Educational Administration: Theory and Practice
2023, 29(1), 705 - 713
ISSN: 2148-2403
https://kuey.net/

Research Article

Analysis Of The Food Security Index Situation In Algeria Through The Global Food Security Index (GFSI) Indicators

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Citation: Ben Moussa Bachir et al. (2023), Analysis Of The Food Security Index Situation In Algeria Through The Global Food Security Index (GFSI) Indicators, *Educational Administration: Theory and Practice*, 29(1) 705 - 713
Doi: 10.53555/kuey.v29i1.8579

ARTICLE INFO
Received:08/12/2022
Accepted:12/02/2023
Published: 28/02/2023

ABSTRACT

This study addresses the issue of food security in Algeria and its achievement through the levels and indicators of food security. The objective of this study is to examine the outcomes of the Global Food Security Index (GFSI) and the Food Sustainability Index, both published by *The Economist Impact*. The findings indicate that Algeria has made tangible efforts to achieve food security, reflected in the improvement of its Global Food Security Index results in 2021.
However, the study concludes that achieving food security in Algeria has not reached the desired level, as the food gap continues to widen. Algeria's performance in some indicators was weak or very weak, particularly in areas related to sustainability, adaptability, nutritional standards, and supply chain infrastructure. This underscores the need to intensify efforts to develop these indicators and to establish the foundations of food security.

Keywords: Food Security, Self-Sufficiency, Global Food Security Indicators, Algerian Economy
JEL Classification: Q18, Q01, Q15, L66

Introduction:

Algeria has made significant progress in the field of food security in recent years. The United Nations World Food Programme (WFP) ranked Algeria as the leading African country in this domain, placing it among the nations where the percentage of individuals suffering from malnutrition is less than 2.5% of the total population during the period 2018–2020.
In 2021, Algeria ranked 54th globally out of 113 countries in the Global Food Security Index (GFSI), a substantial improvement compared to its ranking in 2019. Despite these achievements, Algeria still faces challenges in achieving full self-sufficiency, especially in strategic crops like wheat. Reports indicate that the country imports large quantities of wheat to meet its needs, making it one of the largest importers of this essential commodity.

The Algerian government is implementing strategies to boost domestic agricultural production and reduce reliance on imports. These efforts include encouraging investment in the agricultural sector, providing agricultural land, and removing obstacles in the financing domain. A strategic plan has also been launched to develop grain production for the period 2023–2028, aiming to increase yields, improve production, and enhance seed quality.
Moreover, Algeria is working to strengthen its water resource capabilities by constructing desalination plants to ensure water supply to coastal and nearby areas. This initiative aims to address climate change challenges and guarantee sufficient water availability for agriculture.
Thanks to these efforts, Algeria is steadily advancing towards enhancing its food security and reducing dependence on imports, with a focus on developing the agricultural sector and improving related infrastructure.

Research Problem:

Based on the above, the primary research question can be posed as follows:
Has Algeria achieved food security according to the Global Food Security Index (GFSI) indicators?

Study Objective:

This study aims to analyze food security indicators in Algeria through the Global Food Security Index (GFSI).

Study Methodology:

To address the research problem, the study adopts a descriptive and analytical approach to data, utilizing specialized references, statistical data, and analysis to derive a set of findings and present recommendations.

2. Previous Studies

1. Nasser Mourad Study (2010):

Titled *Food Security Policies in Developing Countries – The Case of Algeria*, this study aimed to analyze the policies and measures implemented at both national and international levels to achieve food security, as programmed by international institutions. The study emphasized the necessity for developing countries to find solutions and policies to address food dependency and ensure food security. The researcher posed the question: *What are the effective policies for achieving food security in developing countries?*
Key findings included:

- Weak agricultural production due to a significant gap between the production and consumption of agricultural and food products.
- Deterioration in most agricultural environmental systems (forests, steppes, and desert oases).
- Depletion of basic agricultural resources (mismanagement of water resources, soil degradation, and water pollution).
- Limited production tools and insufficient training levels for agricultural labor.

2. Youssef Ben Yezza Study (2018):

Titled *Determinants and Threats to Food Security in the Arab Region*, this study explored the reasons behind the Arab region becoming one of the largest hotspots of food insecurity globally. It examined the risks of this situation, given that most consumed calories in these countries are imported. The study highlighted two main factors:

- In-depth analysis of public policies related to food security.
- Strategic cooperation between Arab countries in this domain.

Recommendations included fostering Arab food security through a dynamic approach, revitalizing integrative solidarity among Arab nations.

3. Omar Bouaziz Study (2022):

Titled *Arab Countries According to Food Security Indicators Using Hierarchical Cluster Analysis (2015-2020)*, this study aimed to monitor and analyze the food security situation in Arab countries and classify them according to food security indicators using advanced statistical methods. Findings revealed:

- Food security remains a concern for many Arab countries due to low physical and economic productivity of natural resources.
- High reliance on food imports to meet needs, posing increasing challenges for nations affected by conflicts and displacements, which destabilize food security.

4. O.A. Olaoye Study (2014):

Titled *Potentials of the Agro-Industry Towards Achieving Food Security in Nigeria and Other Sub-Saharan African Countries*, this study highlighted the significant potential of agro-industries in achieving national development, particularly in countries like Nigeria. While Nigeria produces many crops that could be processed into value-added products (VAPs) to enhance foreign earnings, challenges persist, such as inadequate processing facilities and unreliable power supply. The study concluded that Nigeria and other Sub-Saharan African nations could significantly benefit from agro-industrial potentials to achieve food security if these challenges are addressed.

5. Poudel and Gopinath Study (2021):

Titled *Exploring the Disparity in Global Food Security Indicators*, this study emphasized that a wealth of information on food security indicators has become increasingly available in recent years. However, alternative measures with significant disparities can influence policy design and implementation. The study analyzed data from various organizations (FAO, UNDP, IFPRI, and USDA) from 1991 to 2018. Results showed that disparities were significantly influenced by factors like economic growth, literacy, urbanization, and internet access. The findings called for better data aggregation and analysis to provide an accurate picture of food insecurity and the pandemic's impact.

6. Marie Ruel, Jef L. Leroy, and Edward A. Frongillo Study (2015):

Titled *Measuring the Food Access Dimension of Food Security: A Critical Review and Mapping of Indicators*, this study aimed to clarify the assessment of food access dimensions at both household and individual levels. Key recommendations included:

- Using experience-based indicators, HDDS, or FCS for assessing household energy access.
- Employing experience-based indicators to evaluate dietary quality at the household level.
- Using individual dietary diversity scores for women and children to assess nutrient adequacy.

3. Theoretical Background of Global Food Security Indicators

Food security is assessed using various indicators and data available for this purpose. These indicators can be divided into theoretical indicators and practical indicators published by organizations. Below are the main theoretical indicators:

3.1. Theoretical Indicators

- **Food Self-Sufficiency Ratio Indicator**

This measures the percentage of domestic food production compared to total food consumption and can be calculated using the formula:

Food Self-Sufficiency Ratio = (Domestic Production / Total Consumption) × 100

This indicator helps determine whether domestic production is sufficient to meet national consumption needs.

- **Dependency on Imported Food Indicator**

This shows the size of the food gap and ways to address it. It is the inverse of the food self-sufficiency ratio and is calculated as:

Dependency on Imported Food = (Imported Quantities / Total Food Available for Consumption) × 100

This provides an overview of the country's economic vulnerability and the risks to its food security.

- **Per Capita Food Level Indicator**

This measures the average caloric intake per individual based on international standards and is calculated as:

Per Capita Food Level = (Average Individual Caloric Consumption / Average Physiological Energy Requirements per Individual) × 100

If the daily average caloric intake is equal to or greater than the basic caloric requirements, there is no real food gap. Otherwise, a food gap exists.

- **Ratio of Food Import Value to Total Export Value**

This measures a country's ability to pay for food imports using its export earnings. The lower this ratio, the better the country's position to handle food imports, and vice versa.

- **Dependency on Foreign Loans and Aid for Food Imports**

This indicator reflects the extent to which a country relies on foreign aid or loans to meet its food import needs. It is calculated as:

Aid Dependency Ratio = (Quantity of Food Aid / Total Food Needs) × 100

Comparing results across years helps assess changes in aid dependency.

- **Geographical Concentration of Imported Food Sources**

This indicator shows whether the country relies heavily on a single country or a specific group of countries for most of its food imports. Comparing import ratios across regions highlights economic exposure and the need for diversification.

- **Ratio of Foreign Loans and Grants for Food Imports to Total Foreign Loans and Grants**

This indicator measures the extent to which a country depends on foreign aid and loans specifically for food imports.

- **Food Trade Balance Indicator**

This indicator measures the food security gap in absolute and relative terms. The food security gap in absolute terms is the difference between the value of food exports and imports:

Food Trade Balance = Food Export Value - Food Import Value

A positive or zero balance indicates no food security gap, while a negative balance reflects a food security deficit.

Indicator = 1 - (Food Exports / Food Imports)

- A positive value for this indicator signifies an actual food security gap.
- Conversely, a negative or zero value indicates no actual food security gap.

2.3. Operational Indicators Issued by Organizations

These indicators are used by governments and international organizations to identify areas requiring interventions to enhance food security and to develop policies and programs aimed at reducing hunger and malnutrition. These indicators can be categorized into global food security indicators (GFSI) and regional food security indicators (for the Arab region).

Global Food Security Indicators (GFSI) (1):

The **Global Food Security Index (GFSI)** currently considers the four dimensions of food security:

1.Affordability
2. Availability
3. Quality and Safety
4. Natural Resources and Resilience

It evaluates food security across 113 countries based on criteria such as nutritional standards, urban absorption capacity, food expenditure as a percentage of household income, food loss, protein quality, tariffs on agricultural imports, dietary diversity, agricultural infrastructure, agricultural production volatility, the percentage of population living below the global poverty line, GDP per capita, availability of food safety net programs, access to financing for farmers, public expenditure on agricultural R&D, corruption, political stability risks, adequacy of supply, and food safety.

In 2021, the **GFSI** integrated the "Natural Resources and Resilience" category into the main index. This category assesses a country's exposure to climate change effects, vulnerability to natural resource risks, and the impacts of these risks, all of which influence a country's food security status. This category was initially introduced in 2017 as an adjustment factor, but due to its growing importance, it was fully incorporated into the 2021 report.

The GFSI serves as a dynamic, quantitative, and qualitative benchmarking model created from 58 unique indicators to measure the drivers of food security across both developing and developed countries (2). The index aims to evaluate which countries are most affected by food insecurity based on the four dimensions mentioned above (3).

The **2022 GFSI report** highlights the fragility of the global food system, exacerbated by shocks from 2020-2022, including the COVID-19 pandemic and rising commodity prices. These shocks have worsened food security issues and weakened the resilience of the food system (4).

Global Hunger Index (GHI):

The GHI measures hunger globally and is updated annually. It is calculated using four indicators:

1.The percentage of the population suffering from undernourishment.
2. The percentage of children under five suffering from stunted growth (low height for age).
3. The percentage of children under five suffering from wasting (low weight for height).
4. The under-five child mortality rate.

Food Insecurity Experience Scale (FIES):

Developed by the Food and Agriculture Organization (FAO), the FIES measures food insecurity based on the experiences of individuals and households. This scale provides comparable estimates of food insecurity prevalence across countries.

3.3. Regional Food Security Indicators (Arab Region):

According to ESCWA reports for 2020, food security in the Arab region is measured using three main indicators: foundational pillars, stability, and food availability, access, and utilization.

1. Foundational Pillars Indicators:

These indicators reveal the presence or absence of food security, typically reflecting nutritional deficiencies. Food insecurity often translates into undernutrition (inadequate caloric and nutrient consumption) or overnutrition (excessive energy intake) (5).

2. Stability Indicators:

This dimension focuses on the stability of the food system and the consistent availability of food year-round. It addresses issues related to fluctuations in food production and supply caused by price volatility, social and political environments, and prevailing weather patterns (6).

3. Food Availability, Access, and Utilization Indicators:

This category evaluates the accessibility, availability, and effective utilization of food resources.

- **Food Availability Indicator:**

Ensuring sufficient food availability is a necessary condition for achieving food security and nutrition, but it is not sufficient on its own. Food availability is determined by factors such as local food production, food trade, distribution efficiency, and other related aspects (7).

- **Food Access Indicator:**

This indicator examines the extent to which individuals have access to the resources (physical, social, and financial) needed to grow or acquire food. Preferences for specific types of food, disposable income, food prices, social support, and infrastructure are key determinants influencing access to food.

- **Food Utilization Indicators:**

Food utilization is influenced by an individual's health, the nutritional value and safety of food, and how food is prepared and consumed. This indicator focuses on human body metrics, particularly among children, as well as food safety, quality, and sanitation conditions.

4. Food Security Performance and Status in Algeria

4.1. Global Food Security Index (GFSI):

The 2022 **Global Food Security Index (GFSI)** by *Economist Impact* ranked Algeria 3rd among Arab countries and 43rd globally in food security. According to the data, Qatar achieved the highest score in the Arab region, while Ireland ranked first globally. The index measures critical food security issues across 113 countries.

Table (1): Food Security Gap Trends in Algeria (2016-2022)

Country	Global Rank	Overall Score	Food Index	Access Crisis Index	Risk Food Index	Security
USA	1	7.9	8.76	2.76	7.7	
Qatar	29	6.99	8.00	2.09	5.0	
Oman	41	6.77	7.55	2.57	5.33	
Algeria	43	6.76	6.66	1.69	5.29	
Saudi Arabia	44	6.75	7.96	2.32	4.61	

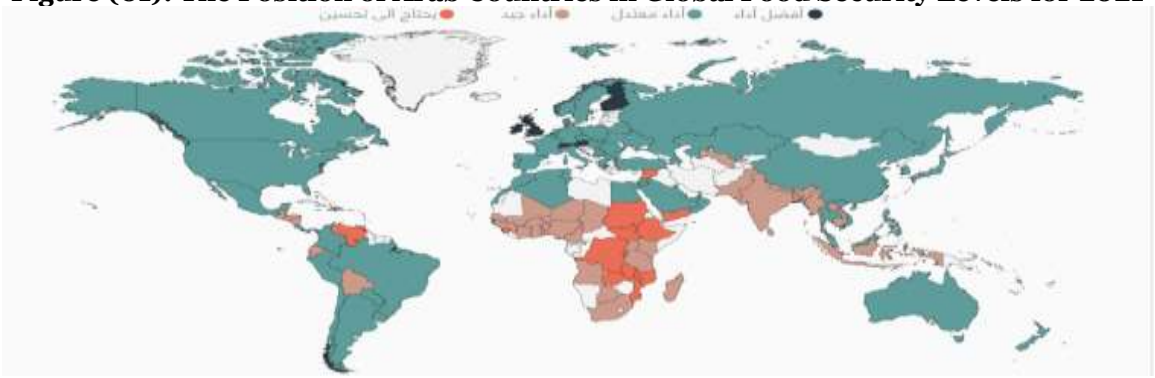
Source: *(Analytics, 2022)*

The various indicators that measure a country's food security are of great significance due to their role in enabling nations to assess the state of their food security. The 2021 Global Food Security Index (GFSI), published by *Economist Impact*, ranked Algeria 8th among Arab countries with a score of 63.9 and 54th globally (8). According to *Economist Impact*, Algeria topped the rankings of African countries, significantly improving its position compared to its 2019 ranking (9).

The 2021 GFSI marks the 10th edition of the index, which is updated annually to reflect structural changes affecting food security. The GFSI considers issues of affordability across several metrics, including the cost, availability, quality, safety of food, as well as natural resources and resilience in 113 countries. The index is built on 58 unique indicators to measure the drivers of food security in both developing and developed nations.

After achieving rapid gains in its early years, the GFSI scores peaked globally in 2019 before declining over the past two years due to the COVID-19 pandemic, conflicts, and climate volatility. Increased volatility in food prices since 2019 has affected food affordability, leading to a decline in rankings for 70 countries in the 2021 index due to rising costs.

Figure (01): The Position of Arab Countries in Global Food Security Levels for 2021



Source: economist impact2021

The index highlights that countries lacking comprehensive and well-funded national food safety net programs tend to have higher levels of hunger. Populations in these countries often consume diets deficient in quality protein and micronutrients, with limited access to safe drinking water. Among the Arab countries, Yemen, Sudan, and Syria were the lowest-ranked globally and regionally on the index (10).

4.2. Food Security Index Status in Algeria

The **Global Food Security Index (GFSI)** considers four key dimensions of food security:

- Affordability of food;
- Food availability;
- Food quality and safety;
- Natural resources and resilience.

These key indicators are essential for assessing a country's food security status. Improving these indicators is critical for ensuring food security, and like other nations, Algeria aims to enhance its food security performance. The main food security indicators for Algeria are reflected in the figures and rankings outlined in the following report, which highlights the scores and rankings across different categories and sub-indicators.

Strengths in Algeria's 2021 Food Security Index

Algeria's strengths in the 2021 GFSI were reflected in six sub-indicators, as follows:

- **Change in average food costs:** 99 points;
- **Percentage of the population below the global poverty line:** 96 points;
- **Adequacy of supply:** 94.2 points;
- **Food safety:** 90.5 points;
- **Micronutrient availability:** 89.8 points;
- **Food safety net programs:** 75 points.

"Strengths" are defined as any sub-indicator with a score above 75.0.

Challenges in Algeria's 2021 Food Security Index

Algeria's challenges in the 2021 GFSI included:

- **Food security policy commitments and access:** 0 points;
- **Nutritional standards:** 0 points.

Algeria was classified as a country with good performance in the 2021 Food Security Index. In terms of food affordability, Algeria ranked 47th globally, improving by four positions. However, the value of this indicator was 77.9 points, representing a decline of 0.3% compared to 2020, reflecting an initial deterioration in purchasing power for Algerian citizens.

For food availability, Algeria ranked 56th globally, improving by 18 positions. The score for this indicator was 58 points, an improvement of 7.7% compared to 2020. In the food quality and safety sub-indicator, Algeria ranked 67th, rising by one position with a score of 62 points, remaining stable compared to 2020.

Regarding the natural resources and resilience indicator, Algeria ranked 51st globally, dropping by four positions. The score for this indicator was 50.7 points, a slight decrease of 0.5% compared to 2020.

4.3. Food Security Index (Deep Knowledge Analytics)

Africa Level:

According to the rankings of the Deep Knowledge Analytics index, Algeria ranked first in Africa in the overall food security index for 2022. This ranking was based on three main factors (11):

- Food accessibility
- Crisis risks
- Economic resilience

The index covered 171 countries globally.

Arab Level:

The United Arab Emirates (UAE) topped the Arab countries in the food security index during Q2 of 2022, as per the report by Deep Knowledge Analytics. The UAE ranked 26th globally, followed by Qatar in 29th place. Below is a summary of the top 10 Arab countries in the food security index:

Table (01): Algeria's Ranking According to Deep Knowledge Analytics in 2022

Country	UAE	Qatar	Bahrain	Oman	Algeria	Saudi Arabia	Kuwait	Morocco	Tunisia	Jordan
Arab Rank	1	2	3	4	5	6	7	8	9	10
Global Rank	26	29	30	41	43	44	47	63	64	76
Total Score	7.07	6.99	6.99	6.77	6.76	6.75	6.69	6.40	6.39	6.10

Source: *Deep Knowledge Analytics, 2022*

The index assigned total scores to each country based on the three main factors. Scores closer to **10** indicate a more secure and stable food security profile. Globally, Bahrain ranked third among Arab countries and 30th globally, followed by Oman (41st) and Algeria (43rd), with Saudi Arabia at 44th.

Algeria is actively developing a plan to reorganize its agricultural sector through several initiatives aimed at enhancing food security.

These initiatives particularly focus on grain production, given the international changes affecting this sector. Plans include (12):

- Expanding agricultural lands for fodder production.
- Using modern technology and fertilizers to increase arable land.

Agriculture contributed 12.3% to Algeria's GDP in 2021, according to the World Bank.

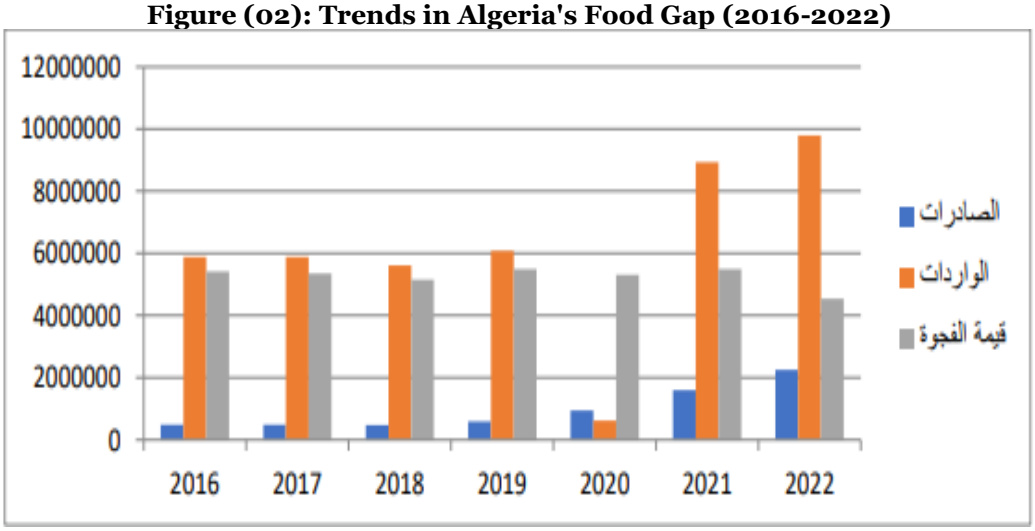
The Deep Knowledge Analytics report warned of rising hunger and food insecurity levels in Sub-Saharan Africa, the Middle East and North Africa, Latin America, and South Asia by the end of the year. While food-secure

developed countries are not expected to face hunger, they may experience shortages in some food products due to inflationary pressures.

4.4. The Status of the Food Gap in Algeria

The food gap refers to the disparity and imbalance between domestic food production and the quantities of food necessary and essential to meet the population's demand. This gap forces the country to import food from abroad. The wider this gap becomes, the greater the inability of the national economy to meet local food needs, thereby increasing the vulnerability and risk to national food security.

Figure (02): Trends in Algeria's Food Gap (2016-2022)



Unit: Thousand USD (blue: export; orange: imports; gray: gap between exports and imports)
Source: FAO Database (www.fao.org)

An analysis of trends in **production, imports, and exports** of agricultural and food products reveals Algeria's significant reliance on external food sources. Algeria has become a major importing country due to its inability to meet internal demand through domestic production.
This dependence, represented by the food gap, can be attributed to numerous challenges within the agricultural sector, including:

- Drought and irregular rainfall;
- Inadequate financing for the agricultural sector;
- Insufficient storage capacities;
- Weak industrial investment in agricultural crops;
- Lack of technical and technological expertise.

These issues underscore the need for strategic interventions to address Algeria's reliance on food imports and enhance local agricultural production (13).

5. A New Agricultural Model 2020-2024 Aimed at Achieving Food Security and Sustainable Development

In 2020, the agricultural sector succeeded in enhancing its resilience to the economic crisis caused by the COVID-19 pandemic. With a production value of approximately 3,500 billion Algerian dinars in 2021, representing over 14% of the national gross domestic product (GDP), the sector now provides more than 73% of the local market's needs, with surpluses allocated for export across about 25 sub-sectors. This sector also strongly contributes to diversifying the country's exports (14).
It is worth noting that the sector, as part of its 2020-2024 roadmap included in the government's work program, has classified oilseeds (rapeseed and soybeans) as strategic sub-sectors. The goal is to meet 25% of the national needs for rapeseed oil and 33% of corn by 2024.
To achieve this goal, efforts have been focused on developing desert agriculture. For this purpose, the *Office for the Development of Industrial Agriculture in Desert Lands* was established to support project owners in southern regions and enable them to benefit from the advantages provided by the law.

The new agricultural policy also seeks to promote the green economy to optimize the management of natural resources. In this regard, sprinkler and drip irrigation systems have been implemented across approximately 939,200 hectares, which represents 64% of the total irrigated area (1,473,919 hectares).
In line with sustainable development, the sector has been encouraging the use of renewable energy since 2020 on agricultural investments located in the High Plateaus and southern regions.
Additionally, the new sector strategy incorporates the forestry sub-sector, which significantly contributes to economic diversification and improving rural incomes through the creation of "green jobs." A broad program has

been launched to develop and expand the cultivation of resilient rural trees, such as carob, argan, and almond trees.

6. Conclusion:

The aim of this study was to analyze the state of the food security index in Algeria through the Global Food Security Index (GFSI) indicators over recent years and to examine the challenges faced by the Algerian economy in achieving food security through future economic models outlined by the government. Here, we attempt to analyze the results and propose suggestions and recommendations based on the study:

• **The Global Food Security Index (GFSI):** Currently, the GFSI considers the four dimensions of food security, namely affordability, availability, quality and safety, and natural resources facilitating access to food. The index covers 113 countries and incorporates "natural resources facilitating access to food" into its main index for 2021.
• Algeria ranked among the countries with good performance in the GFSI for 2021. Regarding the food affordability index, Algeria ranked 47th globally, advancing four positions, with a score of 77.9 points, a decline of 0.3% compared to 2020. This reflects the beginning of a deterioration in the purchasing power of Algerian citizens.
• Various dimensions of food security showed slight improvements, except for the affordability dimension, which declined due to rising food prices.
• The quality and safety of food improved slightly in Algeria, driven by better food safety and the availability of micronutrients.
• The widening food gap indicates the national economy's inability to meet its local food needs. The larger the gap, the greater the vulnerability and risk to national food security.

Recommendations:

Based on the findings of this study, we present the following recommendations, which we believe are essential and closely related to the subject:

1. **Focus on establishing and developing industrial and agricultural production projects** primarily aimed at the local market to meet the basic needs of the population, including vital projects that ensure food security.
2. **Encourage agricultural work and raise public awareness of its necessity** by supporting farmers, providing them with the necessary agricultural production tools, and improving the state of food security.
3. **Prioritize local (national) food security as a matter of food sovereignty**, making it a strategic goal for the state.
4. **Implement smart agriculture strategies** and integrate all levels, starting with farmers, to participate in planning and execution by providing all necessary requirements.
5. **Improve and sustain food systems** while focusing on the requirements and factors necessary for achieving sustainable agriculture to enhance the agricultural sector's contribution to meeting the country's essential food needs.
6. **Reformulate state policies and perspectives on food security, emphasizing food sustainability** and focusing more on the agricultural sector to reduce the food import bill.

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