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Food security in Colombia: Associated factors, public policies and research opportunities

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Abstract

Food security is a concern in Colombia since the availability, access, use, and stability of food directly affect the country's development. Considering these elements, the objective of this research was to identify the main factors that cause food insecurity in Colombia, taking into account climate change, structural inequalities, the supply chain, and its distribution. The methodology used was documentary research, through a critical and exhaustive review of the existing literature. Among the main findings, it was highlighted that although there has been a gradual reduction in food insecurity, improvements have been halted, especially in rural and vulnerable sectors, linked to issues such as poor management of public policies, food losses in the supply chain, the effects of climate change, among others. It was concluded that guaranteeing food security in Colombia requires joint work, the reduction of poverty and social inequalities, and innovation to address the internal challenges facing the country.

Keywords: Food security; public policies; climate change; supply chain; social vulnerability.

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Seguridad alimentaria en Colombia: Factores asociados, políticas públicas y oportunidades en investigación

Resumen

La seguridad alimentaria es una preocupación en Colombia ya que la disponibilidad, acceso, uso y estabilidad de los alimentos afectan directamente el desarrollo del país. Considerando estos elementos, el objetivo de esta investigación fue identificar los principales factores que provocan la inseguridad alimentaria en Colombia, teniendo en cuenta el cambio climático, las desigualdades estructurales, la cadena de suministro y su distribución. La metodología utilizada fue la investigación documental, mediante una revisión crítica y exhaustiva de la literatura existente. Entre los principales hallazgos se destacó que, si bien se ha presentado una reducción gradual de la inseguridad alimentaria, las mejoras se han detenido, especialmente en los sectores rurales y vulnerables, vinculadas a temas como la mala gestión de las políticas públicas, las pérdidas de alimentos en la cadena de suministro, los efectos del cambio climático, entre otros. Se concluyó que garantizar la seguridad alimentaria en Colombia requiere del trabajo conjunto, la reducción de la pobreza y las desigualdades sociales y la innovación para abordar los retos internos que enfrenta el país.

Palabras clave: Seguridad alimentaria; políticas públicas; cambio climático; cadena de suministro; vulnerabilidad social.

Introduction

Food security is an essential right of every human being; it is linked to a series of issues, such as material, economic, and social access to safe and nutritious food, which makes it possible to guarantee a healthy life. In Colombia, a country rich in natural resources and in geographical and demographic diversity, food security faces a series of complex challenges, since, despite advances in production and improvements in public policies, there is still a high level of food insecurity, especially among the rural population, which is characterized by the presence of peasant populations, traditionally invisible and vulnerable sectors. This reality is reflected in the lack of adequate food, both in terms of quantity and quality.

In this context, food insecurity is a reality linked to various factors such as poverty, lack of employment, social inequality, the breakdown of production systems, and climate change, among others. For this reason,

it cannot be overlooked that Colombia is facing a series of challenges in the food supply chains that affect the infrastructure and the functioning of companies in the market. In this way, the final consumer, the workers, and the underprivileged classes are adversely affected by this reality.

For this reason, the research aimed to identify the main factors that cause food insecurity in Colombia, taking into account climate change, structural inequalities, the supply chain, and food distribution. To achieve this objective, a documentary research methodology will be used, through a critical and exhaustive review of the existing literature.

1. Theoretical foundation

The concept of food security has evolved throughout history, from a focus limited to food availability to a broader vision that includes other aspects. Initially, it focused on the availability and stability of the

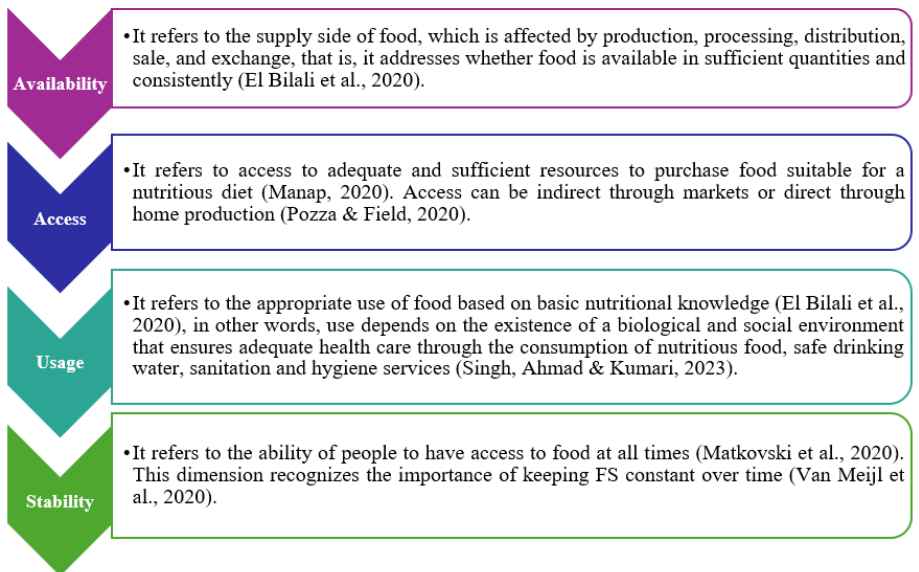
food supply at the macro level. Over time, it has been refined to include the micro level, looking at how individuals or households have consistent access to that food (Vásquez et al., 2018; Kassegn & Endris, 2021; Clapp et al., 2022).

As a terminology, it originated in the mid-seventies of the twentieth century and has been debated in different and interdisciplinary contexts. Osorio et al. (2024) argue that food security should be approached from a family perspective, focusing on access, use, diversity of products, and ways to significantly improve the local economy through the cultivation of different crops such as coffee, bananas, cassava, beans, poultry production, eggs, chickens, among others, leading to marketing and self-consumption as a mechanism to

improve food sovereignty and security in the nation.

Acevedo, Montero & Marrugo (2024) see food security as an inalienable human right that guarantees access to quality products and production using ecological and sustainable methods. In this sense, Colombia needs social and strategic management that promotes community projects, promotes the development of the nation from the social base, from the labor collectives, taking into account the needs of vulnerable sectors.

In line with the above, Clapp et al. (2022) argue that food security has four basic pillars or dimensions: Ensuring the availability of food, ensuring household access to this food, promoting its appropriate use, and maintaining the stability of the food system as a whole, as shown in Figure I.



Source: Own elaboration, 2024.

Figure I: Pillars or dimensions of Food Security

The pillars of food security provide an understanding of how to ensure that all people have access to nutritious, sufficient, and safe

food. The availability of material existence of food is determined by agricultural production, food reserves, and the commercial and strategic

means used by nations to make food available to the population. In this context, production systems must be able to meet the needs of present and future generations. In this sense, it is presented as a proposal to prevent the overexploitation of resources and to maintain a balance in access to them.

In terms of access, this pillar addresses economic, financial, and accessibility issues, as external factors such as poverty and social inequalities limit the population's ability to benefit. Therefore, the implementation of public policies that promote equity and social justice is a priority.

In terms of use, this pillar focuses on the appropriate and appropriate use of food, so that it can be used to its maximum advantage, for the health and overall well-being of the individual. It is a constant struggle to prevent the spread of nutritional pathologies, contributing with educational approaches, health care, and guidance on food intake, taking into account cultural and social preferences.

Finally, stability brings together the three previous pillars and is therefore at the heart of food security. Consequently, stability makes it possible to counter adversity, propose alternatives, and confront external threats to improve the conditions of poverty in nations.

As can be seen, food security is a dynamic and wide-ranging concept, as it goes beyond the problem of food acquisition and focuses on economic, cultural, environmental, and social issues. The evolution of this category is linked to global challenges such as structural inequalities, economic vulnerabilities, and inequalities while questioning the current social orientation. It therefore provides a reference framework for the design of public policies and strategies that promote resilient, equitable, and sustainable approaches.

2. Methodology

Data collection was carried out through a comprehensive analysis of scientific articles extracted from peer-reviewed journals available in scientific databases such as

Scopus, Springer Link, and Google Scholar, published in the last two decades (2004-2024) and selected for their recognized rigor and the quality of their publications (Adelabu & Franke, 2023). In addition, data from grey literature, such as reports from national and international organizations, policy reports, regulations, and other relevant documents, were included to fit the analysis of food insecurity.

3. Results and discussion

3.1. Food insecurity in Colombia

Food security is understood as a comprehensive perspective that addresses the problem of food, eating habits, the nutritional status of individuals, and their preferences. However, although this concept is globally accepted, its implementation has been a challenge in different regions of the world, affecting the quality of life of millions of people.

Food insecurity is defined as the lack of adequate access to food in terms of quantity and/or quality at the household level, due to limited financial resources or other factors (Guiné, 2024). This reality manifests itself as a result of various factors, such as environmental degradation (Mizrahi, Wallace & Moraïs, 2021), supply chain problems (Akintuyi, 2024), disruptions in the labor chain (Xu, Crush & Zhong, 2023), extreme weather conditions (Stuart et al., 2024), economic crises (Podkolzina et al., 2023), conflicts (Lin et al., 2023), health crises including epidemics (Dagar, Gupta & Sileshi, 2023) and pandemics (Hammad et al., 2023), causing chaos, disruption and changes in the way citizens live (Alvarado, 2023).

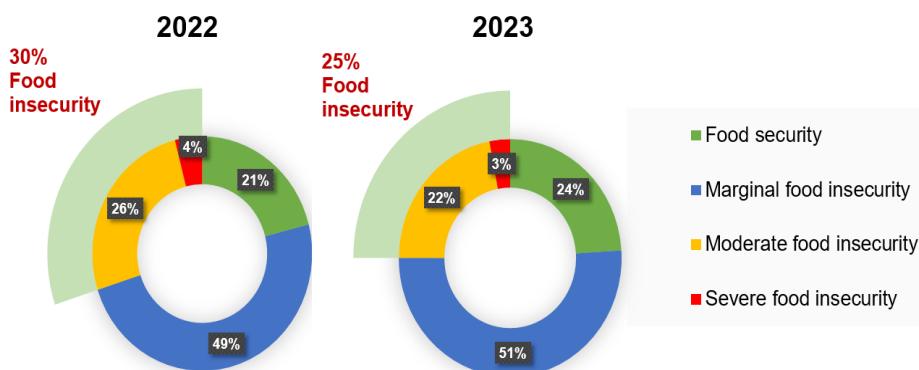
In Latin America and the Caribbean, approximately 34 million people are undernourished (Pereira, Benites & Barros, 2023) and it is estimated that more than 40% of the population is food insecure (Salazar, 2023), mainly in countries such as Mexico, Brazil, Peru, and Ecuador. At the global level,

the main regulatory body for food security is the FAO (Food and Agriculture Organization of the United Nations) (Salinas et al., 2022).

In Colombia, food insecurity is one of the main problems affecting the population living in poverty (Ríos et al., 2015), where low income, unemployment and lack of social support are considered triggers of food insecurity (Sinclair et al., 2022). According to the latest Programa Mundial de Alimentos report (2024), 13 million people in Colombia

are moderately or severely food insecure, representing a quarter of the population.

Between 2022 and 2023, a 5% decrease in food insecurity was observed, which was attributed to a decrease in unemployment, inflation, and monetary poverty rates (see Graph I). As reported by Sinclair et al. (2022), food insecurity increased from 33% to 40% between 2016 and 2019, based on several studies showing the prevalence of this problem in different populations.



Source: Own elaboration, 2024 based on the Programa Mundial de Alimentos (2024).

Graph I: Levels of Food Insecurity in Colombia in Percentage Terms

According to Jurado & Hernández (2023), in 2018, more than 54% of Colombian households suffered from food insecurity, with a prevalence of monetary poverty of 24.4% of the urban population and 36.1% of the rural population. In line with the data presented in Graph I, there is a direct relationship between poverty and geography, as the monetary poverty rate is higher in densely populated and dispersed rural centers. This shows that, among the rural population, food insecurity is mainly due to the lack of income from work due to the lack of formal jobs, which hinders access to food.

In this sequence of ideas, it can be affirmed that income scarcity, and therefore food insecurity, is closely linked to unemployment, since in Colombia

employability is a key source for the acquisition of goods and services, such as food. The most recent report of the Departamento Nacional de Planeación (DNP, 2024) indicates an increase in employment between 2022 and 2023. However, according to the same report, in 2024 the labor market experienced a cooling, especially in rural areas.

According to World Food Program statistics (WFP, 2023), more than 15.5 million people in Colombia suffer from food insecurity, with extreme deficiencies in food consumption and food quality. In contrast, the Departamento Administrativo Nacional de Estadística (DANE, 2024a) reported a decrease in the prevalence of moderate or severe food insecurity from 28.1% to 26.1%. According to the Gobierno de Colombia (2024), these

findings are relevant for the development and implementation of public policies in Colombia, highlighting the need to address specific inequalities and vulnerabilities to effectively combat food insecurity in the country.

A study conducted by Martínez-Torres et al. (2022) in a group of pregnant women found that 60.4% experienced some degree of food insecurity, with higher rates among women of African descent and those from lower socioeconomic groups. More recently, Urbina, Garza & Viana (2024) demonstrated a relationship between land inequality in Colombia and food insecurity, introducing it as a new factor to consider.

In line with the aforementioned issues, public policies related to food security have been developed as a government response to face this problem. In this sense, policies focused on health, education, and social security, as well as macroeconomic policies, have adopted a focus on food security (Cárcamo & Álvarez, 2014) and inclusive education (Díaz-León, Palacios-Serna & Borrego-Rosas, 2024).

In this regard, it is important to mention that action plans in Colombia have focused on the use of agricultural resources in the territory and their recognition of the development of local products as a strategy to add value (Mancilla & Yepes, 2023), generate use (Bayona, Cepeda & León, 2022) and design products with commercial viability and easy access (Ramírez-Navas et al., 2024).

About the problem presented, the use of crops in the country has been studied in the development of products from food security crops, that is, those crops that contain substantial amounts of nutrients and contribute in a relevant way to the sustainable production of food and the environment in the country (Bawa et al., 2023). With this in mind, yam (Martínez-Reina et al., 2023), cassava, potato, plantain, pumpkin, and sesame, which are widely cultivated in Colombia and used for fresh consumption, traditional preparations, and export, have been identified as food security crops.

This raises concerns for the construction of public policies that contribute to regulating

this situation, which will lead to an increase in food production of more than 60% by 2050 (Ristaino et al., 2021). To meet this demand, it will be necessary to increase production and reduce food losses, which suggests the adoption of disciplinary measures in the coming years to curb the advance of this situation.

For his part, Vuppalapati (2022) proposes prioritizing technological innovations that improve food production because he considers them to be the fundamental basis and the best antidote for reducing food insecurity in rural areas where the main economic activity is agriculture. In this sense, given that food insecurity is more prevalent in rural areas, the creation and improvement of economic opportunities in these areas can significantly alleviate the food insecurity of a large part of the population in Colombia.

As can be seen, food insecurity in Colombia significantly affects the population, especially the most vulnerable sectors. Despite progress, economic indicators, unemployment, and social inequality continue to be major constraints, in addition to the environmental crisis, chaotic supply, and other critical barriers to ensuring access to quality food for the nation. The statistics presented show that the problem remains serious, which makes it urgent to ensure compliance with laws and public policies that promote agricultural production, community work, and technological innovation, thus reducing food losses and increasing opportunities for economic improvement, from rural areas to the whole country.

3.2. Climate change and agricultural diseases as drivers of food insecurity in Colombia

Climate change is currently one of the greatest challenges facing humanity (Sánchez & Riosmena, 2021). Although Colombia has a large hydrological basin, climate change can affect agricultural productivity, with negative economic and social consequences (Cortés-

Cataño et al., 2024). This phenomenon alters rainfall and temperature patterns, generating different vulnerability scenarios such as changes in agricultural calendars, and increased health problems, among others (Leonel et al., 2023).

Globally, 31% of agricultural land is considered to be at “high risk” of heat stress in the 21st century. In Colombia, the agricultural sector has been affected by extreme weather events associated with the El Niño and La Niña phenomena. These include heavy rainfall, abnormal temperature variations, changes in crop cycles, landslides, frost, and drought, which have hurt production systems. As a result, climate risks could lead to food

shortages and forced population displacement (Zsögön et al., 2022).

It has been reported that the increased frequency of heat waves and other extreme temperature episodes may be particularly detrimental to crop yields (Zsögön et al., 2022). In addition, a study of the Guali River basin suggests that climate change in Colombia could have a significant impact on water supply (Mena et al., 2021). Similarly, González et al. (2021) argue that climate change in apiculture reduces the population of pollinating bees, which could affect agriculture and rural livelihoods. Table 1 summarizes the main effects of climate change and its impact on food security in Colombia.

Table 1
Effects of climate change and impact on food security

Climate change effects	Implications for food security
Increased temperatures, and changes in precipitation (floods).	Diversifications in plant and animal pests and diseases.
Changes in food processing and packaging conditions (post-harvest handling).	Increased crop losses, mainly in medium and small farmers.
Impact on distribution and sales dependent on infrastructure (supply chains).	Food price increases affecting the accessibility pillar.
Temperature increase in water sources.	Water shortage.

Source: Own elaboration, 2024 adapted from Piña (2020).

Although crops are indeed not only affected by climatic conditions, this factor is a trigger for agricultural diseases. The expected negative effects of high temperatures on crop growth include reduced seed development and germination, increased incidence of plant diseases, changes in respiration rates, and photosynthesis, and changes in flowering time (Zsögön et al., 2022).

As a result, the prevalence of pests and diseases has increased considerably, and the situation is likely to worsen. Currently, affected crops include *Musaceae* (bananas, plantains), coffee, and potato, as well as cocoa, maize and cassava. Intensification of chemical control can represent high economic costs for smallholders and long-term costs for the agroecosystem (Lau, Jarvis & Ramírez,

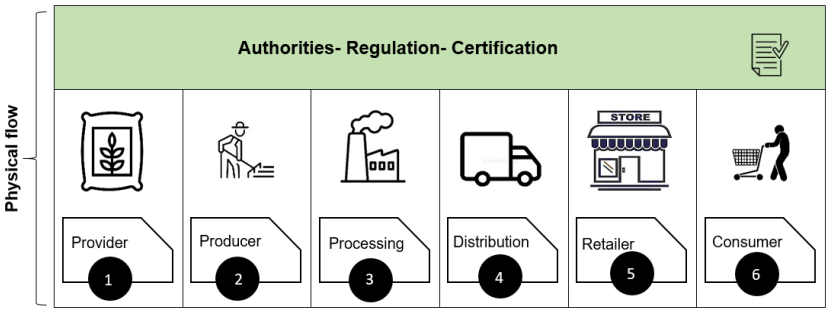
2011). Concern has also been reported at the scientific and governmental levels due to pests that have affected sugarcane, rice, yam, and maize crops.

In synthesis, climate change has consolidated as an exogenous but determining element that aggravates food insecurity in the country, altering the modes of production, especially in agriculture, raising new food challenges. Climatic phenomena have led to changes in production calendars, in addition to promoting the presence of crop diseases. These elements are associated with risk, alteration of economic stability, and disruption of access to resources and food for national sustenance. Therefore, the frequency of climatic changes hurts small, medium, and large producers, with a direct impact on vulnerable populations.

3.3. Problems in supply chains and food loss in Colombia

Supply chains are defined as companies, organizations, or individuals directly involved in the flow of products, services, money, and/or information from supply sources to final customers (Callejas-Jaramillo & Álvarez-

Uribe, 2020). In other words, a supply chain is the sum of all the elements that participate, directly or indirectly, in satisfying the expectations of the final consumer (Carrillo, 2024). To the above, the food supply chain is composed of the main phases described in Figure II.



Source: Own elaboration, 2024 adapted from Kamilaris, Fonts & Prenafeta-Boldó (2019).

Figure II: Phases of the food supply chain

However, access to food for vulnerable populations is largely dependent on traditional supply chains, wholesale markets (cash), and small family businesses. According to the DANE (2024b), Colombia is a predominantly rural country with a population of 48,258,494, of which 23.7% live in rural areas (DANE, 2022), and approximately 83.1% of the population live in urban centers and rural areas, which are considered to have a high density of peasant population (DANE, 2023).

It is estimated that family farming accounts for just over a third (35.3%) of products such as roots and tubers, and 22.8% of the total production of agricultural production units, demonstrating the importance of the farming population in maintaining the supply chain in Colombia. By 2024, 15% of the national population will live in Bogotá (Ministerio de Salud, 2024).

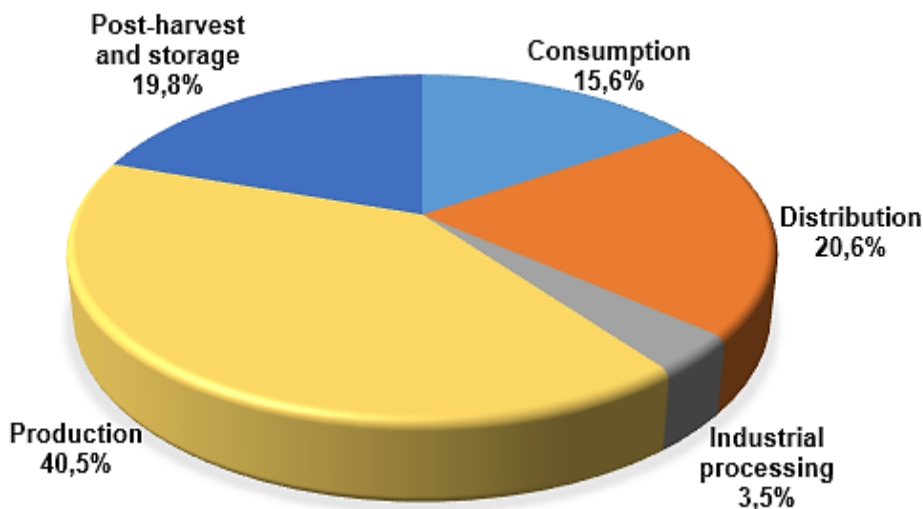
The fruit and vegetable supply system

is centralized in Bogotá’s Central de Abastos, or Corabastos, where small and medium-sized farmers sell their produce. This center supplies almost 100% of the city’s neighborhood shops, marketplaces, and specialized shops, which account for between 60% and 65% of the city’s final consumption (Reina-Usuga et al., 2023).

However, despite the important contribution of supermarkets to the supply chain, they are characterized by high levels of food loss and waste (Chaboud & Moustier, 2021). According to some studies, the causes include poor management of perishable foods (Orjuela-Castro, Orejuela-Cabrera & Adarme-Jaimes, 2021), product aesthetics (Gurralla & Hariga, 2022), supply chain disruptions (Clavijo-Buritica, Triana-Sanchez & Escobar, 2023), inadequate or incorrect packaging (Martínez & Quintero, 2017) and strict quality standards (Chauhan et al., 2021).

As a result, the food waste situation in Colombia remains worrying, with a total waste of 9.76 million tonnes, or 34% of the

total, distributed among different links in the supply chain, as shown in Graph II.



Source: Own elaboration, 2024 from the Departamento Nacional de Planeación (2016).

Graph II: Distribution of loss and waste by link in the food chain

According to the Departamento Nacional de Planeación (2016), the most wasted food in the country is fruits and vegetables (62%), followed by roots and tubers (25%). By stage of the food chain, agricultural production is responsible for the most food loss at 40.5%, followed by distribution and retail at 20.6%, post-harvest and storage at 19.8%, consumption at 15.6%, and industrial processing at 3.5%. These data highlight the difficulties faced by supply chains and the vulnerability of food systems in Colombia.

The outlook for supply chains and food loss and waste has put the Colombian state and the scientific community on alert, leading to an increase in research to find alternatives to improve supply chain dynamics and reduce food loss. Some findings suggest that, in order to guarantee food security, it is necessary for the supply chain to manage additional planning and design conditions, such as disruptive

events in rural areas, where production activities usually take place (Clavijo-Buritica et al., 2023).

On the other hand, the creation of sustainable and efficient networks that promote alliances with farmer organizations, traders and consumers has been recommended to improve productivity, economic viability, social equity and resource conservation (Carrillo, 2024), in order to move towards more sustainable and resilient systems (Reina-Usuga et al., 2023).

The problems associated with the supply chain and food loss hurt food security in Colombia, as the availability, accessibility, and stability of food are affected. Therefore, despite the relevance of agriculture and distribution through small businesses, food waste at different stages of production reveals the urgency of improving processes and adapting them to technological improvements, since poor management, low levels of quality,

and deficient infrastructure exacerbate this problem. To address this situation, collaborative measures, integrated approaches, and efficient planning are required for the country to move towards a more productive future.

3.4. Public policies and food security in Colombia

In Colombia, the issue of public policies related to national security is in line with the National Plan for Food and Nutritional Security (NPFNS), established in 2008, which aims to ensure that the population has constant access to varied and sufficient nutritious food. This is a response to food insecurity and the negative changes caused by climate change and supply chain disruptions, which lead to food loss and waste (Gobierno de Colombia, 2012).

In 2016, Resolution No. 2465 established the indicators and guidelines necessary to determine the nutritional status of children and adolescents, as well as the adult population. For the year 2012, the NPFNS was reformulated and its scope is defined until 2019, to reduce losses and promote sustainable practices in the food environment in Colombia, as well as activating complementary feeding plans, attention to breastfeeding mothers, support to local agriculture, improvement of the value chain, implementation of special attention programs for children at risk of malnutrition, among other aspects related to the Sustainable Development Goals.

In this regard, beyond promoting food production, emphasis is placed on the need to combat structural problems and unstable conditions, such as malnutrition, poverty, and growing social demands, which increase the nation's existing vulnerabilities (Gobierno de Colombia, 2012).

In the current context, the National Development Plan, also known as "Colombia World Power for Life", treats the issue of food security as a public policy priority, linked to macro proposals such as sustainable

development, to improve access to food and strengthen production, distribution, and marketing, reducing unjustified food losses. It aims to strengthen national production by supporting small producers and communities through technological innovation and territorial approaches.

In other words, public policies seek food production, to meet domestic demands and replenish current losses due to pests, pathogenic elements, climate change, and food waste, among other aspects that trigger this reality. In this way, food security is conceived as a matter of general interest, which requires a critical intergenerational perspective (Alvarado, 2019). The literature used suggests various alternatives to address food demands, supported by efficient management, leading to food access.

In this context, public policies need to be supported by scientific research to face adversities and mitigate risks, building resident systems for food systems, which implies greater efficiency in food production, use of natural resources, minimization of waste, and balance in food access opportunities.

Public policies are therefore geared towards improving food security, supported by the design and development provided by high-impact research in this field. From the above, it can be affirmed that the collaboration between the public sector, research institutions and communities, offers perspectives for social change to face, from an integral point of view, the degradation of the planet and food sources.

Conclusions

The issue of food security in Colombia presents a series of complex challenges that are in line with the social, economic, environmental, and political demands of the nation. While it is true that steps have been taken to improve the living conditions of citizens, food insecurity remains a real determinant of the quality of life of millions of people and is linked to other structural problems such as poverty, unemployment, and

social inequality, among others.

In the context of this research, climate change and supply chains have been highlighted as visible problems leading to food loss, destabilizing the national food system, production, and the provision of quality products to vulnerable sectors. There is therefore an urgent need to strengthen supply chains, improve agricultural practices, innovate technologies, and involve communities to promote collaborative and productive work from the social base, moving towards a sustainable nation that combines food security with prospects for the future.

For this reason, it is recommended that public policies be enforced to ensure the availability, access, use, and stability of food in both urban and rural areas. It is also suggested that sustainable, resilient agricultural practices be promoted as a mechanism for dealing with climate change, including the efficient use of local products and cultural preferences for them. In the area of education, plans, and programs could be developed to teach students how to properly handle and care for food. Similarly, educational plans could be proposed to raise awareness of healthy eating habits.

It should be noted that this research represents an exhaustive bibliographical review that comprehensively addresses the problem of food insecurity. However, it presents a series of limitations due to its theoretical approach, so it is proposed to give continuity through new lines of research related to technological innovation, agro-ecological production, sustainable development, and community production, among others, to reduce poverty and social inequalities in the nation through common work, as a means to face the internal and external challenges of the country.

The aim is to promote research that will lead to sustainable food production in Colombia, especially those products that are specific to the country, strengthen the local economy, and provide safe crops. This offers a wide range of opportunities for research and for the reformulation of public policies for the benefit of the community.

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