Food Security: Processing, Utilization and Households' Welfare in Nigeria

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Abstract

The main objective of this study was to determine the effect of food processing and utilization on the food security aspirations and welfare of Nigerian households, using Nigerian data. The study utilized econometric techniques and based its framework on Sen's Poverty and Famine hypothesis. It was found that an individual or household's constant and lower calorie intake undermines their nutritional dreams, hence exacerbating food insecurity in the process. It was also discovered that the cost of sourcing for kerosene fuels remained the main constraint for the majority of households in the country. This is given the fact, that the average Nigerian household's poor purchasing power had incapacitated them; hence they lacked the financial muscle to continue purchasing kerosene fuel at exorbitant prices, with adverse consequences for processing and hence food security. Deriving from the foregoing, the study recommended that government should evolve poverty reduction strategies, including promoting income generating strategies that can transit a chunk of the unemployed to persons with income to command adequate access to their food needs. Furthermore, for Nigeria to overcome the incidence of food insecurity, the focus should be on curtailing corrupt practices, particularly in the oil industry towards making cooking fuels affordable to every household.

Keywords: Food security, Processing, Utilization, ARDL, Nigeria

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Background to the Study

Food is a universal human right, with no known substitute, thus Woolf (2016), stated that, "one cannot think clearly, reason well, love well, or sleep well until one has dined properly." This remark underscores the imperativeness of food to man, hence mankind faced with the dilemma of food insecurity from time immemorial, has continued to strive to achieve food sufficiency through different agricultural policy initiatives. This is given the fact that a deficit in food sufficiency which triggers food insecurity portends a great danger / threat to the existence of countless households. Accordingly, the United Nations Food and Agriculture Organization, views food security as a condition or a state in which every person (families, local government, state, and the nation) have unhindered and unobstructed physical, social, and economic access to enough, safe, and nutritionally inclined food which guarantees their dietary requirements for an active, energetic and productive life. This implies that food insecurity refers to the absence or lack of access to enough, safe, and nutritionally inclined food for an active, healthy and productive life (FAO, 2002; Barrett, 2002). Food security is commonly understood to comprise four important components: food availability, food access, food consumption (usage), as well as a constant and sustained assurance of access to it.

The United Nation's Food and Agricultural Organization (FAO, 2019) estimated that 842 million people globally are undernourished; out of which an estimated 98 percent are said to be living in developing or third world countries, with South Asia presently having the highest total figure of the undernourished, estimated at 295 million hungry persons, whereas the countries of Africa collectively has the biggest concentration of food insecure persons of any region. Food insecurity affects more than 2 billion people worldwide, with 1.03 billion living in Asia, 675 million spread across the Africa continent, 205 million persons distributed across Latin American countries and the Caribbean, while 88 million of these hungry people are in Northern America and Europe, with 5.9 million in the Oceania. To be concise, the vast majority of the world's hungry people are largely residents of poor countries, which as it were, accounts for 12.9 percent of the global population of the malnourished, daily in search and yearning for the true definition of food to be actualized in their lifetimes (FAO, IFAD, UNICEF, WFP & WHO (2020).

Despite policies articulated by global food agencies such as the International Food Policy Research Institute (IFPRI), the International Institute for Tropical Agriculture (IITA), the International Fund for Agriculture Development (IFAD) and the International Institute for Sustainable Development (IISD), food insecurity has remained on the rise in Nigeria. This is given the fact that the various agricultural initiatives and interventions have remained less effective, hence food insecurity has remained high in Nigeria; as revealed in negative effects on access, usage, and stability of access, hence a drop in households' welfare (Babatunde, Omotesho & Sholotan, 2007). Even where these food policies are deemed effective, food insecurity has remained intractable, as households quest to meet their food security aspirations has remained largely unresolved; given that the dimension of food processing and utilization has remained bleak.

Several studies have been carried out to investigate the relationship between food processing, utilization and the welfare of households, with some believing that different socio-economic and political factors are responsible for households' inability to meet their basic and desired food needs. It is noteworthy that food processing and utilization are at the core of every food security discourse. This assertion is buttressed by the fact that every household's goal/objective in food studies is the expectation of an assurance or guaranteed utility, derivable by consuming the needed food combinations that meets their dietary requirements for a healthy living and productive lifestyle. Thus, the loss of economic power coupled with other socio-political problems that hinder the attainment of households' food security aspirations, according to Sen (1981), are expressed in reduced food production, access, usage, which culminates in the adoption of several food coping strategies, climaxing in food rationing, hunger and malnutrition and hence calorie deficiency among such households.

However, the magnitude of these distortions principally occasioned by lack of economic power such as lack of access to cooking gas (fuel), safe water/sanitation, low purchasing power due to a vicious and an unending poverty are factors that undermine an individual's food use. These challenges differ in most developing countries, most notably Nigeria, which justifies this study, as stemming this cankerworm will improve several households' food processing and utilization capabilities leading to improve citizen welfare. Consequently, in the light of the foregoing, the most pressing economic policy option is to evolve ways to lessen the negative consequences of food insecurity on households' welfare, hence to this connection, the problematic of this research is to evaluate the extent of food processing and utilization on the welfare of Nigerian citizenry. There is dearth in literature on this problematic, given that, to the best of the researcher's knowledge no such work exists in this regard for Nigeria and as such this research is undertaken to fill this knowledge gap.

Deriving from the foregoing, this study's main objective is to assess food processing, utilization and households' welfare in Nigeria between 1999 to 2021, while addressing the following specific objectives: (i) to examine the extent to which the determinants of food processing and utilization had significantly impacted households' welfare in Nigeria (ii) to examine the extent to which food processing and utilization and hence households' welfare had been impacted by poverty in Nigeria.

Conceptual Clarification
Food Security
There are two ways to look at food and nutrition security: self-sufficiency and the ability to manage risk and vulnerability in food and nutrition supply. According to (IFPRI, 2004), for a long time in the 1970s and 1980s, the term "food security" referred solely to a country's ability to produce enough food to feed its population. Four fundamental pillars underpin food security: food availability, food access, food consumption, and food stability, which imply removing the potential that any shock may cause any of the first three dimensions or pillars to be disrupted in any way. While food availability is

required, it is not a sufficient condition for food accessibility, just as food accessibility alone cannot suffice without consumption.

Food security is mostly determined by two variables. These include guaranteeing enough food supply and, secondly, ensuring that households suffering from undernutrition or malnutrition have the opportunity to access food, either via self-production or by the ability to purchase it. As a result of the disagreements and divergent views expressed by various scholars regarding the definition of food security, this study adopts, as its working definition and hence views food security as a fundamental human right, and the ability and / or capacity of all people, to have unfettered access to a sufficient, safe, and nutritious food combination that satisfies, guarantees, and meets their food preferences and dietary needs for an active and productive life at all times, regardless of their financial means, as they could fall back on food aid.

Food Security Dimensions
Food Availability
According to Oni and Fashogbon (2013), food availability refers to the amount or stock of food that households, communities, states, geopolitical areas, and nations have at any one moment. It is primarily influenced and guided by domestically produced foods, imported foods, food aid / assistance, and other demand and supply elements in food production, as well as the underlying causes of each of these aspects (FAO, 1996). Food availability is defined as the availability of sufficient quantities of food to all persons within a given country on a regular and consistent basis. Food availability, according to this study, refers to the accumulation or stock of food accessible in a given home, community, local government, state, or nation, which is attainable through domestic food production activities, food aid from donor organizations, or open importation from overseas. Food availability is sometimes confused with food access, as it can apply to both household and aggregate food supply. Although it should be noted that food availability is a poor indication of food security because it does not account for disparities in food access, the average daily calorie consumption per person does provide some insight into a country's overall food situation (Kidane, Maetz & Dardel, 2006).

Food Access
On the other hand, food accessibility refers to a household or nation's capacity or ability to have easy access to accessible food supplies at all times, given the income at their disposal. Access to food is mostly a demand-driven issue. Consumers' or households' access to food is contingent upon their available money and the cost of the foodstuff in question (FAO, 1996). These elements are influenced by the household's resource endowment, which specifies the range of productive activities available to achieve income and food security objectives (Kidane, et al, 2006). Food accessibility is governed globally by four critical factors: economic, physical, political and sociocultural influences.

Food Utilization
Food usage is a concept that refers to the quantity and quality of food that a household consumes in order to fulfill its nutritional and/or dietary requirements. A good dietary

environment, also referred to as proper food use, connotes the presence of suitable and appropriate food processing and storage systems, acceptable and adequate knowledge of nutrition and child-rearing techniques, and access to suitable public health and sanitation services such as cleanliness and hygiene (FAO, 2000; Food and Nutrition Technical Assistance Project (FANTA), 2006). Food usage extends beyond the quantity of food consumed to the quality of food products consumed, since quantity alone does not equate to well-nourished households. Malnutrition is almost always the result of underutilization of available and accessible dietary combinations. This can manifest as stunting, sickness, or even obesity. However, this research study interprets food utilization differently and so adds that food use, as the end goal of the food production discourse, is the capacity of households to consume quality food of all categories or types required for their diet and a healthy living. To ensure total food utilization, end users must have access to a variety of processing and storage methods for their food in order to maintain its shelf life and avoid contamination. Additionally, this study asserts that Nigeria's desire for continuous food consumption is defined or assured by the behavior of the following elements: the cost of cooking gas; calorie intake and the poverty rate among the citizens in that nation.

Stability of Food Access
Food access stability connotes that households are not at risk of losing access to food due to unforeseen shocks induced by changes in weather conditions or other crises or cyclical occurrences such as seasonal food insecurity (Olarinde, Abass, Abdoulaye, Adepoju, Adio, Fanifosi & Wasiu, 2020). It is expected that causes of food insecurity will grow more frequent in the future, particularly as a result of climate change. This is due to escalating climate change and the impact of global warming, which has resulted in regular temporary food shortages and strains on existing resources, leading to political turmoil. Furthermore, the climate-induced migration of herders and their cattle throughout Nigeria in search of food and feed usually leads to violence. Conflicts over scarce resources such as water and land, as well as migration due to drought, may become more frequent and extreme as a result of climate change, increasing the risk of food poverty and malnutrition (Oni et al, 2013).

However, it is the contention of this study that food stability or access stability refers to the continuous assurance that households, communities, states, and nations have that their food needs will always be met, regardless of external threats such as income loss (unemployment or underemployment), poverty, or political violence. Unfortunately, food security in Nigeria has become a problem for policymakers, given the present degree of insecurity in the country's key farming areas. This is in addition to the growing threats posed by unavoidable changes in climatic conditions as a result of global warming's devastating effects, which have resulted in unstable rains, flooding of agricultural products due to torrential rainfall, and a recurring incidence of excessive heat waves, which are detrimental to the yield of a variety of agricultural products. These undesirable events wreak havoc on food production. It is important to remember that food security objectives can only be achieved when all four elements of food security are met concurrently.

Households' Welfare

The term "household" refers to the fundamental residential unit in which economic output, consumption, inheritance, child-raising, and housing are structured and conducted. It is not always synonymous with household. In many social, microeconomic and government models, the home serves as the fundamental unit of study. The notion encompasses all those who share a residence. Household welfare and standard of living can be measured in terms of wealth, income, the quality and availability of employment, comfort, material goods and necessities available to households, the number of vacation days available per year, class disparity, poverty rate, life expectancy, disease prevalence, the cost of goods and services, the quality and affordability of housing, as well as the hours required to purchase a home; this is according to the United Nations Development Index (2013); (Morattti and Natali, 2012). For this study, household welfare is defined as the aggregate happiness or value that individuals, households, or communities obtain from the consumption of certain bundles of products (food) or services, given their available financial resources. It is a state of well-being, pleasure, and comfort, or the degree of prosperity and standard of living achievable by an individual or a group of individuals as a result of the satisfaction gained from their income and consumption of certain bundles of commodities (food inclusive). An excellent example of welfare is having access to the food combinations necessary to maintain a healthy lifestyle for a person or household, given the purchasing power available at the time.

Theoretical Review

Sen's Theory of Poverty and Famine: An Essay on Entitlement and Deprivation

This theory propounded by Sen (1981), tied its arguments to the fact that hunger and famine for a very long time have been largely rooted in postulations made by Thomas Malthus' food availability approach. Sen did not contribute to challenging Malthus (1798)'s stance on food security until the early 1980s, when attention was shifted from national food availability to people's access to food in a dissertation on "entitlement and deprivation. The emphasis on food security in the entitlement discourse was an insistence on each individual's entitlements to commodity bundles, including food, by viewing famine as a result of households' failure to be entitled to the bundle(s) that assures them of sufficient food to improve their welfare (Sen 1981). Sen's Poverty and Famine Hypothesis which examined the socio-economic factors that influences food insecurity among nations, *due to the robustness and logicality of its assumption is considered as the theory that best provides answers to the discourse on food security and households' welfare in developing countries, particularly Nigeria, hence it is adopted for this study.*

Review of Related Literature

In line with this study's objectives, the following literatures are reviewed as follows: Firstly, Owoo (2021), examined demographics and food security in Nigeria from 1970 to 2018, employing data from three waves of the World Bank's Living Standard Measurement Survey for Nigeria in fixed effects regressions to show spatial trends in food security in the country. Larger households, according to their findings, have poorer food security outcomes and are more likely to report being food insecure than smaller

households. It is also well recognized that children from large families are more likely to suffer from malnutrition. This link was substantial in urban Nigeria, as it was in rural Nigeria, with implications for sustainable urban development and household planning with the goal of meeting unmet contraceptive need. Similarly, Fadarele, Akerele, Mavrotasl, and Ogunniyi (2019), evaluated the relationships between conflict, food price shocks, calorie consumption, and acute malnutrition among children using a cross-sectional survey and fixed-effect and random-effects models within a panel framework. Their research, which was presented at a conference, demonstrated that increased food prices, particularly staples, had a lowering effect on calorie intake, hence raising the risk of acute malnutrition. The study recommended that a guided food pricing strategy and conflict prevention be implemented to ensure adequate calorie intake and nutrition outcomes, as well as consideration of other nutritionally linked aspects that contribute to a higher reduction in wasting prevalence.

Furthermore, Onunka, Ihemezi, and Olumba (2018), used descriptive and inferential statistical approaches to analyze rural households' coping strategies against food insecurity in Enugu State's Udi Local Government Area from 2000 to 2016. Households were classified according to their level of food security (food secure and food insecure). The study's findings indicated that the two groups of households had significant differences in a number of socioeconomic factors. As a result, research established that the vulnerable households' coping mechanisms were not mutually incompatible; rather, a mixed approach incorporating various tactics was used to buffer food insufficiency shocks. The report advocated for more focus on education, poverty alleviation programs, and the creation of sustainable off-farm work alternatives to help customers earn an income.

In another primary data survey, Muhammad-Lawal, Ibrahim, Oloyede, Belewu, and Adesina (2017), utilized a random utility model to fit the collected data, which was then analyzed using the household Dietary Diversity Score (DDS), Analysis of Variance (ANOVA), and Multinomial Logit Regression (MLR) technique to assess the factors that influence rural households' dietary diversity behavior, as well as the relationship between dietary diversity and food calorie consumption among rural households in Kwara State, Nigeria. It was discovered that in the medium term, dietary diversity category, age, household income, gender, and education level were the socioeconomic characteristics that were beneficial in describing the respondents' dietary variety attitude. Based on the findings, the study recommended that enlightenment efforts on family planning, food-aid intervention, and nutrition education be expanded in order to produce a recommendable dietary formula that improves human health status in the study area.

Additionally, Fawole, lbasmis, and Ozkan (2015), used econometric techniques to conduct a time series survey in Nigeria from 1990 to 2014 and explored the trend in food insecurity and its consequences for the country's stability over time. Critical food security indicators in Nigeria, such as the incidence of malnutrition, food insecurity, and the

number of undernourished individuals, all increased between 2009 and 2014. Consequently, the continuance of this trend would eventually become a ticking time bomb, posing huge security dangers and threats to both the country and the African sub-region as a whole, given that it is by far the most populous black nation on the earth. To avoid this, several recommendations were made, one of which stated that the study's immediate causes of rising food insecurity should be addressed by implementing appropriate measures such as increased food production, infrastructure provision, and population control in order to address Nigeria's and other African countries' food security challenges.

Furthermore, Imonikebe (2010), also employed the use of percentages, mean, standard deviation and variance of the responses to explore the limitations to food security and its attendant effects on Nigerians. Using questionnaires administered on the population of Agricultural Science teachers, lecturers, students, farm managers, Home Economists, Nutritionists and literate farmers from four states in Nigeria from which a sample of 320 was randomly selected, the study found that some of the constraints to food security are poverty and households low purchasing power, which hamper their food security aspirations, leading to food insecurity, malnutrition, poor health outcomes, high mortality rate and low life expectancy as a consequence. Owing to the preceding outcome, the study recommended that Nigeria should adopt and implement food security measures adopted by developed countries to lessen the incidence of food insecurity among its citizens.

In the same vein, cooking energy was viewed to have remained a critical component of life for the survival of any home on a daily basis as man must eat in order to survive. Consequently, Olugbire and Aremu (2016) explored the factors of household cooking energy choice in Oyo State, Nigeria, using a structured questionnaire to collect data from 130 households. Using descriptive and inferential statistics, they discovered that while fuel wood, charcoal, kerosene, gas, and electricity were the most frequently used cooking energies by households in the study area, that is, kerosene was the cooking energy of choice for many households, without which cooking was difficult. While homes with a high monthly income frequently chose gas and electricity with kerosene as a backup, households with a low monthly income frequently chose fuel wood, charcoal, and kerosene. Therefore, it was recommended that the government provide means to improve the welfare and standard of living of households in the study area, enabling them to afford gas and electricity as a cooking energy source, thereby protecting them from the harmful effects of charcoal, fuel wood, and stove use.

Finally, applying MATLAB methods to conduct descriptive and inferential statistics and percentage difference between used and preferred energy, Emagbetere, Odia and Oreko (2016), randomly sampled 250 houses in Ikeja, Lagos State, Nigeria, to measure household cooking energy. Their survey discovered that kerosene and liquefied petroleum gas (LPG) were the most used fuels for daily cooking (48.60 percent and 36.30 percent, respectively). Only a minority of respondents, 7.10%, 5.7 percent, and 2.4

percent, respectively, used charcoal, firewood, or electricity for regular cooking. However, gas had the highest preferred rating for domestic energy, followed by electricity, kerosene, charcoal, and firewood. Additionally, empirical data from the chi-test, linear-by-linear connection test, and likelihood ratio test demonstrated that income level, level of education, and kind of work all influenced the type of cooking fuel utilized and chosen.

Methodology

The utilization of the Auto-Regressive Distributed Lag (ARDL) technique is adequate for this study given that it is secondary data-based analysis with a small and finite size of the data. Pesaran, Shin, and Smith (2001) alluded to gains of this technique as it utilizes mixed order of integration but not of I(2) and beyond. This technique also enables simultaneous estimation of long run association amongst variables of interest, in the determination of long and short run estimates. The validity and forecasting strength of the model will also be determined via tests of heteroscedasticity, autocorrelation and model misspecification.

Model Estimation

Theoretical Framework

This research model is based on Sen's (1981) theory of Poverty and Famine and is derived from Sen's proposition that the causes of food crises and famine in many countries around the world are not simply a result of a food supply gap but also as a result of several other socio-economic factors, including declining wages (income), poverty, cost of cooking gas and calorie deficiency. The theoretical model is as represented below:

Model 1: Food Processing / Utilization Determinants and Households' Welfare in Nigeria

$$Hwelfare = f(FUT) \qquad ..... \qquad (Eqtn \quad 1)$$
$$\text{But} \quad FUT = f(C\_GAS, CAL\_DEF, SWS, LEXP, POV) \qquad ..... \qquad (Eqtn \quad 2)$$

By substitution of FUT into equation (4.13) we have

$$Hwelfare = f(C\_GAS, \ CALO\_DEF, SWS, LEXP, POV) \ ..... \qquad (Eqtn \quad 3)$$

Specification of the Empirical Models

To estimate the models above, the study utilized a simple ordinary least squares regression technique. This is given the fact that all the variables included in the models were level stationary series, that integrated of order zero I(0). Econometric theory suggests that where variables in a model are all at level order I(0), an OLS estimate could suffice. Thus, the decision was arrived at owing to the uniform order of stationarity for all the variables included in the models (1) and (2). Therefore, the preceding equations are re-specified in their explicit form as follows:

Model: Food Processing / Utilization Determinants and Households' Welfare in Nigeria:

$$\Delta Hwelfare \ = \ \alpha_o \ \beta_1 C\_GAS_{\square} + \ \beta_2 CALO - DEF + \ \beta_3 SWS + \ \beta_4 LEXP + \ \beta_5 POV + \ \mu_t \ ... (Eqtn \ 4)$$

Where:

C_GAS	=	Cooking gas
CALO_DEF	=	Calorie deficiency
SWS	=	Safe water / sanitation
LEXP	=	Life expectancy at birth
POV	=	Effect of poverty
μ_t	=	Stochastic error term / time trend

While $\alpha_0 + \beta_1, \beta_2, \beta_3, \beta_4$ and β_5 respectively are the parameter estimates

The ARDL transformation for Equation 4.31 is stated as follows:

$$\Delta Hwelfare = \alpha_o + \beta_1 C\_GAS_{t-1} + \beta_2 CALO\_DEF_{t-1} + \beta_3 SWS_{t-1} + \beta_4 LEXP_{t-1} + \beta_5 POV_{t-1} +$$

$$\sum_{j=1}^{p} \pi_1 \Delta CALO\_DEF_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta C\_GAS - PC_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta SWS_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta LEXP_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta POV_{t-}$$

$$+ \mu_t \qquad (Eqtn\ 5)$$

A general error-correction representation of the equations above is formulated as follows:

$$\Delta Hwelfare = \alpha_0 + \sum_{j=1}^{p} \pi_1 \Delta C\_GAS_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta CALO\_DEF_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta SWS_{t-j} + \sum_{j=1}^{p} \pi_1 \Delta LEXP_{t-j}$$

$$+ \sum_{j=1}^{p} \pi_1 \Delta POV_{t-j} + \delta_i ECM_{t-j} + \mu_t \qquad (Eqtn\ 6)$$

Results and Discussion
Augmented Dickey-Fuller (ADF) Unit Roots Tests
The following table summarizes the results of the ADF/ PP unit root testing.

Table 1: Augmented Dickey Fuller and Phillips-Perron Unit Root Test

Variable		Level t-statistic value	1st Difference t-statistic value	5% critical value	Order of Integration
Log(Hwfare)	ADF	-3.622137	****	-2.895109	I(0)
	P-P	-4.618824	****	-3.459950	I(0)
C-GAS	ADF	****	-3.579335	-3.012363	I(1)
	P-P	****	-3.579335	-3.012363	I(1)
CALO-DEF	ADF	-5.980196	****	-3.004861	I(0)
	P-P	-5.368806	****	-3.004861	I(0)
LEXP	ADF	-3.755349	****	-3.012363	I(0)
	P-P	****	-3.774890	-2.893956	I(1)
SWS	ADF	****	-4.274614	-3.012363	I(1)
	P-P	****	-4.362737	-3.012363	I(1)
POV	ADF	****	-3.319148	-2.897223	I(1)
	P-P	-3.112550	****	-2.893589	I(0)

Source: Extracts from E-views 10

Above is the extract from the Augmented Dickey Fuller and Philips-Perron unit root tests. The unit root test verifies that the variables in the models are of order zero and one, that is, of mixed order of integration. Having confirmed that the variables: Households welfare (Hwfare), cooking gas (C_GAS), calorie deficiency (CALO_DEF), safe water / sanitation (SWS), life expectancy (LEXP) and poverty (POV) were of mixed order of integration, the study proceeded to estimate the food utilization-households model function using the Autoregressive Distributed Lags (ARDL) regression technique, by first examining the lag selection criterion.

Lag Selection Criteria
Before delving into the complexities of the cointegration test, it is crucial to choose a suitable lag length. The Akaike Information Criterion in selecting an appropriate lag for this study. The maximum number of lags that could be taken in this study was determined to be six, utilizing Akaike Information Criterion (AIC), and this was selected for the estimation of a parsimonious model. The result is attached in the appendix page.

Cointegration Testing Using ARDL Bounds
A cointegration test is one of the most certain ways to determine whether or not there is a long-run linkage between series in a model. Cointegration of two or more variables is defined economically as the existence of a long-run or equilibrium relationship between or among variables or series in the model (Gujarati, 2004). The cointegration results are summarized in Table 2.

Table 2: ARDL Bounds Testing for Food Utilization and Households' Welfare in Nigeria

Test Statistic	Value	K
F-Statistic	5.824056	5
Critical Value Bounds		
Significance	*I(0) Lower Bounds*	*I(1) Upper Bounds*
1%	3.41	4.68
5%	2.62**	3.79
10%	2.26	3.35

Note: ** signifies rejection of the null hypothesis at 5 per cent level of significance
Source: Author's Extract from E-views 10

Table 2 revealed that the estimated F-statistics for the ARDL Bounds Testing Wald Test revealed a value of 5.824056, which is greater than both the upper and lower bounds of the 95 percent critical value interval (2.32 – 3.5). This also necessitates the rejection of the null hypothesis that no long-run relationship exists between the variables, implying the existence of a unique long-run cointegrating relationship between food utilization and household welfare in Nigeria during the reference period.

ARDL Long run and Short run Estimates for Model 4

Food security is defined not only by the production and supply of food, but also by households having unrestricted and unfettered access to their food choices towards meeting their nutritional needs. This is critical, since leaving a healthy and productive life demands an adequate consumption of high-quality food in the recommended quantity and nutritional content. The food to be consumed passes through different processes before its final consumption (utilization) by the different households. While previous research in Nigeria has focused primarily on anthropometric indicators, total calorie intake, or the household dietary diversity score (HDDS), this study adds to the body of knowledge by examining factors influencing household food processing and utilization such as cooking gas (proxied by the official price of kerosene), calorie deficiency, the extent of poverty, life expectancy at birth and safe water and sanitation, These are all contingent upon households' actualization of their food potentials. Consequently, the model for this study is constructed and analyzed in order to provide an answer to the question "what significant influence does the determinants of food processing and utilization has on the welfare of Nigerian households?

Table 3: ARDL Regression Estimates

Dependent Variable: Hwfare				
Variable	Coefficient	Std Error	t-statistic	P-value
A: Longrun Estimates				
CALO_DEF	6.975173	2.019375	3.454125	0.0012
C_GAS	0.162714	0.070748	2.299896	0.0026
LEXP	0.000000	0.000000	2.666918	0.0105
SWS	-0.000000	0.000000	-2.063998	0.0447
C	27.810698	0.344372	80.757693	0.0000
B: Short-Run Estimates	Coefficient	Std Error	t-statistic	P-value
D(CALO_DEF)	8.168808	1.361049	6.001845	0.0000
D(C_GAS)	0.215116	0.028675	7.501821	0.0000
D(LEXP)	0.000000	0.000000	5.028534	0.0000
D(SWS)	-0.000000	0.000000	-7.249977	0.0000
D(POV)	0.002485	0.000495	5.021635	0.0000
ECM(-1)	-0.092857	0.025683	-3.615454	0.0007

Source: Author's computation from E-views 10

Tables 3(A and B) show the findings of the long run and short run estimates for the determinants of food processing, utilization and household welfare model for Nigeria. As a result of the statistically substantial positive link between calorie deficiency (Calo-Def) and household welfare shown in Table 3(A and B), each kilocalorie taken or consumed by households tends to make them more calorie deficient and thus food insecure. This finding corroborates Fawole et al. (2015)'s assertion that the prevalence of malnutrition, food inadequacy, and the number of undernourished persons in Nigeria were increasing due to inadequate calorie consumption.

Additionally, as illustrated in Tables 3(A and B), (C-Gas) as proxied by kerosene (household fuel consumption) had a significant positive link with household food consumption patterns, as every naira increase in the cost of cooking energy resulted in a proportionate decrease in households' capacity to process their food, leading to a fall in their consumption patterns and hence their welfare during the study periods. This is especially true, given that the average Nigerian household's poor purchasing power has incapacitated them; hence they clearly lacked the financial muscle to continue purchasing kerosene fuel at exorbitant prices, thus their capacity for food processing is imperiled. This finding is further bolstered by the fact that the short run coefficient of poverty is positive; implying that as more households fall further into poverty, their ability to sustain food consumption is jeopardized. Thus, any exceptional and unjustified increase in the price of this critical cooking fuel comes with a detrimental effect on the welfare of households and their quest for food security. The finding is corroborated by Nwoko et al. (2016)'s assertion that fuel prices exert adverse effect on households' food security in Nigeria. Olugbire et al. (2016), and Emagbetere et al. (2016) also supported the aforementioned findings that increased income is required to keep up with rising cooking fuel costs.

Again, in Table 3(A and B), the interaction between life expectancy (LEXP) and households' welfare showed her as a significant and positive predictor of households food use. To be precise, it was revealed that the more households' food security is imperiled, the likelihood of enjoying a decent living becomes a mirage, hence the potential for surviving beyond a certain age is jeopardized. Life expectancy in Nigeria has remained at a worrisome trend because many of the citizens are poor and as a result, experiences frequent food insecurity challenges, which in most part is the greatest trigger for malnutrition and deaths. The findings above are bolstered by Imonikebe (2010)'s study that, life expectancy in Nigeria has remained a worrisome trend because many of the citizens are poor and as a result experiences frequent food insecurity challenges, which in most part is the greatest trigger for malnutrition and deaths.

It was equally revealed in Table 3(A and B), that the interactions between households' welfare and safe water / sanitation (SWS) had reported negative and significant relationship with food processing and utilization, which is in tandem with expectations. It was shown that lack of safe drinking water and sanitation impacted negatively on access to proper nutrition and food security. Safe drinking-water, sanitation and hygiene are crucial to human health and well-being. Furthermore, the short-run dynamics of the food processing / utilization show a significant and positive relationship between food utilization and poverty. Empirical evidence indicated that rising household poverty is a significant impediment to households' desire for increased food processing and use. This is not unconnected to government's incapacity to drive growth in the economy, both in the private and public sectors, leading to low economic growth with attendant high unemployment rates that further exacerbate the already high poverty incidence which continues to thwart every household's desire for guaranteed food security.

Finally, it was shown that when the food processing, utilizations and household welfare equations are disturbed, the slope coefficient of the error correction term (-0.092857) indicated the extent to which the equations readjust towards long-run equilibrium. Consequently, given the requisite system innovation, the error correction term revealed a 10 years and seven months period of convergence to equilibrium path. However, the achievement of these goals is conditional upon the effectiveness and efficiency of government policies in identifying appropriate solutions to Nigeria's food security crisis. The adjusted R-squared is 89 percent and the F-statistics are significant at the 1% level, indicating that the model is well fitted and explained. That is, the food utilization-corruption nexus model as captured or explained does indeed have a significant justification.

Conclusion and Policy Recommendations
The main objective of this study was to determine the effect of food processing and utilization on the food security aspirations and welfare of Nigerian households. The study concluded that during the study periods, the welfare of several Nigerian households was jeopardized given the alarming poverty levels which impeded their access to vital ingredients such as cooking fuels, safe and clean water culminating in inadequate calorie consumption which severely undermined their aspirations for nutritious and healthy food. To this connection, this study concludes that Nigerian households were food insecure between 1999 and 2021.Consequently, it was recommended as follows:

(i)   To ameliorate or reduce the incidence of calorie deficiency among Nigerian households, it is recommended that households should reorder their eating habits by consuming foods high in fiber and making better drink choices

(ii)   Furthermore, the Nigerian government should work expeditiously and assiduously towards reviving the country's existing refineries in order to increase output and mitigate the current volatility in oil prices. These fluctuations have a detrimental effect on households' food security objectives, particularly in terms of transportation and distribution of food, as well as access to cooking energy, such as kerosene for cooking.

(iii) Nigerian households can also improve on their diets or calorie intake by adding more fruits and vegetables to their eating plan.

(iv)   Both the government and households should ensure that safe drinking water and sanitation is taken very seriously to avoid the incidence of water borne disease such as diarrhea, typhoid fever and other water-related challenges. This they can do through sinking boreholes and investing in sensitization programmes for adequate enlightenment to the general public on the need to always consume safe water.

(v)   To address the current challenge of rising poverty, which has harmed households' expectations for food security, the government is advised to develop more effective poverty reduction policies that would mitigate the effect of poverty on Nigerian households.

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