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FOOD PRICES IN NIGERIA, IMPLICATIONS ON POPULATION HEALTH: AN ARDL APPROACH

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Abstract

Measures, like Nigeria Health Sector Renewal Investment Initiative (NHSRII), in 2023, increased healthcare funding in 2025 aims at improving population health to increase individual and aggregate productivity over time by boosting physical and mental capacities which is becoming increasingly vital for economic growth and development in Nigeria, but despite all effort population health remains unsatisfactory with life expectancy of 53.6 and many living below poverty threshold. Food price inflation, sanitation, school enrollment, health expenditure were analysed by using the auto-regressive distributed lag (ARDL) method in explaining population health in Nigeria The outcome shows that in the long run increase in food prices was negative and statistically significantly with life expectancy and positive and significant with infant mortality rate, improved sanitation shows a positive and substantial link with life expectancy at birth and negative with infant mortality rate while secondary school enrollment shows negative and non-significant link with life expectancy and per capita health expenditure also indicate a positive but insignificant relationship. These results has significant implication for health policy formulation. The study, therefore, recommend policymakers to prioritise actions aimed at stabilising and reducing food costs, including subsidies for critical food items, enhancements in agricultural production, and initiatives to alleviate supply chain disruptions. This could be achieved by promoting local farmers to reduce reliance on import foods, school feeding program be initiated, ensuring real time monitoring of food price and improve access to sanitation service.

Keywords: ARDL, Food Prices, Infant Mortality Rate, Life Expectancy

1.0 Introduction

The global food prices have remained high, since the peak of the food crises that occurred globally in 1998, this increases hunger and malnutrition mostly felt by the poorest household and this could lead to poor population health. Moreover, it is becoming critical to improve population health to enhance mental and physical abilities of the populace for promoting economic growth particularly in emerging nations. Population health has been unsatisfactory owing to high cost of food. Nations of the world are realising that poor population health undermines human capital development, reduces labour productivity, increases healthcare costs, and impeding sustainable development (Magida et al.,2025).

Food costs have an impact on consumption patterns; however, they may also negatively impact nutrition and health. Rising food prices often force household to compromise dietary patterns and nutritional choices, households may choose to consume less expensive, nutrient-poor, and high-energy foods when food costs rise, which raises the risk of cardiovascular illnesses, obesity, and diabetes (Asfaw, 2007;Darmon& Drewnowski, 2008). Furthermore, the effects of food prices on population health are often exacerbated by underlying socioeconomic inequalities, disproportionately affecting the most susceptible populations (Friel et al., 2008; Phalkey et al., 2015). Low-income households, with limited resources and coping mechanisms, are particularly susceptible to food insecurity and sudden increases in prices (Reuveni, (2025). These households usually may lack access to nutritious food, and adequate healthcare services and clean water compounding the negative health outcomes associated with food insecurity. In 2024, more than 31.9% of the global population are unable to purchase adequate food and basic nutritional needs. World Health Organization (WHO, 2024).

For economies around the world, particularly emerging ones like Nigeria that are headed toward sustainable economic growth and development, population health is a crucial health factor. In accordance with the (WHO), population health is associated with an individual's psychological, physical, and social fitness, as well as the absence of illness or disease. Empirical evidence suggests that improving access to nutritious meal in most industrialised economy has resulted in a significant improvement in population health. However, this is not the case in developing nation like Nigeria, despite all the efforts for instance, Nigeria Health Sector Renewal Investment Initiative (NHSRII), in 2023, Increased Healthcare Funding in 2025, at improving healthcare delivery systems by the government, population health has been abysmally poor.

Several studies have emphasized the effect of food prices on nutrition outcomes (Duncan, et al.,2022; Fajobi, et al.,2024). Food price and poverty (Iheonu, & Oladipupo, 2024). others examined linkages between food prices and population health outcomes, such as malnutrition and diet-related diseases (Bradbear & Friel, 2013; Duffey, et al., 2010). However, the documented empirical indication of the effect of food prices on population health in Nigeria is scarce. On this basis, this study looked at the influence of food price on population health in Nigeria from 2000 to 2024. The remaining segments of the study are summarized as follows: Section two summarizes the literature review. Section 3 outlines the technique and sources of data. Section 4 presents and analyzes the data, while Section 5 provides the conclusions and policy recommendations.

2. Literature Review

2.1 Conceptual Issues

Food price is the monetary value assigned to food products within the market, and they have a glaring work in the well- being of individual and their economies. Food prices affect vulnerable populations, leading to issues of malnutrition and food insecurity (Barrett, 2020; Smith et al., 2019). Economic analyses often involve examining trends in food prices to identify patterns and assess the affordability of food for different demographic groups.

Policy discussions on hunger, poverty, and sustainable agricultural practices frequently revolve around the implications of food prices on global and local scales (Rahaman, et al., 2021; Byaruhanga, & Isgren, 2023). In a broader context, the concept of food prices is integral to discussions on global food systems, trade policies, and the interconnectedness of markets. Researchers and policymakers delve into these topics to develop strategies and interventions aimed at ensuring food accessibility, mitigating the impact of price volatility, and encouraging a more adaptive and equitable food system (FAO, 2022; World Bank, 2017).

Population Health

Population health is the collective status of the health of a specific group, encompassing more than just individual health and the provision of treatment (Galea et al., 2005). It emphasises the collective impact on individuals within that population (Cogburn, 2019; Lett et al., 2022). While individual health focuses on health conditions and treatments, population health adopts a comprehensive perspective, considering the well-being of entire societies, this perspective recognizes the interconnectedness of health results and the necessity to tackle fundamental factors that contribute to health inequalities.

Population health encompasses the origins and outcomes of a collective's well-being, including social, economic, environmental, and behavioural factors (Marselle et al., 2021). It covers an array of areas, such as health distribution within a certain population and determinant outcome framework, health outcomes, and the social components of health. (Dover & Belon, 2019). Some essential methods for gauging population health are life expectancy at birth, infant mortality, social determinant of health, others are morbidity data, health surveys, health care utilization as determined by social activities, environmental health indicators, social and economic indicators, environmental impact assessments and global health metrics, among others.

From a societal perspective, a healthy population forms the backbone of a productive and resilient society (Cavagnaro, 2022). Economically, the importance of population health is evident in its impact on healthcare costs, workforce productivity and the overall stability of economies. Healthy populations generally incur lower healthcare expenses, allowing for increased investment in other critical sectors.

On a global scale, population health is a key basis of public health (Salgado et al., 2020). With the increasing interdependence of nations, threats to health, such as pandemics and diseases that are infectious, can quickly transcend borders (Kumbhar et al., 2023). Prioritizing population health not only safeguards the well-being of individuals but also contributes to global health security (WHO, 2022).

2.2 Theoretical literature

The relationship between food prices and population health is explore through theories like the classical economic theory of supply and demand, Malthusian Theory of Food Supply and Eco-Social Theory of Health.

The classical theory of demand and supply, rooted in the works of Adam Smith and David Ricardo in the 18th and early 19th centuries. This enduring framework provides crucial insights into the functioning of markets, resource

allocation, and the invisible hand that guides economic transactions. At the center of the classical theory lies the fundamental law of demand as well as supply. Classical economists acknowledged the concept of price elasticity, recognizing that the degree of responsiveness of the quantity required and provided to variations in price may vary, Inoua, & Smith, (2023). Understanding how consumers and producers respond to price changes enhances the classical framework's applicability to real-world scenarios Kafoe, (2024).

The Malthusian theory of food security, developed by Thomas Malthus in the 18th century, affirm that population growth tends to surpass the growth of food production, which led to inevitable scarcity and famine. Malthus contends that while population upsurges geometrically, food production only increases arithmetically. This imbalance, he asserted, would result in a population that exceeds the available food supply, creating a crisis. Malthusian theory continues to influence discourse on global food security, with its emphasis on the delicate balance between population growth and resource availability. The rapid increase in population can put a lot of pressure on agricultural resources, making the problem of food insecurity worse.

The Eco-Social Theory Krieger (2001), contributed significantly to identify how economic, social inequalities and ecological factors interact to influence health outcomes. Theory argue that it is essential to consider political, historical, temporal, economic and spatial analyses in the distributions of disease. This mathematical expression for the Eco-Social Theory of health provides a quantitative framework to comprehend the link between food prices and population health in Nigeria.

This study found its theoretical supporting in Eco-Social Theory of Health Krieger, (2001), which argue that distributions of disease are determined at multiple levels and that analyses must incorporate ecological, political, historical, temporal, economic, and spatial analyses. has contributed significantly to know how economic and ecological factors interact to influence health outcomes. theory integrates so many estimations, from the molecular to the societal, to provide a complete framework for probing the complex interaction between ecological conditions, social structures, and individual health. This mathematical expression for the Eco-Social Theory of health provides a quantitative framework to comprehend the link between food prices and population health in Nigeria. The model captures the relationships among social determinants, and health outcomes, offering insights into how social interventions can impact health. This model can be used to simulate various scenarios and inform policy decisions aimed at improving health outcomes

The model is expressed as:

$$H = f(E, S) \quad (1)$$

Where: H is the health outcomes, E is the Economic features and S is the social factor

2.3 Empirical Review

The academic works incorporates an increasing volume of investigation that scrutinizes the affiliation between food prices and population health. This investigation discovers numerous issues that surpass national boundaries. To begin with, Sadikeen, et al. (2024) investigate the association between stunting and food

price inflation among children between age 0 to five in Bangladesh from 2014-2018, by employing Generalized Linear Regression model. The study deduced that Food price inflation significantly reduces stunting. Result also shows a significant negative relationship between stunting and the wealth index, education level of mothers, breastfeeding, pregnancy status, and child age, weight has a substantial favorable effect on stunting. However, the study discovered no significant variations in stunting between boys and females. In another study, Hoenink, et al. (2024) examine changes in food prices by healthiness and food group. With dataset spanning the years 2013 to 2023 in the United Kingdom. The study employed UK nutrient profiling score model. Price of healthier food increases since 2021 and remain more costly, worsening dietary inequality, while diary food group attracted highest prices.

Azimi and Rahman (2024) investigate the effects of food insecurity and ecological degradation on health outcome indicators, study also investigate the complex moderating effect of institutional quality on the interplay among endogenous factors, external shocks, and food insecurity for South Asia from 2000 to 2021. Using the model of Generalized Autoregressive Conditional Heteroskedasticity (GARCH). The two-step system generalized method of moment. Findings shows that undernourishment, disparities in capita calorie intake, and carbon dioxide emissions all considerably shorten life expectancy and raise death rates. It also demonstrates that urbanization, per capita GDP, per capita health expenditures, and per capita kilocalorie supply are statistically significant factors in raising life expectancy and lowering death rates. Result also reveals that environmental factors and food insecurity are significantly impacted by inflationary shocks, which further puts pressure on current death and life expectancy rates. It was also discovered that the institutional quality index significantly affects mortality rates and life expectancy, respectively. Additionally, the institutional quality index effectively mitigates the adverse effects of inflationary pressures and modifies the relationship between health outcomes, environmental degradation, and food insecurity.

Fajobi et al. (2024) analyze nutritional outcomes as a result of food prices on Nigerian women. In this cross-sectional study, from 2018, Nigeria Demographic and Health Survey (NDHS) were analysed by employing Multinomial logit regression. Results reveal that the price of foods high in energy was found to positively correlate with nutrition outcomes (obesity and overweight), while there is negative association between undernutrition and the price of nutrient-dense foods. Meanwhile, Springmann et al. (2017) analyzes the effect of putting a charge on greenhouse gas (GHG) emissions from food items on both GHG emissions and human health in 2020. This analysis was carried out by employing the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT), an agricultural-economic model. It was discovered that imposing emissions pricing on food commodities has the potential to dramatically reduce global climate change.

In another vein, Odusanya and Akinlo (2016) analyse the impact of increasing food prices on the economic welfare of 31 Sub-Saharan African nations between

2001 and 2012 using panel regressions. The study deduced that both current and initial food prices have a detrimental impact on the economic well-being of the region.

Bouis et al. (2011) examine how main socioeconomic determinants influence health and nutrition outcomes in the Philippines. An increase in food expenditures is simulated using demand elasticity factors derived from household-level survey data and then projected into nutrient intakes and energy. Moreover, the study looks at household-level data to see how unequal intra household food distribution affects the nutritional status of women and female children. The study found that an increase in food costs reduces calorie intake and iron consumption, depending on the severity of the induced income effect.

Duffey et al (2010) analyze the relationship between food prices, diet, and health outcomes in the United States, from 1985-2006 using conditional log-log and linear regression models. There were collapsed in the price of pizza and soda over time, while whole milk price surge. this surge in price of soda was linked with reduced daily calorie consumption and weight loss. The surge in prices of pizza and soda were related with reduction in energy intake

Elijah, (2010) investigates the consequences of rising food prices and elucidates both the immediate and underlying factors that affect the nutritional well-being of Nigerians. Two primary methodologies were employed to generate information. The initial method involved collecting primary data from 396 families in North Central Nigeria to obtain empirical evidence. The second method involved gathering secondary data from various sources. The study reveals that food price hikes have a widespread impact on almost all agricultural products in Nigeria, whereas the disposable income of population and household categories, particularly disadvantaged groups, does not experience a matching increase.

The association between food prices and population has been widely investigated in the academic discourse, considering elements such as food price inflation, per capita health expenditure, sanitation, and secondary school enrollment. Food price and its interactions with other factors are not adequately investigated in current study, indicating a clear gap in the subject

2.3.1 Gap in the Literature

Empirically, there are studies that are largely focused on the welfare and nutritional implications of rising food prices in Nigeria; however, studies that focus on broader effects on population health, such as life expectancy at birth and infant mortality rate, as well as the role of macroeconomic factors such as health expenditure, have been scarce in recent years. Addressing this gap would provide evidence for developing policies to improve Nigeria's public health.

3.Methodology

3.1: Sources of Data

The study uses annual time series information from 2000 to 2024 in Nigeria. Food price inflation denotes the dimension of food costs. Infant mortality rate and life expectancy at birth were employed as a proxy for population health, data were sourced from FAOSTAT and World Development Indicator (WDI) as previously used by Molla, (2001) Murray, (1988), Robine & Ritchie (1991). Per capita health expenditure, secondary school enrolment and improved sanitation were introduced as exogeneous variables,

as commonly used in existing studies such as Liang & Tussing (2019), Singh (2014). Data on food prices, life expectancy, infant mortality and health expenditure were transformed into natural logarithm to achieve stationarity in variance.

Table 1. *Description of variables*

Variables	Description	Measurements	Source
LLE	Life expectancy	Life expectancy at birth, total(years)	World Development Indicator (WDI) 2024
LIMR	Population Health	Mortality rate, infant (per 1,000 live births)	World Development Indicator (WDI) 2024
LFP	Food Prices	Food price inflation (Consumer price index)	Food and Agriculture Organization of the United Nation statistical database (FAOSTAT)
LHEXP	Per capita Health expenditure	Domestic general government health expenditure per capita (current US$)	World Development Indicator (WDI) 2024
SANI	Sanitation	People using at least basic sanitation services (% of population)	World Development Indicator (WDI)2024
SSEN	Secondary School Enrolment	School enrolment, secondary (% gross)	World Development Indicator (WDI)2024

Source: authors' compilation (2025)

Model Specification

The study adapted Akinlo and Odusanya, (2016) for the consequence of food prices on life expectancy at birth and infant mortality rate as stated

$$LLE = \beta_0 + \beta_1 LFp + \beta_2 LHexp + \beta_3 Sani + \beta_4 Ssen + \mu_t$$

$$LIMR = \beta_0 + \beta_1 LFp + \beta_2 LHexp + \beta_3 Sani + \beta_4 Ssen + \mu_t$$

Where LLE is life expectancy, LIMR is infant mortality rate, LFP is a delegation for food price inflation a measure for food prices. β0 is the constant term, β_1, β_2, β_3,and $\beta_4$denotes the coefficients of the model, and μ_t stances for error term, LHEXP denotes per capita health expenditure and SANI proxy for sanitation and SSEN proxy for Secondary School enrollment.

3.2Technique of data analysis

The equation is estimated using the ARDL process as part of the chosen empirical approach. For a long run, the area of econometrics has made extensive use of ARDL approaches. Their use has grown in popularity, especially when it comes to cointegrating connection analysis of variables that are integrated of order I (0) and I (1) (Odusanya and Adegboyega,

2014). The studies of Pesaran, Shin, and PSS (2001) more especially, Pesaran and Shin (1995) and Pesaran et al. (2001) make two important contributions in this regard. Further, the ARDL $(p, q_1, q_2, q_3, q_4, q_5)$specification for LE is expressed as:

$$\Delta LLE_t = \alpha_0 + \sum_{i=1}^{p-1} \phi_i \, \Delta LLE_{t-i} + \sum_{j=0}^{q_1-1} \beta_{1j} \, \Delta LFP_{t-j} + \sum_{j=0}^{q_2-1} \beta_{2j} \, \Delta LHEXP_{t-j} + \sum_{j=0}^{q_3-1} \beta_{3j} \, \Delta SANIp_{t-j} + \sum_{j=0}^{q_4-1} \beta_{4j} \, \Delta SSENn_{t-j} + ECT_{t-1} + \varepsilon_t$$

However, a similar ARDL specification is estimated for infant Mortality rate LIMR as:

$$\Delta LIMR_t = \alpha_0 + \sum_{i=1}^{p-1} \phi_i \, \Delta LIMR_{t-i} + \sum_{j=0}^{q_1-1} \beta_{1j} \, \Delta LFP_{t-j} + \sum_{j=0}^{q_2-1} \beta_{2j} \, \Delta LHEXP_{t-j} + \sum_{j=0}^{q_3-1} \beta_{3j} \, \Delta SANIp_{t-j} + \sum_{j=0}^{q_4-1} \beta_{4j} \, \Delta SSENn_{t-j} + ECT_{t-1} + \varepsilon_t$$

4.Result and Discussions

Descriptive statistics

The mean (x) value of infant mortality rate was 84.58, which indicated a high level of infant deaths, and this showed the level of health challenges in the economy. Its minimum and maximum values of 68.50 and 109.60, respectively, indicated a considerable variation in infant survival rates. The mean (x) value of life expectancy rate was 50.96 indicated a high level of deaths, and this also reveals the level of health challenges. Its minimum and maximum values of 47.19 and 53.63, respectively, indicated a considerable variation in survival rates Also, with a mean value of food price at 99.17 and standard deviation of 73.00 indicate that the average food price was moderately high, but there was substantial variability in prices. Sanitation with a mean value of 36.823 and standard deviation of 6.161 signifying that a relatively low percentage of the populace were able to make use of basic sanitation services, and the standard deviation suggested a moderate variation in sanitation access in various areas. Furthermore, the descriptive statistics of the government health expenditure gave minimum and maximum values of 3.232 and 15.834, respectively, with the mean and standard deviation values of 10.948 and 3.291, indicating that per capita health expenditure varied significantly, with a mean of 10.948. The standard deviation of 3.291 showed notable fluctuations around the average expenditure during the period.

Food prices, sanitation, and infant mortality rate are positively skewed, depicting that they were characterized by a longer right tail. meanwhile, life expectancy, health expenditure and secondary school enrolment were negatively skewed, signifying that their distributions have longer left tails. The skewness values are within the acceptable range of ±2, indicating that none of the variables exhibits severe asymmetry. Moreover, food prices, infant mortality, life expectancy and sanitation are platykurtic, but health expenditure is mesokurtic while school enrolment is leptokurtic, while Jarque bera test depicts food prices, infant mortality, health expenditure, sanitation and life expectancy show probability were normally distributed, except school enrolment which is significant at 5% level.

Table 2: *Descriptive statistics Result*

	FP	LE	IMR	SSEN	HEXP	SANI
Mean	99.174	50.966	84.587	36.752	10.948	36.823
Median	75.975	51.497	81.800	40.910	10.657	36.430
Maximum	249.028	53.633	109.600	54.882	15.834	46.570
Minimum	17.196	47.193	68.500	4.637	3.232	27.994
Std. Dev.	73.002	1.889	11.961	11.889	3.291	6.161
Skewness	0.661	-0.555	0.604	-1.432	-0.867	0.093
Kurtosis	2.026	2.128	2.308	4.930	3.297	1.653
Jarque–Bera	2.808	2.078	2.022	12.432	3.228	1.925
Probability	0.245	0.353	0.363	0.001	0.199	0.381
Sum	2479.372	1274.172	2114.681	874.433	273.720	920.581
Sum Sq. Dev.	127904.4	85.695	3433.780	3331.931	260.042	911.120
Observations	25	25	25	25	25	25

Source: authors' compilation, 2025

Test of Multicollinearity

A correlation matrix was created to determine the presence of multicollinearity among the predictor variables. (Food price inflation, health spending, sanitation, and secondary school attendance). Table 3 presents the correlation matrices. The correlation matrix results, revealed that the factors produce positive correlation coefficients. According to Wooldridge, 2007 the correlation coefficient of less than 0.95 indicates a lack of multicollinearity among the variables.

Table 3. Correlation matrix Result

Variables	FP	SSEN	HEXP	SANI	VIF
FP	1				
SSEN	0.365	1			1.4
HEXP	0.457	0.483	1		1.7
SANI	0.863	0.432	0.394	1	4.8

Source. Authors' Compilation, 2025.

Table 4: Unit Root test Result

Variables	@Level		@First Difference		Order of Integration
	ADF	PP	ADF	PP	
LLE	-4.780	-9.037	-1.194	-5.972**	I (1)
	-1.139	-0.506	-5.510**	-22.188**	
LIMR	-4.885	-4.885	-2.868	-2.868	I (1)
	1.659	-1.404	-4.750**	-4.435**	
LFP	-4.199**	-5.074**	-4.866**	-10.061**	I (0)
	-4.200**	-4.824**	-4.368**	-12.282**	

HEXP	-2.704	-2.701	-4.226**	-4.232**	I (1)
	-2.236	-2.193	-4.427**	-4.416**	
SSEN	3.611**	-3.614**	-8.208**	-10.868**	I (0)
	-4.101**	-4.094**	-8.017**	-10.707	
SANI	0.845**	0.239**			I (0)
	-2.221	-2.712			

Source. Authors' Compilation, 2025. Note: *, ** and *** imply significance at 1%, 5% and 10% respectively.

Table 4 Shows the results of the Phillip-Perron test (PP) and Augmented Dickey-Fuller (ADF) confirmatory tests. The results shows that the variables are stationary at the level and at first difference. Variables that were stationary at levels, are categorized as I (0); while those that were stationary after first differencing, were classified as I (1). We used an ARDL model to determine the relationship between the variables under examination. In this study, the estimation technique must be chosen so that it matches the observed data patterns. Choosing an appropriate lag period for each underlying variable in the ARDL model is crucial because of mixed order of integration.

4.1Result of the impact of food prices on population health in Nigeria.

Lag Length Selection

The issue of determining the appropriate lag duration for each of the fundamental variables in the ARDL model is critical. For optimal lag length selection, we used the Akaike Information Criteria (AIC) to determine the lag length value that minimizes the Information Criterion while preventing autocorrelation.

Table 5: Lag length selection for model 1

Lag Length	AIC
1	12.240
2	2.740*

Sources: Author Computation, (2025) Note: *, ** and *** imply significance at 1%, 5% and 10% respectively

Table 6. *Lag length selection for Model 2*

Lag Length	AIC
1	25.208
2	13.057*

Sources: Author Computation, (2025)

Note: *, ** and *** imply significance at 1%, 5% and 10% respectively.

Table 5 and Table 6 shows that lag 1 reduces AIC, making it our best lag duration. We then examined the long-run connection between the factors.

The Bound Test

The bound testing approach was employed to determine the long-term association between the variables. The bound testing approach was based on the F-test, as described by Pesaran et al. (2001). The F-test was predicated on a presumption of no co-integration within the variables against the basis of its presence, as denoted by:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$, i.e., there is no co-integration among the variables.

$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$, i.e., there is co-integration among the variables.

Table 7: Bound Test Results, model 1

F-Statistic	1%		5%		10%	
39.492	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
K 4	3.06	4.15	2.39	3.38	2.08	3.00

Sources: Author Compilation, (2025) Note: *, ** and *** imply significance at 1%, 5% and 10% respectively

Table 8: Bound Test Results model 2

F-Statistic	1%		5%		10%	
59.182	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
K 4	3.06	4.15	2.39	3.38	2.08	3.00

Sources: Author Compilation, (2025) Note: *, ** and *** imply significance at 1%, 5% and 10% respectively.

Given the bound test results in Table 7 and Table 8. The values are 2.08-3.00 at a 10% level of significance, 2.39-3.38 at a 5% level of significance, and 3.06-4.15 at a 1% level of significance. We rejected the null hypothesis because the F-statistic of 39.492 and 59.182 for model 1 and 2 respectively was greater than the upper bound critical value, and we concluded that all the variables in the models have co-integration in Nigeria over time. As a result, we were able to quantify the long-run link between food prices and population health.

Table 9: ARDL Long-run results of the relationship between food price and population health outcomes in Nigeria. Dependent variable: *LE*

Variable	Coefficient	Std.err.	t-Statistic	Prob.
FP	-0.02143	0.002593	-8.2626	0
HEXP	0.012793	0.011956	1.069998	0.3057
SANI	0.042989	0.063977	6.299018	0.000
SSEN	-0.00149	0.002457	-0.60511	0.5564
C	-5.5974	2.710809	-2.06484	0.0612
R-squared	0.697503		–	–
Adjusted R-squared	0.696207		–	–
F-statistic	592.92223		Durbin–Watson Stat.	2.178274
(Prob.)	0			

Sources: Author Computation, (2025)

Food Price: Food price was negative and statistically significant at 1% level. Long-run analysis indicated that a unit increase in food prices corresponds to an approximate decrease of 0.021 units in life expectancy, suggesting that sustained rises in food prices could lead to poor access to nutritious meal eventually leading to an adversely effect on life expectancy.

Health expenditure: The result shows a positive and insignificant correlation with life expectancy, a unit increase in health expenditure led to 0.012 unit improvement in life expectancy at birth, but for its insignificance, health expenditure does not have long run link with life expectancy.

Sanitation: Reveal a positive and significant relationship with life

expectancy at birth at 1% level. A unit improvement in sanitation corresponds with 0.402 increase in life expectancy, depicting that improved sanitation minimizes exposure to diseases that contribute to a lower life expectancy.

Secondary school enrollment: This result shows a negative and insignificant relationship with life expectancy, a unit increase in school enrollment correspond with 0.001 decrease in life expectancy, this implied that school enrollment alone does not have a meaningful influence on life expectancy in the model.

Table 10: ARDL Short-run results of the relationship between food price and population health in Nigeria. Dependent variable: *LE*

Variable	Coefficient	Std.err.	t-Statistic	Prob.
FP	-0.020589	0.004227	-4.871114	0.0002
HEXP	0.11929	0.03368	3.54174	0.003
SANI	0.00593	0.023585	0.25149	0.8048
SSEN	0.003057	0.006464	0.472925	0.6431
CointEq(-1)*	-0.0717	0.001815	-39.4967	0

Sources: Author Computation, (2025) Note: *, ** and *** imply significance at 1%, 5% and 10% respectively

Food Price shows a negative and statistically significant association with Life expectancy. A unit increase in food price led to 0.0205 unit decrease in life expectancy in the short run, this implied that food price shock exerts immediate and negative effect on life expectancy,

Health expenditure depicts a positive and significant relationship with life expectancy (0.11929) in the short run, this implied that a unit increase in health expenditure are associated with progress in life expectancy in the direction as expected

Sanitation services reveals a positive and statistically insignificant link with life expectancy (0.2853), depicting that sanitation improvement does not significantly affect life expectancy in the short run.

School enrollment shows a negative but insignificant relationship with life expectancy in the short run (-0.0014). Implicating that change in school enrollment does not have immediate influence on life expectancy. Moreover, the Error correction term was negative (-0.064257) and significant, depicting a long run equilibrium link between food price and life expectancy

Table 11: Post Estimation Tests

Tests	Coefficient Value	Prob.
Normality	0.7102	0.701
Ramsey Reset Test	0.001808	0.104
Breusch-Godfrey Serial Correlation LM Test	0.091	0.766
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.724	0.173

Source: Author's Compilation (2025)

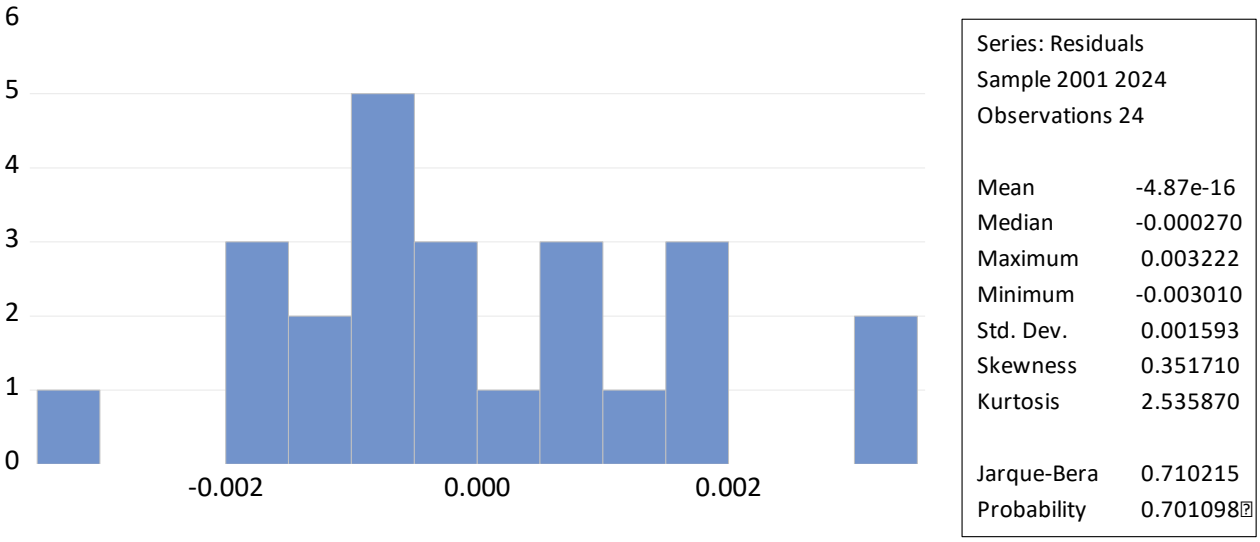


Figure 1: Normality Test – Histogram

The residuals are normally distributed, with the probability of 0.701098 which is greater than 5%. Therefore, we fail to reject the null hypothesis of normality

Table 12: ARDL Long-run results of the relationship between food price and population health in Nigeria. Dependent variable: *IMR*

Variable	Coefficient	Std.err.	t-Statistic	Prob.
FP	0.048	0.015	3.135	0.006
HEXP	-0.013	0.087	-0.149	0.875
SANI	-0.007	11.211	-0.006	0.004
SSEN	0.042	0.091	0.461	0.647
C	207.376	34.149	6.072	0
R-squared	0.69798		–	–
Adjusted R-squared	0.699297		–	–
F-statistic	291.660		Durbin–Watson Stat.	
(Prob.)	(0.0000*)			2.364

Sources: Author Computation, (2025) Note: *, ** and *** imply significance at 1%, 5% and 10% respectively

Food Price: Food price inflation proxy for food prices was determined to be positive and significant at the 5% level. Long-term analysis indicated that a unit increase in food price corresponds to an approximate increase of 0.048 units in infant mortality, suggesting that sustained rises in food prices reduced household ability to afford sufficient and nutritious food thereby adversely affected infant mortality rates.

Health expenditure: The result shows a negative and insignificant correlation with infant mortality, a unit increase in health expenditure led to 0.013 unit decrease in infant mortality, this implied that there is inadequate allocation or monitoring of

health care resources and infrastructure in Nigeria.

Secondary school enrollment: This result shows a positive but insignificant with infant mortality. A unit increase in school enrollment correspond with 0.042 unit improvement in infant mortality, this implied that school enrolment alone is not sufficient to reduce infant mortality.

Sanitation: A negative and statistically significant link exists between improved sanitation and infant mortality, showing that a unit increase in sanitation correlates with a 0.007 decrease in infant mortality. This implies that access to food, clean water, healthcare, and sanitation are crucial for child survival.

Table 13: ARDL Short-run results of the relationship between food price and population health in Nigeria. Dependent variable: *IMR*

Variable	Coefficient	Std.err.	t-Statistic	Prob.
FP	0.02143	0.001634	13.1104	0.0000
HEXP	-0.01782	0.00433	-4.115359	0.0009
SANI	-0.285389	0.060052	-4.752361	0.0005
SSEN	-0.00149	0.00127	-1.173228	0.2580
CointEq(-1)*	-0.064257	0.003155	-20.36355	0

Sources: Author Computation, (2025) Note: *, ** and *** imply significance at 1%, 5% and 10% respectively

Food Price shows a positive and statistically significant association with infant mortality. A unit increase in food price led to 0.02143 unit increase in infant mortality in the short run, this implied that food price shock exerts immediate and negative effect on infant health within the period of study

Health expenditure shows a negative and significant relationship with infant mortality (0.0178) in the short run, this implied that a unit increase in health expenditure is associated with improvement in infant health in the direction as expected, this implied that health spending translates into assessable outcome in the short run.

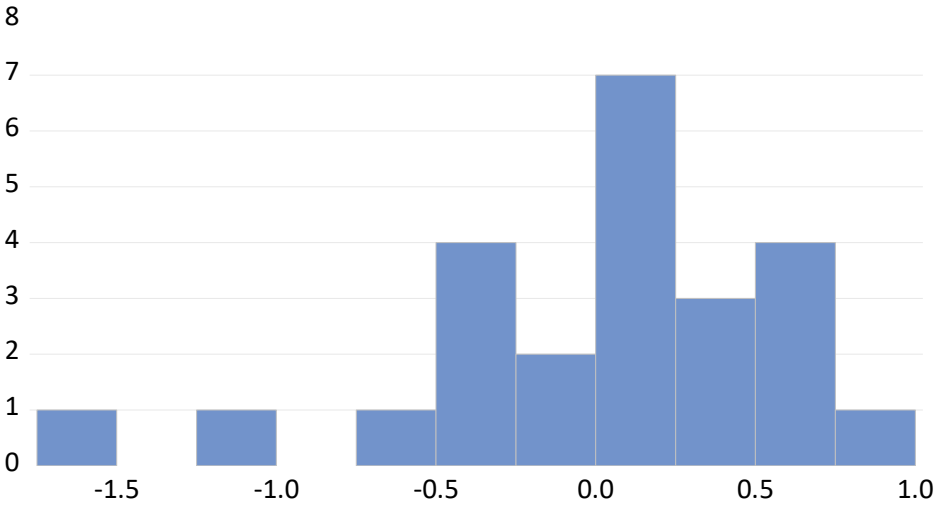
Sanitation services reveals a negative and significant link with infant mortality (-0.2853), depicting that sanitation improvement have immediate impact on infant health in the short run during the period of study.

Secondary school enrollment also shows a negative and statistically insignificant link with infant mortality (0.00149), this implied that meaningful short run impact does not exist between infant mortality and secondary school enrollment during the period of study.

Table 13: Post Estimation Tests

Tests	Coefficient Value	Prob.
Normality	3.5358	0.170
Ramsey Reset Test	-8.8100	0.1435
Breusch-Godfrey Serial Correlation LM Test	1.835	0.195
Heteroskedasticity Test: Breusch-Pagan-Godfrey	2.202	0.189

Source: Author's Compilation (2025)



Series: Residuals	
Sample 2001 2024	
Observations 24	
Mean	0.011248
Median	0.053969
Maximum	0.928439
Minimum	-1.614748
Std. Dev.	0.593086
Skewness	-0.854878
Kurtosis	3.782644
Jarque-Bera	3.535800
Probability	0.170691

Figure 3: Normality Test - Histogram

The residuals are normally distributed, with the probability of 0.170691 which is greater than 5%. Therefore, we fail to reject the null hypothesis of normality

Discussion of Results

Food Prices and Population Health

Increase in food prices have become an economic concern, as they account for a notable portion of household expenditure. Because food demand is relatively price inelastic, households does not have alternative than to devote a substantive proportion of what they earn to food consumption as prices rises (Obayelu et al 2022). Therefore, as food costs rises, spending on other critical primary needs such as housing, healthcare, and education, are frequently cut, thereby raising vulnerability, and shrinking overall welfare. Sustained food price hikes substantial consequences for population health and economic stability. Higher food prices could diminish dietary diversity and nutritional intake, particularly among children and vulnerable groups, raising the exposure to health problem and malnutrition (Broadbent et al 2023).

food prices were determined to be positive and statistically significant with infant mortality, suggesting that sustained rises in food prices adversely affected infant mortality rates, at the same time was determined to be negative and statistically significant with life expectancy, signifying that sustained rises in food prices could lead to poor access, and poorer nutrition eventually leading to an adverse effect on life expectancy.

It is important to state that when per capita health expenditure surge, does not translate to lesser infant mortality and it does not also translate to improvement in life expectancy, this depicts the inefficient allocation and utilization in health resources in Nigeria. Though the negative sign aligned with the theoretical expectation, but lack of statistical significance indicated that health expenditure alone is not sufficient to drive improvement in infant death and predicted life duration.

Furthermore, finding from the study shows that school enrolment is not sufficient to achieve improvement in infant mortality and life expectancy in Nigeria when this

study was carried out, this mirrors the challenges of low educational quality, limited translation of schools with higher income.

Consequent upon improved basic sanitation. It is worthy of note that improved sanitation reduces exposure to diseases that contribute to low life expectancy. This is shown by the fact that a unit change in SAN (people using at least basic sanitation services) results in increase in life expectancy.

And infant mortality reduced during the period of study in Nigeria, depicting a strong correlation between sanitation and child health.

5. Conclusions and Recommendation

The study focused on the link between food prices and population health in Nigeria between 2000 and 2024, Using ARDL estimation techniques, Findings reveals the existence of long run co-integrating relationship among the examined variables. The first model of the study reveals that in the long – run food price was negative and statistically significant with life expectancy while sanitation services also show a positive and significant relationship with life expectancy at birth. Health expenditure was positive and insignificant correlation while secondary school enrollment reveals a negative and insignificant relationship with life expectancy. From the second model, food price was positive and significant with infant mortality, sanitation services also reveal a negative and statistically significant link, while health expenditure shows a negative and insignificant correlation with infant mortality, secondary school enrollment shows a positive but insignificant relationship.

In the short run food price and health spending significantly affect life expectancy and the error correction was highly significant and negative (-0.0717), which confirmed that there exists a steady long run equilibrium among variables of interests. This implied that 7.2% of any short run disequilibrium in life expectancy is corrected at each period. This shows that there is a relatively slow but stable adjustment back to equilibrium in the short run, while model 2 reveal that food prices, health spending and sanitation improvement impact infant mortality in the short run, while school enrollment shows insignificant link. The error correction term is significant and negative, this indicate the existence of a steady long run association among variables of interest, and depict that about 6.4% of the short run deviations are adjusted towards long run equilibrium.

Thus, study concluded that in the long run food price significantly influence population health in Nigeria, based on these, the study recommends that actions aimed at stabilising and reducing food costs, including subsidies for critical food items, enhancements in agricultural production, and initiatives to alleviate supply chain disruptions be priotised. This could be achieved by promoting local farmers to reduce reliance on import foods, school feeding program be initiated, ensuring real time monitoring of food price before escalation, maintain well grain and staple food reserve to release supply during shortage or price hike, at the same time, Policy makers should make it a priority to ensure access to basic sanitation setup, by devoting effort on construction of public toilet, sewage system, and waste disposal amenities, and incorporate sanitation education in the school

curriculum to ensure abolition of open defecation. The statistically negligible effect of health expenditure on infant mortality emphasizes the necessity for comprehensive policy solutions, and future study should look into this.

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