips and Orzol (2006) observed that food insecurity is linked to poor mental health conditions such as sadness, stress and anxiety and all these conditions have been found to be associated with obesity and cardiovascular risk. Finding further support in this observation, Schaible and Kaufmann (2007) contended that hunger and under-nutrition may arise when the supply of food is limited, potentially resulting in wasting, stunting and immunological deficiencies. Viewed from another perspective, Weiser *et al.* (2009) observed that food insecurity has been found to have a link with decreased antiretroviral adherence, falling physical health status and worsening of immunological status. In another vein, Laraia, Epel and Siega-Riz (2013) noted that food insecurity has negative impact on health as it results in women's disordered eating patterns. Weiser, Palar, Hatcher, Young and Frongillo (2015) observed that food insecurity impacts on the health condition of the people through the channels of nutrition. The paper further argues that the impact of food insecurity on mental health becomes worse for people who are already sick, and it can as well result in the acquisition of disease. Furthermore, it has been observed that food insecurity can aggravate the risk of severe health outcomes such as cardiovascular disease, diabetes, hypertension, chronic obstructive pulmonary disease (COPD), kidney disease and asthma (Coleman-Jensen, Rabbitt, Gregory & Singh, 2020). It has also been argued that there is a link between food insecurity and health practices which may result in poor health. When a household lacks access to food, people may be tempted to make bad decisions which may increase their risk to sickness. Such decisions could be settling for cheap food, calorically dense and nutrient-poor meals which have potential for adverse health conditions.

Empirical Literature

In recent times, research interests on food security have increased. A study in Ghana by Saaka and Osman (2013) used food security measures to examine the extent of household food insecurity and its impact on the nutritional status of children between 6 and 36 months. The result of the study indicated that the magnitude of household food insecurity depended on the food access indicator, with household food insecurity access scale (HFIAS) producing the highest household food insecurity. The study revealed that children in food secure households were highly protected from chronic malnutrition in relation to children in food insecure households. In Venezuela, Hernández and Camardiel (2021) carried out an investigation on the link between food security, socioeconomic status and dietary diversity among the students of sociology at the Central University of Venezuela. The study found that the socioeconomic status in the households of the students investigated does not have link with either their food security level or the diversity in their dietary. The study observed that the odds of a student

household having a diverse diet instead of a monotonous diet are greater compared to those in food security instead of moderate/severe food insecurity. In Australia, Lindberg, McNaughton, Abbott, Pollard, Yaroch and Livingstone (2022) investigated whether the quality of diet among Australian adults differed with respect to the food security status of their household. The study examined adherence to the 2013 Australian Dietary Guidelines using the Dietary Guidelines Index (DGI). Findings of the study revealed that adults from food-insecure households had a mean total DGI score lower than food-secure adults. Adults from households that experience food insecurity had several lower DGI component scores including dietary variety in comparison with those who were food secure. On the average, adults from food-insecure households consumed less protein as well as more carbohydrates than food-secure adults.

In a cross-country study involving Small Island Developing States (SIDS), namely Fiji, St. Vincent and the Grenadines (SVG), Bhagtani et al. (2022) examined the dietary patterns, food insecurity and their connections with socio-demographic characteristics and food sources. The study did not find the prevalence of food insecurity to be statistically different across dietary patterns. Food insecurity wasfound to be higher in the SIDS that sourced their food regularly from small shops. Another cross-country study involving sub-Saharan African (SSA) countries by Beyene (2023) investigated the impact of food insecurity on life expectancy and infant mortality. The study used a multi-country panel data analysis in addition to several estimation techniques with findings showing that the prevalence of undernourishment reduced life expectancy in the selected countries. On the other hand, rise in average dietary energy supply improved life expectancy. Some studies have also investigated the link between food production and life expectancy. Golkhandan (2019) revealed that food production index improved life expectancy in Iran. Other factors that contributed to improvement in life expectancy include per capita public health expenditure and urbanization. In Turkey, Gulcan (2020) found food production index to improve life expectancy, while the impact of urbanization and GDP per capita was negative. In Nigeria, while Aigheyisi (2020**)** found agricultural productivity to improve life expectancy, finding by Agu, Agu and Onwuteaka (2020) reveal that food poverty reduced life expectancy. The positive impact of food production on life expectancy also found support in the study by Nzeh (2023) for low-income food-deficit African countries.

Methodology

The analysis of this study began with some preliminary examination of the behaviour of the variables included in the model. The first preliminary test is the descriptive statistics. Descriptive statistics is paramount to identify the behavior of the variables in the model. Under it, information concerning the variables with regard to the mean, median, standard deviation, maximum, minimum, kurtosis, skewness and normality (using the Jacque Bera statistics) can be known. The paper also conducted a test to ascertain the order of integration of the variables included in the model. Time series data in most cases move in similar direction and there are chances that one can obtain meaningless results if the variables are not tested for stationarity (unit root). Three panel unit root tests were

used to examine the stationarity of the variables namely: the Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS) and the augmented Dickey-Fuller-Fisher (ADF-Fisher) panel unit root tests. Having identified the order of integration of the variables, the paper conducted a cointegration test to ascertain the long-run relationship among the variables. The panel Kao cointegration test was used to examine the existence of cointegration among the variables. The impact of the selected food security variables and other relevant variables on the prevalence of undernourishments was thereafter conducted using the panel random effect model. The choice of panel random effect model was arrived at after conducting the Hauseman test.

Model Specification

The econometric model of the relationship between the prevalence of undernourishments and its determinants can be specified as follows:

$$PUNR_{it} = \delta_0 + \delta_1 FACCESS_{it} + \delta_3 FAV_{it} + \delta_4 FPI_{it} + \delta_5 FIMPT_{it} + \delta_6 PCI_{it} + \mu_{it} \quad (1)$$

Where:

$PUNR$ = prevalence of undernourishments, $FACCESS$ = food access, FAV = food availability, FPI = food production index, $FIMPT$ = food import, PCI = per capita income, μ = error term, δ_0 = intercept term, while the subscripts i and t represent the country and time.

Data Type and Sources

In this paper, annual data that spanned the period from 2012 to 2020 are used and Table 3 shows the variables, their measurement and data sources.

Table 3: Data Sources and Measurement

Variables	Definition	Measurement	Sources
PUNR	Prevalence of under-nourishments	Percentage of the population whose habitual food consumption is insufficient to provide the dietary energy levels that are required to maintain a normal active and healthy life	WDI
FACCESS	Food access	Physical and economic access to the basic food (Measure in percentage)	FAO
FAV	Food availability	Availability of sufficient quantities of food (Measured in percentage)	FAO
FPI	Food production index	2014-2016 as base year	WDI
FIMPT	Food import	Percentage of merchandise imports	WDI
PCI	Per capita income	Current US Dollars	WDI

Results and Interpretation

The results of the descriptive test in Table 4 show that the mean and the median of all variables are very close, indicating that the variables are symmetric. A variable is said to

be symmetric when the values of the variables appear at regular frequencies and in such case, usually the median, mean and mode all occur at the same point. It is equally found that the variable with the highest mean is per capita income with a mean of 1512.96 and a standard deviation of 653.31. Findings reveal that the mean value of food availability is higher than the mean of food access which indicates the difficulty in obtaining food in these countries owing majorly to poverty. Per capita income has the highest range compared to other variables, implying that it is more volatile within the study period. On the other hand, the variable with the least range is food affordability, indicating that it exhibited the least volatility. With respect to normality, evidence shows that the prevalence of undernourishments, food availability and per capita income with a Jarque-Bera probability greater than 5%, were all normally distributed while others were not normally distributed.

Table 4: Results of Descriptive Statistics

	PUNR	FACCESS	FAV	FIMPT	FPI	PCI
Mean	8.252	-2.896	3.626	19.497	105.98	1512.96
Median	7.800	-1.300	4.100	17.027	104.27	1391.53
Maximum	18.000	11.100	20.600	52.311	181.33	3200.95
Minimum	0.000	-22.700	-7.500	0.000	80.94	632.12
Std. Dev.	3.269	7.802	6.458	11.502	17.489	653.31
Skewness	0.124	-1.137	0.496	1.005	1.794	0.456
Kurtosis	3.226	3.948	3.191	4.254	7.942	2.315
Jarque-Bera	0.296	15.950	2.686	14.751	97.940	3.421
Probability	0.862	0.000	0.261	0.000	0.000	0.180
Sum	519.9	-182.5	228.5	1228.3	6677.2	95316.7
Sum Sq. Dev.	662.8	3774.8	2586.4	8202.3	18964.90	264

In Table 5, the results of the panel unit root reveal that under the LLC, the prevalence of undernourishments achieved stationarity at the 10% after a first difference. However, at level while food access achieved stationarity at the 10% level of significance, other variables became stationary at the 5% level of significance. Under the IPS all the variables achieved stationarity at first difference at the 5% level of significant except the prevalence of undernourishments and food affordability. Under the ADF-Fisher, all the variables achieved stationarity after first difference. In summary, all the variables were *I(0)* under the LLC, except the prevalence of undernourishments that was *I(1).* On the other hand, all the variables became *I(1)* under the ADF-Fisher.

Table 5: Results of Panel Unit Root

	LLC		IPS		ADF-FISHER	
Variable	Level	First Diff.	Level	First Diff.	Level	First Diff.
PUNR	1.20(0.88)	0.62(0.07)* *	1.99(0.97)	2.34(0.99)	6.58(0.94)	15.09(0.03) *
FACCESS	-1.49(0.06) **	-1.51(0.06)	-0.14(0.44)	-0.86(0.19)	16.13(0.30)	39.78(0.00) *
FAV	-4.32(0.00) *	-6.79(0.00)	-0.50(0.30)	-1.65(0.04) *	16.93(0.25)	24.67(0.03) *
FPI	-6.12(0.00) *	-3.79(0.00)	0.25(0.60)	-2.06(0.01)	17.22(0.24)	29.84(0.00) *
FIMPT	-1.72(0.04) *	-16.99(0.00)	-0.76(0.22)	-4.44(0.00) *	18.01(0.20)	37.84(0.00) *
PCI	-1.86(0.03) *	-7.75(0.00)	0.44(0.67)	-2.28(0.01) *	8.11(0.88)	31.62(0.00) *

Having ascertained the order of integration of the variables, the study next carried out a test for the long run relationship among the variables. The test for the long-run relationship was conducted using the Kao panel cointegration test. The Kao cointegration test is carried out under the null hypothesis that there is no long-run relationship among the variables. The result of the Kao cointegration test in Table 6 reveals that at the 5% level of significance, the study cannot accept the null as the p-value of the residual is less than the 5% level of significance. Thus, the study concludes that the variables have a long-run relationship or are cointegrated.

Table 6: Result of Kao Residual Cointegration Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.415	0.190	-2.181	0.034
D(RESID(-1))	0.493	0.233	2.110	0.040

In this study, the panel random effect model is used to examine the impact of food security and per capita income on the prevalence of undernourishments. Random effect model was selected for the study after carrying out the Hauseman test. The assumption guiding the Hausman test is that there is no correlation between the random effect and the explanatory variables. Under the null hypothesis that the random effect is uncorrelated with the explanatory variables, the random effect model is chosen against the fixed effect model. However, the random fixed effect is chosen if the null hypothesis is rejected. The result of the Hauseman test in Table 7 reveals that the p-value is greater than the 5% level of significant. This suggests that the random effect model is appropriate for the study since the study cannot reject the null hypothesis that the error terms have no correlation with the explanatory variables.

Table 7: Result of Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	5.975	5	0.308

The results of the panel random effect in Table 8 indicate that food access has a negative and significant impact on the prevalence of undernourishments in the selected countries. Finding reveals that if food access is raised by one unit, the prevalence of undernourishments reduced by approximately 37 percent. Result also indicates that food

availability has a negative impact on the prevalence of undernourishments, but the result is not significant. Food production index is also revealed to impact negatively on the prevalence of undernourishments even though the result is not significant. However, the result of food importation reveals that it impacted positively on the prevalence of undernourishments, but the result is not significant. Finally, the study shows that income per capita has a negative and significant impact on the prevalence of undernourishments. If income per capita is raised by one US Dollars, the prevalence of undernourishments reduces by 0.3 percent.

Table 8: Results of Panel Random Effects

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.534	3.599	4.315	0.000
FACCESS	-0.365	0.123	-2.951	0.004
FAV	-0.043	0.126	-0.347	0.729
FPI	-0.026	0.030	-0.860	0.393
FIMPT	0.017	0.044	0.392	0.696
PCI	-0.003	0.001	-3.222	0.002
R-squared	0.248			
Adjusted R-squared	0.173			
Durbin-Watson stat	0.522			

Discussion of Findings

Findings of the study have revealed certain issues that need to be discussed. Firs, the result revealed that food access has a negative and significant impact on the prevalence of undernourishments in the selected ECOWAS countries. This result is in line with apriori expectation as food access means that people can provide food for consumption, and this has the tendency to reduce the level of undernourishments. Accessibility has to do mainly with income level and the negative impact of per capita income on the prevalence of undernourishments supports this. The fact that per capita income has a negative and significant impact on the prevalence of undernourishments indicates that as people have the means to access food, their nutritional level is expected to improve. Across different countries, this finding has been supported empirically. Such studies include a work in Ghana by Saaka and Osman (2013) and in Venezuela by Hernández and Camardiel (2021). In Australia also, the role of food accessibility and income level in reducing the prevalence of undernourishments finds empirical support in a study by Lindberg *et al.* (2022). In this present study also, food availability has been found to have a negative impact on the prevalence of undernourishments in the selected ECOWAS countries even though the outcome is not significant. This result is not surprising because food productivity in ECOWAS countries is very low, resulting in the countries suffering from food insecurity and always resorting to food importation to argument the shortfall in local supply. The 2023 FAO rated almost all the ECOWAS countries as food-deficit, except Nigeria and Cape Verde.

In further support of the menace of food-deficit in these countries, food production index was shown to influence the prevalence of undernourishments negatively but the result is not significant. The none-significant effect of this variable on the prevalence of undernourishments is an indication that domestic production of nutritious food in these countries is not enough to improve the nutritional need of the people. Finally, the study found food importation to have positive but none-significant impact on the prevalence of undernourishments in the selected ECOWAS countries. As a means to support domestic shortfall in local food supply, it is expected that food import should add to improved nutrition in these countries. It is the contention of the study that the likely reason for the positive impact of food importation on the prevalence of undernourishments is because most of the imported foods in these countries lack nutritional value as they are mostly processed foods. This result finds support in a study by Nzeh (2023) which found food import to contribute insignificantly to life expectancy in low-income food-deficit African countries.

Conclusion and Policy Implications

In this study, attempt was made to provide answer to the question of whether food security and per capita income could reduce the prevalence of undernourishments in some selected ECOWAS countries over the period from 2012-2020. Findings of the study revealed that both food accessibility and per capita income had negative and significant impact on the prevalence of undernourishments within the study period. However, while food availability and food production index had negative but none-significant impact on the prevalence of undernourishments, the impact of food importation was positive but none-significant. The findings so far have shown that income level and food accessibility matter most in reducing the prevalence of undernourishments than food availability and these have some policy implications for these countries. Among the implications is that the policy efforts of the governments of these countries to enhance food availability is yet to produce significant results with respect to reducing the prevalence of undernourishments. It is therefore not out of place to state that food availability and importation is the route through which food insecurity contributes to the prevalence of undernourishments in the economic bloc. From the foregoing, it is pertinent to assert that improvement in both income level and nutritional food production holds the key to the reduction in the prevalence of undernourishments in the ECOWAS countries. Consequently, this present study recommends that there is need for the governments in these countries to formulate policies that address income inequalities through institutional overhaul targeted at reducing the level of corruption. Also, it is important to improve domestic food production through incentivizing small-holder farmers. These incentives could be in the form of providing financial grants to farmers, provision of disease resistant and high yielding seedlings as well as fertilizers. Food importation should be limited to foods that have nutritional values and which can also be affordable to the people.

References

Adams, S. O., Bamanga, M. A. & Mbusube, A. (2019). Principal component analysis of Nigerian economy from 2006-2017. *Asian Journal of Advanced Research and* Reports 5(4), 1-9.

Agu, A. O., Agu, S. V. & Onwuteaka, I. C. (2020). Food poverty in Nigeria: Implications for life expectancy, *Journal of Economics and Sustainable Development, 11*(2), 107-114. doi.org/10.7176/JESD/11-2-11.

Aigheyisi, O. S. (2020). Determinants of life expectancy in Nigeria: Does agricultural productivity matter? *KIU Interdisciplinary Journal of Humanities and Social Sciences, 1*(2), 194-210.

Beyene, S. D. (2023). The impact of food insecurity on health outcomes: Empirical evidence from sub-Saharan African countries*, Beyene BMC Public Health 23*(338), 2-22. Retrieved from: https://doi.org/10.1186/s12889-023-15244-3

Bhagtani, D., Augustus, E., Haynes, E., Iese, V., Brown, C. R. Fesaitu, J., Hambleton, I., Badrie, N., Kroll, F., Saint-Ville, A.. Samuels, T. A., Forouhi, N. G., Benjamin-Neelon, S. E. & Unwin, N. (2022). Dietary patterns, food insecurity, and their relationships with food sources and social determinants in two small Island developing states, *Nutrients, 14*(14), 2891 https://doi.org/10.3390/nu14142891

Bouis, H. & Welch, R. M. (2010). Biofortification: A sustainable agricultural strategy for reducing micronutrient malnutrition in the global South, *Crop Science, 50, S20-S32.*

Burchi, F., Fanzo, J. & Frison, E. (2011). The role of food and nutrition system approaches in tackling hidden hunger, *International Journal of Environmental Research and Public Health, 8, 358-373*. doi:10.3390/ijerph8020358

Coleman-Jensen, A., Rabbitt, M. P., Gregory, C. A. & Singh, A. (2020). Household food security in the United States in 2020. U.S. Department of Agriculture 2021;ERR-298.

Drammeh, W., Hamid, N. O. & Rohana, A. J. (2019). Determinants of household food insecurity and its association with child malnutrition in sub-Saharan Africa: A review of the literature, *Current Research in Nutrition and Food Science, 07 (3), 610-623.*

FAO. (2006). *Food and agricultural organization of the United Nations (FAO) agriculture and development economics division*, Policy Brief. June 2006, Issue 2.

FAO (2009*). The state of food insecurity in the World 2009: Economic crises-impacts and lessons learned*, FAO: Rome, Italy.

FAO (2010). *The state of food insecurity in the world: Addressing food insecurity in protracted cris*es.

FAO, IFAD, WFP. The state of food insecurity in the world (2013). *The multiple dimensions of food security. Rome: Food and Agriculture Organization of the United Nations 2013*, Available from: http:// www.fao. org/3/ i3434e/ i3434 e00. htm.

Fernandes, M. & Samputra, P. L. (2022). Exploring linkages between food security and economic growth: a Systematic mapping literature review, *Potravinarstvo Slovak Journal of Food Sciences, 16, 206-218*. Retrieved from: https://doi.org/10.5219/1734

Golkhandan, A. (2019). Long-term impact of economic misery on the life expectancy in Iran, *Health Research Journal, 4*(2), 104-111.

Gulcan, C. (2020) A study on life expectancy in Turkey. *EMU Pharmaceutical; Sciences, 3(*2), 86-96.

Hernández, P. & Camardiel, A. (2021). Association between socioeconomic status, food security, and dietary diversity among Sociology students at the Central University of Venezuela. *Frontiers in Sustainable Food Systems, 5*, 623158. doi: 10.3389/fsufs.2021.623158

Laraia, B. Epel, E., & Siega-Riz, A. M. (2013). Food insecurity with the experience of restrained eating is a recipe for increased gestational weight gain, *Appetite, 65, 178–84.*

Lindberg, R. Sarah, A., McNaughton, G. A., Pollard, C. M., Yaroch, A. L. & Livingstone, K. M. (2022). *Nutrients 14(19), 4133*. Retrieved from: https://doi.org/10.3390/nu14194133

Mozaffarian, D., Fleischhacker S, & Andrés, J. R. (2021). *Prioritizing nutrition security in the US. JAMA, 325(16), 1605-6.*

Nzeh, I. C. (2023). Does domestic food production contribute to improved life expectancy? Evidence from low-income food-deficit countries (LIFDC) in Africa, *International Journal of food and agricultural economics, 11(1). 51-63.*

Nzeh, I. C., Ogwuru, H. R., Okolie, D. O & Okolie, J. I. (2023). Application of GARCH models in the volatility of food inflation in Nigeria. *Global Journal of Business, Economics, and Management: Current Issues, 13(1), 63-81.*

Rose, D. (1999). Economic determinants and dietary consequences of food insecurity in the United States. *Journal of Nutrition, 129(2), 517-520.*

Rouse, T. I. & Davis, D. P. (2004). *Exploring a vision: Integrating knowledge for food and health. A workshop summary*, The National Academies Press: Washington, DC, USA, 1-88.

Saaka, M. & Osman, S. M. (2013). Does household food insecurity affect the nutritional status of preschool children aged 6-36 months? *International Journal of Population Research, 2-12.* Retrieved from: http://dx.doi.org/10.1155/2013/304169

Schaible, U. E. & Kaufmann, S. H. (2007). Malnutrition and infection: complex mechanisms and global impacts, *PLoS Med., 4(5), e115.*

Weiser, S. D., Frongillo, E. A., Ragland, K., Hogg, R. S., Riley, E. D & Bangsberg, D. R. (2009). Food insecurity is associated with incomplete HIV RNA suppression among homeless and marginally housed HIV-infected individuals in San Francisco. *J. Gen. Intern Med. 24(1)14-20.*

Weiser, S. D., Palar, K., Hatcher, A. M., Young, S. L & Frongillo, E. A. (2015). Food insecurity and health: a conceptual framework. In: Ivers L, editors. *Food insecurity and public health* (23-50). 1st ed. Boca Raton: CRC Press.

Whitaker, R. C., Phillips, S. M. & Orzol, S. M. (2006). Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children, *Pediatrics, 118(3), e859–68.*

Appendix i

Appendix 1 Low-Income Food-Deficit Countries (LIFDCs)

Africa	**Africa Contd.**	**Asia**
Benin*	Lesotho	Afghanistan
Burkina Faso*	Liberia*	Bangladesh
Burundi	Madagascar	Republic of Korea
Cameroon	Malawi	Kyrgyzstan
Central African Republic	Mali*	Nepal
Chad	Mauritania	Syrian Arab Republic
Comoros	Mozambique	Tajikistan
Congo	Niger*	Uzbekistan
Côte d'Ivoire*	Rwanda	Yemen
Democratic Republic of the Congo	Sao Tome and Principe	
Eritrea	Senegal*	**Americas**
Ethiopia	Sierra Leone*	Haiti
Gambia*	Somalia	Nicaragua
Ghana*	South Sudan	
Guinea*	Sudan	
Guinea-Bissau*	Togo*	
Kenya	Uganda	
Tanzania		
Zimbabwe		

Source: Food and Agricultural Organization (FAO, 2023)
Note: ECOWAS countries are with asterisks