Vegetable Consumption Paradox: Has Domestic Consumption Match the International Recommended Minimum Standard in Nigeria?

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Abstract: Vegetables consumption has immense health benefits to human especially in developing countries where poverty is prominent. The study basically was set up to ascertain the gap between domestic consumption and the World Health Organization (WHO) minimum recommended standard using time series data that spanned from 1961 to 2017. The result revealed that, annual production of vegetable increased exponentially at the rate of 4.42% compared to the annual population grow rate of 2.58%. Despite the increase in vegetable production in the country, the average consumption level was far below the WHO minimum recommended standard. For instance, the study discovered an average of 67.47 g/capita/day or 24.63 kg/capita/year consumption level of vegetable during this period in Nigeria. This is far below the WHO minimum recommended standard of 200g/capita/day or 73kg/capita/year. Hence, an average vegetable intake in Nigeria has remained at 66.23% below the WHO minimum recommended requirement from 1961 to 2017 period. However, from 2008 to 2016, the country witnessed tremendous increase in vegetable production that pushes the country to about 53.0% below the WHO minimum recommendation standard. The country has suffered annual gross deficit of 132.53g/capita/day or 48kg/capita/year from 1961 to 2017. Given the health benefits of vegetables, it is obvious that poverty, mortality and morbidity rates will continue to flourish in Nigeria unless there is proactive action plans that would focus on total attainment of the objectives of the Fruit and Vegetable Initiative of the WHO and Food and Agricultural Organization (FAO).

Keywords: Vegetable, Consumption, Health, Nigeria, WHO standard.

Introduction

Vegetable is defined as the edible parts of plant (including the flowers, fruits, stems, leaves, roots, and seeds), that are consumed whole or in parts, raw or cooked as part of main dish [1]. In Nigeria, there is plethora of vegetables either domesticated or grows freely in the wild. The popular ones include: bitter leaf, African Spinach, waterleaf, African basil, leafy fluted pumpkin, potatoes, onion, corn and squash. Vegetables are essential sources of cheap micronutrients available to human [2].

They constitute important part of healthy human diet. Scientifically, it is proven that vegetables are low in calorie and supply many vitamins, minerals and phytonutrients that help maintain healthy body and hence prevent potentially serious, chronic diseases. Low intake of vegetable increases the risk of heart disease, obesity, type 2 diabetes, elevated cholesterol, high blood pressure and even cancer [3, 4, 5, 6, 7, 8]. World Health Organization [9] affirmed that, annual mortality and morbidity rates will continue to flourish in Nigeria unless there is proactive action plans that would focus on total attainment of the objectives of the Fruit and Vegetable Initiative of the WHO and Food and Agricultural Organization (FAO).

The WHO recommended minimum consumption standard for vegetable alone is 200g/capita/day or about 73kg/year/person and 400g/capita/day or 146kg/capita/year for fruit and vegetables. In spite of the growing body of literature emphasizing the health benefits of consuming vegetables, their intakes are still below the minimum recommended standard for developing and most developed countries of the World. Based on this increasing gap in fruit and vegetable...
consumption in individual countries and the WHO minimum recommended standard, the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) of the United Nations in [10] launch a global initiative known as “Promotion of Fruit and Vegetables for Health” (PROFAV). This initiative aims to raise awareness and to boost fruit and vegetable production and consumption for improving people’s health and farmers’ incomes. In response to above deficiency level in vegetable consumption, countries were also advised to set up fruit and vegetable promotion initiative with the aim of increasing intakes to 140 g serving vegetable per day for children and up to 400 g serving per day for adults [11].

The aims of the fruit and vegetable promotion initiatives according to the report of WHO, [12] were to increase awareness and understanding of the role of fruit and vegetables in preventing non-communicable diseases (NCD) and increase fruit and vegetable consumption through essential public health and agricultural action, particularly emphasizing environmental and policy change. The initiative also aimed to support research in a broad spectrum of areas relevant to the promotion of fruit and vegetable production and consumption and develop the human resources required to design and implement fruit and vegetable promotion programme.

Researchers have shown that vegetable consumption is far below the WHO minimum standard recommended for human consumption in Sub Saharan Africa. Per capita vegetable consumption in this region is lower than the rest of the world, and is declining [13]. It is found that, the annual consumption of fruit and vegetable stood at 27 kg/capita/year to 114 kg/capita/year which is below the WHO/FAO recommendation of 146 kg/capita/year.

As noted by [14], Nigeria is the largest consumer of vegetables in Sub Saharan Africa with the consumption level of 61.31 g/capita/day. This is far below the required standard needed for efficient supply of nutrients, hence the need to scale up production and actualized the aims of fruit and Vegetable Initiative of the WHO. However in recent years, the federal government has initiated several agricultural programmes and set up institutions to help upshot agricultural production [15]. Also, there is increase awareness on the health benefits of vegetables, as such individuals, groups, organizations and communities have mounted several intervention programmes to upsurge vegetable production [16]. It is worth to note that, the cultivation of common leafy vegetables like water leaf, fluted pumpkin, green and Amaranths among others have constitute major livelihood activities in most rural communities because of the short gestation period, easily affordable, nutritive value and high gross margins [17].

In spite of all these improvements, the question this study intended to answer is, has daily consumption of vegetable increase or met the WHO minimum standard requirement? In an attempt to answer this question, the study specifically worked out the current consumption level of vegetable and compared with the WHO minimum and maximum standards.

Research Methodology

Study Area

The study was conducted in Nigeria; the country is situated on the Gulf of Guinea in the sub Saharan Africa. Nigeria lies between 4° and 14° North of the Equator and between longitude 3° and 15° East of the Greenwich. The country has a total land area of about 923,769 km² (or about 98.3 million hectares) with 853 km of coastline along the northern edge of the Gulf of Guinea and a population of over 140 million people [18]. Nigeria is bounded by the Republics of Benin in the west, Chad and Cameroon in the east and Niger to the north.

Data Source

Secondary data were used in the study. These data were sourced from several publications of Central Bank of Nigeria (CBN), National Bureau of Statistics, Food and Agricultural Organization (FAO) and World Bank data base website. Data covered the period 1961 to 2017.

Analytical Technique

Trend Analysis of Variables

The study analyse the nature of growth in vegetable tonnage and population by assuming exponential growth rate. As such, an exponential growth rate was specified as thus:
\[ VEG_t = b_0 e^{b_1 t} e^{ut} \]  

Where exponential growth rate is calculated as \((r) = (e^{b_1} - 1) \times 100 \ldots \ldots \ldots (3)\)

\[ log_e VEG_t = log_e b_0 + b_1 t + U_t \]  

Variables used in the trend analysis include:
- \(VEG_t\) = Total vegetable production in tonnes
- \(POP_t\) = Annual Population in number
- \(T\) = Annual time trend as numeric

Note equation 2 was also estimated for population output of vegetable in the country has a positive significant relationship with time. This implies that, the production of vegetable increases with time. A positive annual exponential growth rate in vegetable production of 4.42% was obtained from the period 1961 to 2017 in the country, revealing that, the growth rate in the sub sector was somehow substantial.

### Results and Discussion

**Exponential Growth Rate in Annual Tonnage of Vegetable in Nigeria**

The exponential trend equation for annual vegetable output and population in Nigeria is presented in Table 1. The result shows that, fluctuation in annual tonnage of aggregate variables in Figure 1. However, it worthy to mention here that, the magnitude of growth rate in vegetable production should be sufficient to offset the standard minimum daily per capita demand before the country could be considered as being secured in vegetable production. To further investigate the nature of vegetable production and the demand in the country, five – year average growth rates in vegetable production and population was computed and presented graphically in figure 1.

It is observed that, from 1961 to 1965, the average growth rate in vegetable production stood at 1.96% while the population growth rate was 1.71%. Positive growth rates of 3.86% and 2.23% for vegetable output and population respectively were obtained in the period 1966 to 1970. These periods coincided with the era of import substitution policy that emphasized on the establishment of industries.

Agricultural programme such as farm settlement scheme was initiated in the western region of the country during this period. There were incentives for farmers such as the establishment of agricultural extension, cooperative farming, and credit facilities among others that helped boost farm production. Again development plan for the country during this era was targeted on agricultural sector. During this period, agriculture was the main revenue earner for the country. In the period 1971 to 1975, the average growth rate in vegetable output reduced compared to the previous period rate while the population growth rate averaged at

### Table 1: Exponential growth rate in annual tonnage of vegetable and Population in Nigeria

<table>
<thead>
<tr>
<th>Variable</th>
<th>Exponential growth rate of Vegetable output</th>
<th>Exponential growth rate in Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Constant</td>
<td>13.2825</td>
<td>0.0633(209.9)***</td>
</tr>
<tr>
<td>Time</td>
<td>0.0442300</td>
<td>0.0019(23.3)***</td>
</tr>
<tr>
<td>Growth rate (%)</td>
<td>4.42</td>
<td></td>
</tr>
</tbody>
</table>

**Diagnostic test**

<table>
<thead>
<tr>
<th></th>
<th>F(1, 55)</th>
<th>543.0478***</th>
<th>F(1, 55)</th>
<th>149695.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log-likelihood</td>
<td>2.502387</td>
<td></td>
<td>193.4795</td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.908034</td>
<td></td>
<td>0.999633</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.906362</td>
<td></td>
<td>0.999626</td>
<td></td>
</tr>
</tbody>
</table>

Note: Asterisks ** and *** represent 10%, 5% and 1% significance level respectively
2.5%. This period marked the era of Dutch disease due to increasing crude oil exploitation in the country. The agricultural sector was gradually neglected while the entire economy concentrated on heavy yielding crude oil sector. National Accelerated food production programme was set up during this period. Incentives such input subsidy, credit, adaptive research and demonstration plots were available to farmers to help improve farm productivity.

Despite these additional opportunities for farmers to increase productivity, the crop sub sector responded sluggishly and was subjected to undue competition following increase in food import. The period 1976 to 1980 is one of the most turbulent eras in Nigeria. This is the first period in the history of the country that, noticeably hike in inflation rate, devaluation of naira and high instability in key macroeconomics fundamentals in the country occurs. This is also the period government responded massively to the downturn in agricultural sector by enunciating plethora of agricultural programmes such as Operation Feed the Nation, River Basin-Development Authorities, Agricultural Development projects (ADPS) and Green Revolution in an attempt to upsurge production. Despite these attempts, vegetable output witnessed negative growth rate of 5.51% while population continue to escalate exponentially at the rate of 2.99% per annum.

![Fig. 1: Five - year moving average of growth rates of aggregate vegetable output and population in Nigeria](image)

However the vegetable output trended upward from 1981 to 1985 period up to 2011 to 2015 period. In these periods the growth rate in vegetable output was higher than the growth rate in population. This means that, the average rate at which vegetable was produced was greater than the rate of growth in population. This result on one part means that, the country did stepped up vegetable production in some years now and had led to higher output, but meanwhile population was mounting astronomically.

This result is as expected because government had implemented several credit policies in agricultural sector during this period. Also, the introduction of the structural adjustment programme in 1986 has help to strengthen public private partnership in activities related to agriculture. Foreign direct investment in agricultural sector mounted during this period. Value addition in crop sub sector was paramount with the establishment of several agro processing enterprises in the country. In addition, increase awareness of the dietary requirement of vegetable products received a huge boom in this period too.

On the other part, the per capita daily production should be sufficient to meet the World Health Organization (WHO) minimum daily recommended intake before the country can boost of sufficient vegetable production.
In order to investigate whether the current production level in the country is sufficient to meet the WHO minimum daily requirement (on assumption that, all what is produced is consumed in the country and no wastage at any level of production and consumption), the annual production in tonnage was converted to per capita daily production/consumption in grams. The trend diagrams depicting fluctuations in per capita daily consumption/production of vegetable, minimum and maximum WHO recommended consumption in gram/day is presented in figure 2.

The finding reveals that, the per capita daily production/consumption of vegetable in Nigeria since 1961 has not met the minimum WHO recommended requirement. This implies that, the country has not for once met the minimum recommended vegetable daily intake of 200g/person/day. It is in recent years (i.e. from 2008 to 2016) that the country has managed to reach half mark of the minimum daily requirement. This is not a good report for agrarian country like Nigeria who’s natural and human resources are enormous and mostly remained untapped.

Figure 2: per capita daily production of Vegetable in Nigeria

Given the trend in the daily per capita intake of vegetable in the country, it is revealed that, the depression in the trend mostly occurs during the military eras compared to the civilian periods. The depression in the vegetable production during the military eras could be linked to insecurity, and lopsided agricultural policies of the time. It is also on record that agricultural sector suffered severely because of high level of corruption, civil war and investments on white elephant project that lack sustainability.

**Extent of Deficiency in Vegetable Consumption in Nigeria**

The magnitude of five – year annual vegetable deficiency in Nigeria from 1961 to 2017 is shown in Table 2. The result revealed that, from 1961 to 1965, about 150.57g and 200.5g of vegetable fell short from the daily minimum and maximum requirements respectively among Nigerian. The figures stood at 149g/day and 199g/day respectively from 1966 to 1970. The trend continues till 2001 and 2005 period. The findings revealed massive deficiency in vegetable consumption among Nigerian. The magnitude of the deficiency connotes that, the country needs drastic and urgent implementation of sound agricultural policies to upsurge vegetable production at all means.

The health benefits of vegetable are highly compromised given this ugly trend in vegetable sub sector in the country. Reasons for these interventions are obvious given the exponential growth rate in the country’s population and the high degree of severe poverty that has rampage most of the population especially in the rural areas of the country.
Table 2: Five year Moving average in vegetable production, per capita daily production, population, Minimum and maximum daily per capita Consumption in Nigeria

<table>
<thead>
<tr>
<th>Category</th>
<th>Five-year average in vegetable output (ton/annum)</th>
<th>Five-year Average in population</th>
<th>Five-year average Per capita daily production (g/day)</th>
<th>Deficit from WHO minimum per capita daily consumption in g/day (200g/day)</th>
<th>Deficit from WHO maximum per capita daily consumption in g/day (250g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961–1965</td>
<td>9867200</td>
<td>48063513</td>
<td>49.4239</td>
<td>150.5741</td>
<td>200.5741</td>
</tr>
<tr>
<td>1966–1970</td>
<td>9394000</td>
<td>5552661</td>
<td>50.81639</td>
<td>149.1836</td>
<td>199.1836</td>
</tr>
<tr>
<td>1971–1975</td>
<td>6202307520</td>
<td>69317520</td>
<td>55.33927</td>
<td>144.6997</td>
<td>194.6997</td>
</tr>
<tr>
<td>1981–1985</td>
<td>1063400</td>
<td>79505755</td>
<td>163.4139</td>
<td>213.4139</td>
<td>263.4139</td>
</tr>
<tr>
<td>1986–1990</td>
<td>1425800</td>
<td>90496950</td>
<td>156.9604</td>
<td>206.9604</td>
<td>256.9604</td>
</tr>
<tr>
<td>1991–1995</td>
<td>24242600</td>
<td>1.3E+08</td>
<td>135.0766</td>
<td>185.0766</td>
<td>235.0766</td>
</tr>
<tr>
<td>1996–2000</td>
<td>3758200</td>
<td>1.16E+08</td>
<td>111.6095</td>
<td>161.6095</td>
<td>211.6095</td>
</tr>
<tr>
<td>2001–2005</td>
<td>4562800</td>
<td>1.32E+08</td>
<td>105.5492</td>
<td>155.5492</td>
<td>205.5492</td>
</tr>
<tr>
<td>2011–2015</td>
<td>6022307520</td>
<td>1.72E+08</td>
<td>101.7899</td>
<td>151.7899</td>
<td>201.7899</td>
</tr>
<tr>
<td>2016–2017</td>
<td>7007431</td>
<td>1.58E+08</td>
<td>98.0921</td>
<td>148.0921</td>
<td>198.0921</td>
</tr>
<tr>
<td>Average</td>
<td>2827535</td>
<td>1.01E+08</td>
<td>132.5336</td>
<td>182.5336</td>
<td>232.5336</td>
</tr>
</tbody>
</table>

Source: Computed by author and data collected from FAO

The finding further shows a less severe situation in the periods 2006 – 2010 to 2016 – 2017. For these periods, the country witnessed for the first time daily consumption deficiency less than 100g/capita/day. These periods corresponded to the eras of intense economic diversification drive of the federal government. Probably due to the downturn in the global crude oil market which Nigeria depended so much, the country has gradually re-focused her economic policies towards the development of agrarian economy.

For instance, during these periods, government has strengthened agricultural credits, researches and encourage younger generation to embrace agricultural production among others. From the study, it is discovered that, the country has an average daily per capita consumption of 67.5g/capita/day. This has fell short of the standard daily minimum consumption by 132.5g/capita/day and maximum level by 182.5g/capita/day. These findings portray among other issues, the fact that Nigeria is currently facing food insecurity and are highly unsecured in vegetable consumption.

Conclusion and Recommendation

The study has shown that, the daily intake of vegetable by majority of Nigerian is far below the WHO minimum standard requirement. Despite the extensive promotion of vegetable consumption in the country, per capita consumption is estimated to be 50.96 to 66.23 per cent short of the minimum daily recommended level of 200 grams per person per day.

Though the study has discovered that, there are noticeably increments in vegetable production over the years in the country, but the change is grossly inadequate to meet the minimum standard stipulated by the WHO. This means that, the country must have to step up vegetable production in order to adequately meet the dietary requirement of the teeming population of Nigeria. Based on the current need of the federal government to diversify the source of the country’s revenue, there are needs to intensify agricultural production in order to help sustain the country’s economy. Hence, technology driven vegetable production is the key to achieve this anticipated achievement in vegetable production in the country.

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