

Exploring Blue Zone food practices for sustainability and health in Ica, Peru

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Abstract

In Ica, a region located in Peru, the export-oriented agriculture is compromising food security, health issues, and environmental sustainability. The study examines the food system of Ica compared to the Blue Zones, regions known for their exceptional longevity and health, aiming to delve into how can Ica's agricultural sector and food system be aligned with Blue Zone principles to improve sustainability and community health. Previous research highlighted how the food component in Blue Zones impacts on mental well-being, physical activity and social connections. To address the food system of Ica, a mixed-methods approach was employed, such as comprehensive literature review, a comparative case study and interviews with residents. The findings emphasize the importance of community engagement in revitalizing traditional dietary practices and emphasize the need for initiatives to promote healthier and sustainable eating habits. By adopting sustainable agricultural practices inspired by Blue Zones Ica could enhance community health and environmental sustainability.

Key words: Ica, Blue Zone, food system, sustainability, eating practices

Introduction

Blue Zones is a concept introduced by Dan Buettner (2008) and refers to regions where residents exhibit exceptional longevity and quality of life. There are only five locations around the world that are classified as Blue Zones: Loma Linda (United States), Nicoya (Costa Rica), Icaria (Greece), Sardinia (Italy), and Okinawa (Japan). These areas provide valuable insights that contribute to the creation of nine principles (**Figure 1**) that make an area a Blue Zone (Rosero-Bixby et al., 2014; Madrigal-Leer et al., 2020), which in this paper will be condensed into four main principles —physical activity, local food, social connections, and mental well-being— to streamline the analysis and highlight the most relevant factors.

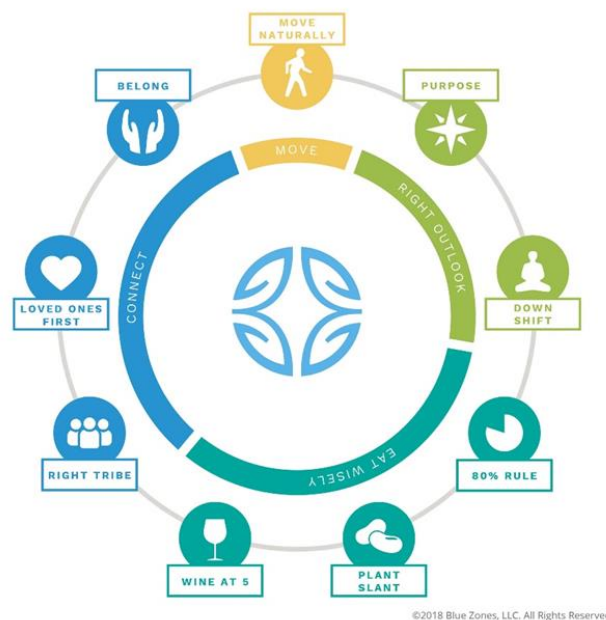


Figure 1: Nine principles that characterize Blue Zones. Taken from: Blue Zones.com.

The Blue Zone's success is partially attributed to the food principle, which relates to other principles (**Figure 2**). For example, in Ikaria, food plays a central role in social life and longevity

due to the importance of social life among elderly residents. Cultural significance is also linked to food tradition in Ikaria, with traditional recipes passed down through generations and the participation of family members in meal preparation, all of which strengthen relationships (Panagiotakos et al., 2011). Similarly, Sardinia's food component revolves around traditional farming methods and food preparation techniques passed down through generations which foster pride and continuity, essential for mental and emotional well-being (Wang et al., 2022). In other Blue Zones like Okinawa, food and longevity are deeply connected. As Terada (2023) noted, the role of traditional food and food memories among the centenarians are integral to their identity and longevity, as represented by regular physical activity in Okinawans, who integrated it through farming and gardening (Terada, 2023). Therefore, a Blue Zone food system can be a foundation for a healthy and sustainable livelihood.

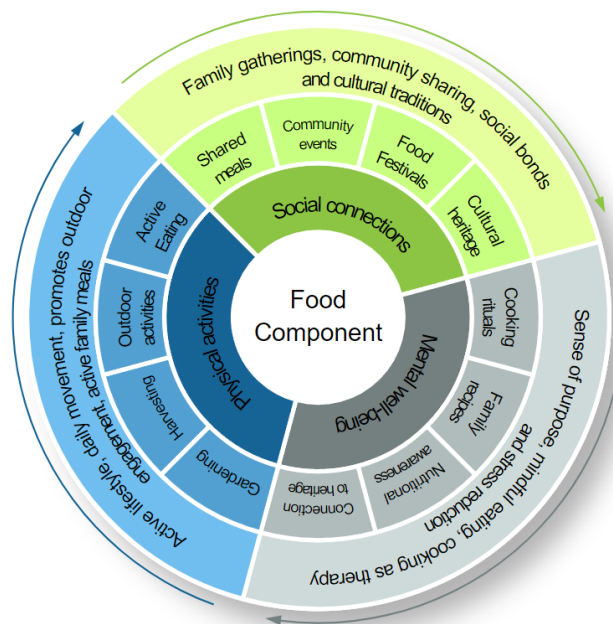


Figure 2: Food's relationship with social connections, physical activities, and mental well-being. Author's elaboration.

Food systems in Blue Zones (**Figure 3**) revolve around local production and plant-based diets, emphasizing freshness and traditional practices. Buettner's (2022) work highlights that Blue Zone diets typically work around local, seasonal produce and minimal consumption of processed foods, and this dietary pattern contributes to individual health and supports sustainable agricultural practices.

Nicoya, located in Costa Rica, is one of the five Blue Zones that serves as a global model for health and well-being initiatives. Nicoya residents, particularly centenarians, exhibit vibrant lifestyles and a 10% lower mortality rate among 90-year-olds than the national average (Bixby, 2013). Nicoya's food system relies on traditional agricultural methods emphasizing local food production, aligning closely with Blue Zone Principles. According to Pes et al. (2022), Nicoya's agricultural practices—including cultivating diverse crops such as beans, corn, and tropical food, which are staples in the local diet—promote food security and enhance the nutritional quality of the diet. Furthermore, the community's strong connection to the land and emphasis on family and social ties foster a sense of belonging and purpose (Poulain et al., 2013).

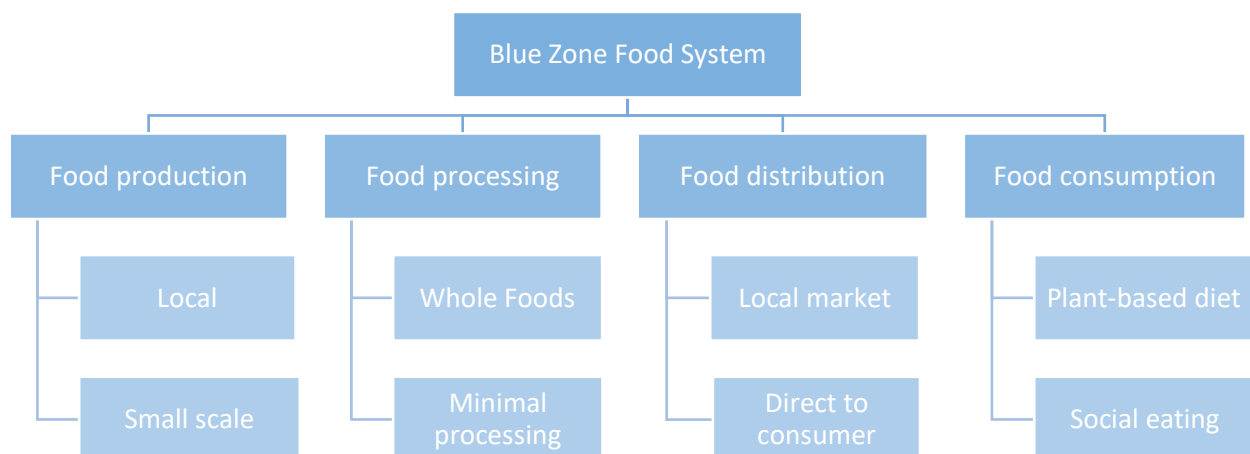


Figure 3: Study's conceptual framework. Author's elaboration.

The Blue Zone food system does not only provide valuable insights on healthy livelihood. Helne and Hirvilammi (2015) and Buettner and Skemp (2016) emphasize that integrating sustainability practices into daily life fosters a holistic approach to health and well-being. This echoed the comparative studies conducted by Thornhill et al. (2022) and Wiltshire et al. (2019) that highlighted the potential for Blue Zone-inspired practices to enhance public health and sustainability in diverse contexts. Additionally, Poulain et al. (2013) observed that these practices include sustainable agriculture and low environmental impact lifestyles.

The locally grown food and a plant-based diet of Blue Zone food systems contribute to environmental health by reducing greenhouse gas emissions and supporting biodiversity due to the minimize of carbon footprint associated with food transportation and livestock farming (Sage, 2014; Carvalho, 2017). However, conventional industrial agriculture practices, including monoculture and excessive chemical use, lead to soil degradation, water scarcity, and biodiversity loss, accounting for approximately 25% of global greenhouse gas emissions (IPCC, 2019; Millennium Ecosystem Assessment, 2005).

Peru has emerged as a significant player in the global agricultural market. However, the Peruvian profile does not reflect the economic benefits of this agricultural expansion, nor does it reflect increasing issues such as food insecurity and dietary quality. According to the report on Food and Nutritional Security in Peru (2020), a significant portion of the population still faces difficulty accessing nutritious food for a healthy diet. This situation is particularly evident in the Ica region, where the export of agriculture leads to environmental concerns, including significant water scarcity and soil degradation (Ministry of Health of Peru, 2018) and food issues.

Although Ica's food system is highly productive, concerns remain regarding local food security and nutrition as agricultural practices prioritize export crops over local needs (Rendón-

Schneir, 2009; National Institute of Statistics and Informatics, 2018). Compounding this issue, water scarcity and soil degradation challenge the region's sustainability efforts. Moreover, the prevalence of processed foods contributes to rising health concerns among the population (National Institute of Statistics and Informatics, 2020).

Despite the region's agricultural potential, food insecurity remains a significant concern in Ica. *Grupo Impulsor Inversión en la Infancia* report highlights that Peru's regions most affected by nutritional food insecurity include Ayacucho, Apurímac, Cusco, Puno, and Ancash. In contrast, regions with relative food security include Ica, Arequipa, La Libertad, and Moquegua. However, numbers are high in these regions (Figure 4), highlighting Peru's alarming spectrum around food. In addition to this alarming situation, the Peruvian government has not officially documented food insecurity statistics, as highlighted in the Food and Agriculture Organization (FAO) report titled "The State of Food Security and Nutrition in the World 2023".

In response to this hidden reality, two independent Peruvian sources (*Inversión en la Infancia* and *Ipsos*) collaborated to conduct a survey measuring the extent of food insecurity in the country (**Figure 4**). The findings of this survey echo the concerns raised in the "Emergency Food Security Assessment (ESAE)" conducted by the Ministry of Development and Social Inclusion (MIDIS) and the Ministry of Agriculture and Irrigation of Peru (MIDAGRI), which reveals an alarming level of food insecurity in rural areas but more vulnerable in urban areas.

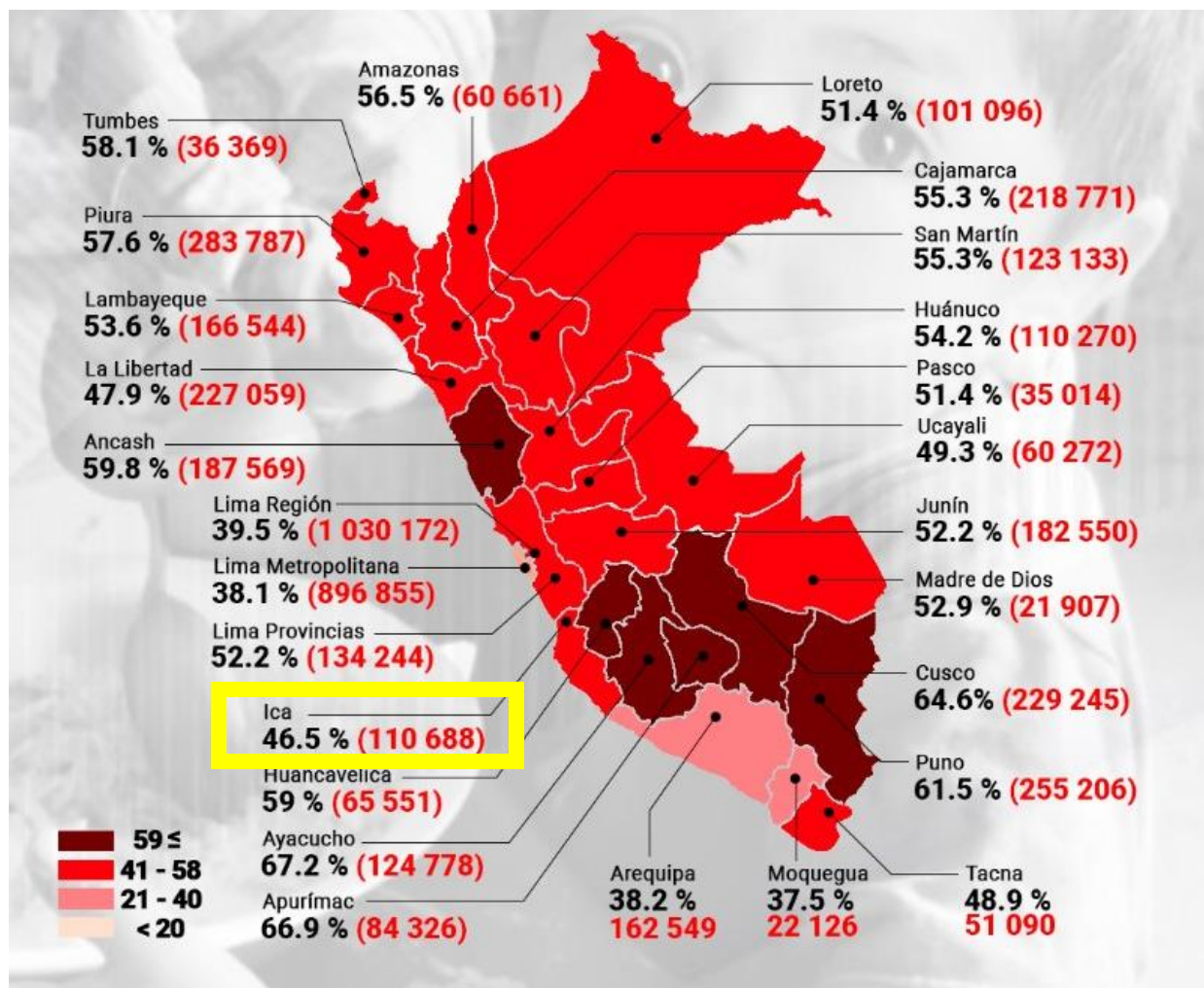
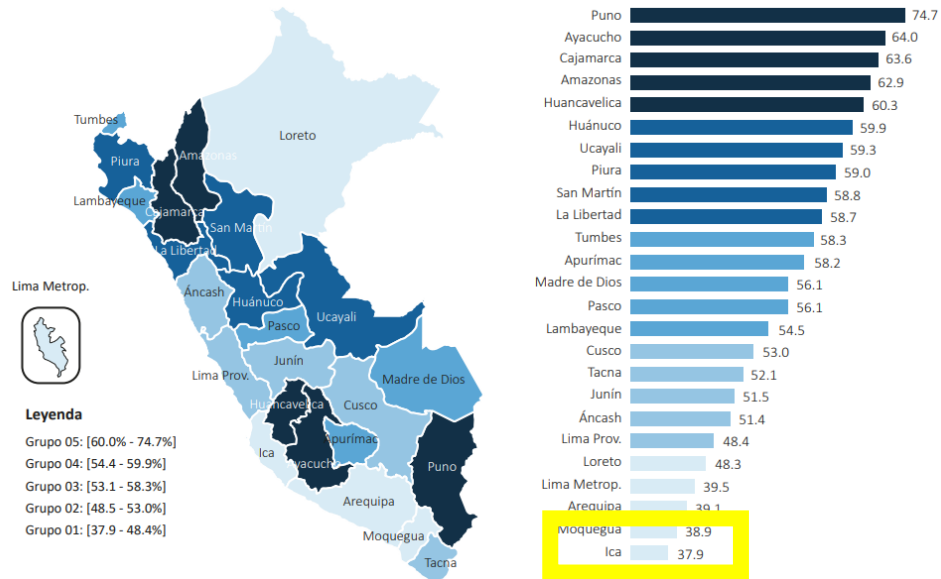


Figure 4: Peruvian food insecurity by region. Adapted from *Sobrevivir con hambre en el Perú* (*Inversión en la Infancia* and Ipsos, 2023).

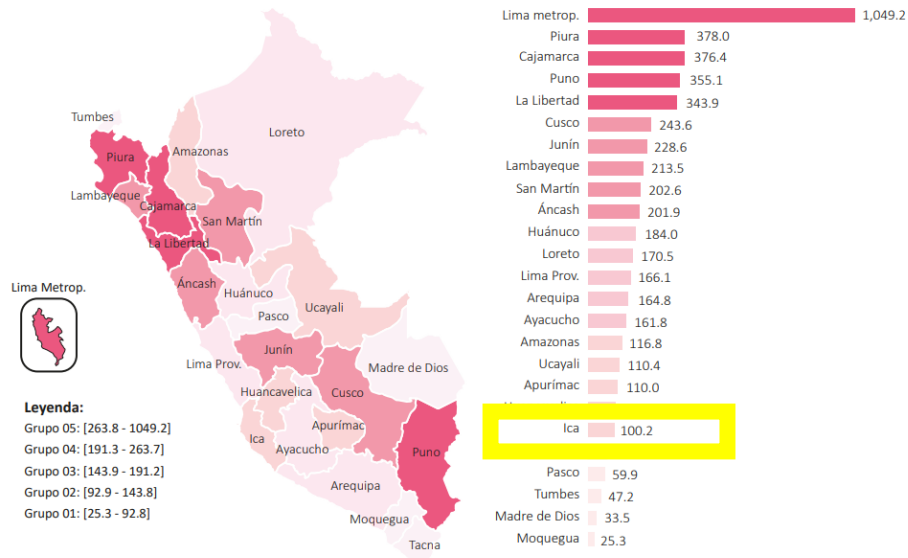
However, a general concern about these reports is the discrepancy in the data reported. In Ica's case, the MIDIS report (**Figure 5** and **Figure 6**) showed 10,488 households or 8.6% less food insecurity than the independent sources (**Figure 4**), highlighting the challenges of accurately estimating food insecurity in the region.

Despite these inconsistencies, Ica continues to face significant disparities related to food insecurity, emphasizing the need for a slight and comprehensive understanding of the issue.



1/ Lima Metropolitana comprende los 43 distritos de la Provincia de Lima y 7 distritos de la Provincia Constitucional del Callao.
 2/ Lima Prov. Comprende las provincias de Barranca, Cajatambo, Canta, Cañete, Huaral, Hurochiri, Huaura, Oyón y Yauyos.
 Fuente: MIDIS-WFP Sede Perú: Perú: Evaluación de la Seguridad Alimentaria ante Emergencias (ESAE), 2023.
 Elaboración: Ministerio de Desarrollo e Inclusión Social-Dirección General de Seguimiento y Evaluación.

Figure 5: Peruvian food insecurity by region. Adapted from *ESAE, 2023* (Midis and WFP, 2024).



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Figure 6. Food insecurity by region (Thousands of Households). Adapted from *ESAE, 2023* (Midis and WFP, 2024).

While Ica does not experience extreme poverty or the highest levels of food insecurity compared to other regions, it remains a critical area for study due to its agricultural strength. The region is known for its fertile land and diverse agricultural output, making it a good candidate for becoming a Blue Zone.

Despite much research that has explored Blue Zones, less attention has been paid to how their practices can be adapted to different contexts. By focusing on sustainable agricultural practices and enhancing community health, Ica has the potential to become a model for other regions in Peru.

Exploring Ica's food systems and its challenges and comparing them with Nicoya's sustainable food practices are of significant interest. This intriguing problem highlights the potential of sustainable practices to significantly enhance quality of life. Solving the problem could improve health outcomes, provide longer life expectancy, and enhance environmental sustainability while enhancing food security in Ica. Blue Zones, like Nicoya, provide a blueprint for sustainable living that could be adopted worldwide to improve health and longevity (Buettner, 2008). In other words, Ica could become a model for sustainable food development/production by adopting food strategies from Blue Zones, leading to broader applications to other regions facing similar challenges. This study delves into the agricultural sector and food system of Ica, Peru, aiming to identify areas where sustainability and community well-being can be improved.

Methodology

Study area

Ica region is located on the southern coast of Peru and is characterized by its diverse demographic and socio-economic landscape (**Figure 7**). The population of Ica district is approximately 1, 000,000, with a significant portion residing in urban areas (92,4% population residing in urban areas and 7,6% residing in rural areas) particularly the city of Ica, which serves as the regional capital. The demographic profile indicates a youthful population with a median age of around 27 years (INEI, 2021).



Figure 7: Locator map of Ica District in Peru. Taken from: Wikipedia (2010).

Ica is an ideal case for studying food systems and human well-being due to its heavy reliance on agriculture and resultant environmental challenges. However, food insecurity remains at 46.5%, as many residents lack access to nutritious food despite the region's agricultural wealth (Food and Nutritional Security in Peru, 2020). Ica's reliance on export-oriented agriculture — crops include asparagus, grapes, avocados, onions, pomegranates, blueberries, and various types of peppers— often prioritizes cash crops over local food needs, exacerbating malnutrition and

health disparities (Inter-American Network of Academies of Sciences, 2018). Ica has 254 thousand hectares of land suitable for agriculture, which approximately 91.3% are under irrigation and the rest depends on rains. While production for export purposes use adequate technical irrigation systems (e.g. Subsoil waters), mainly crops for local consumption use irrigation by flooding (Central Reserve Bank of Peru, 2018). Furthermore, environmental challenges such as water scarcity and soil degradation threaten sustainable food production, making Ica a key area for research on resilience and sustainability in food systems (Cadwallader, 2013).

Research design

To understand how Blue Zone practices can be adapted to different contexts, this study compares the food system in Nicoya, Costa Rica, to Ica, Peru, to identify practices that can transform Ica environmentally and socially into a place where everyone can thrive. The comparative case study framework is supplemented with interviews to derive deeper understanding of cultural eating practices in Ica. Additionally, literature review is used to collect data on food system components in Nicoya and Ica to recommend improvements to Ica's food system.

Research question

How can Ica's agricultural sector and food system be aligned with Blue Zone principles to improve sustainability and community health?

Data collection and analysis

The study relied on literature review and interviews for data collection. Literature review was used to collect data on food system components that can be implemented in Ica. The

literature review employed a systematic approach to gather and analyze information on Blue Zone principles, agricultural practices, and food systems in both Blue Zones and Ica, Peru. Publications were selected based on relevance, recency (prioritizing sources from the last ten years), and credibility, including peer-reviewed academic journals and reputable grey literature. Critical databases such as Web of Science, Scopus, and Google Scholar were searched using combinations of terms like "Blue Zone principles," "Ica, Peru agriculture," "sustainable food systems" and "resilient food system." The analysis involved thematic coding, identifying recurring patterns across the literature, and categorizing information according to food system components. This approach allowed a systematic comparison between Blue Zone practices and current practices in Ica. It used the synthesized information to identify gaps and develop context-specific recommendations, aligning them with Blue Zone principles.

To complement the literature review and gain insights into local eating habits, interviews were conducted to understand better the role of social connection and consumption in Ica's food system. The interview consisted of five questions about daily eating habits, food-related rituals, and perceptions of dietary changes over time.

Participants were selected to represent diverse ages and backgrounds within the Ica region. The participants were identified from personal connections, and only those who lived in Ica were selected. Four participants were born and live in Ica while one participant was born in Lima but residing in Ica now. The interviews were conducted on the phone and audio recorded. The recordings were translated, transcribed, and analyzed using the thematic approach. When coding, the data was analyzed for the following information: personal food production and food consumption context.

Results

Data collected from the literature review and interviews helped understand agricultural practices in Blue Zones and Ica, Peru.

Table 1: Comparison of dietary and eating patterns in Blue Zones and Ica, Peru.

Dietary Pattern	Nicoya, Costa Rica	Ica, Peru
Main food staples	Corn, rice, and black beans (Appel, 2008).	Rice, potatoes, and legumes, with a strong emphasis on local grains.
Protein sources	Beans, dairy products, and moderate amounts of meat, particularly pork. Fish is consumed but less frequently compared to other protein sources (Pes et al., 2022).	Heavy consumption of chicken, some fish, pork, legumes such as lentils, and beans.
Fruit and vegetable consumption	Mango, papaya, oranges, and bananas, with vegetables like squash, tomatoes, and bell peppers (Buettner, 2010).	Grapes, avocados, and citrus fruits, alongside various vegetables like tomatoes or potatoes.
Processed food consumption	Some processed foods are consumed, but the focus remains on whole, locally sourced ingredients. However, the availability of processed foods is increasing (Buettner, 2010).	The consumption of processed foods is already high and increasing, particularly carbohydrates and sugary beverages.
Eating patterns	Typically eaten in a communal setting, focusing on family and social interactions. Often three meals a day, with a significant emphasis on breakfast and lunch (Pes et al., 2022).	Less people eating in family. Structured around three main meals a day, with lunch being the most significant meal.

Table 1 compares dietary and eating patterns between Blue Zones (exemplified by Nicoya) and Ica, Peru. Notable differences emerge in their main food staples, protein sources, and consumption of processed foods. While both regions emphasize local grains and legumes, Ica relies more on animal proteins and processed foods. This contrast is particularly evident in

the consumption of processed foods, which is increasing in Ica but remains limited in Blue Zones. The eating patterns also differ, with Blue Zones emphasizing communal, family-centered meals, while Ica's meal revolves around three main meals and less family frequency, with lunch being the most significant meal.

Table 2: Comparison of agricultural practices in Blue Zones (represented by Nicoya, Costa Rica) and Ica, Peru.

Agricultural Practice	Nicoya, Costa Rica	Ica, Peru
Production system	Small-scale, subsistence	Commercial production
Crop diversity	High crop diversity	High crop diversity
Water management	Rainwater harvesting and the use of natural water sources	Advanced irrigation techniques, including drip irrigation
Soil conservation	Crop rotation and intercropping	Use cover crops and reduced tillage to prevent erosion and maintain soil fertility, although challenges remain due to intensive farming practices
Use of pesticides/fertilizers	Limited use of pesticides	Prevalent use, particularly in large-scale farming operations aimed at maximizing yield for export markets
Local vs. export focus	Primarily local	Much of its agricultural production is directed towards international markets, particularly for high-value crops

Table 2 illustrates the contrasting agricultural practices between Blue Zones and Ica, Peru. While both regions maintain high crop diversity, significant differences exist in their production systems, water management, and market focus. Ica's agriculture is characterized by commercial production with advanced irrigation techniques for exports, prevalent use of pesticides, and a strong export focus. In contrast, Blue Zones typically feature small-scale, subsistence farming with limited pesticide use and a local market focus.

Table 3: Health indicators in a Blue Zone (represented by Nicoya, Costa Rica) and Ica, Peru.

Indicator	Nicoya, Costa Rica	Blue Zones	Ica, Peru	National Average (Peru)
Life expectancy	85 years	More than 90 years	73 years	76 years
Rates of chronic diseases	Lower rates of chronic diseases	Lower rates of chronic diseases	Increase in chronic diseases (Rates of diabetes and hypertension are rising, influenced by diet and physical inactivity)	Chronic diseases are on the rise (significant rates of cardiovascular diseases, diabetes, and respiratory conditions)
Obesity rates	Relatively low, estimated to be around 10-15%	Generally low, often below 10%	Around 30% of the adult population may be classified as obese or overweight	Estimated to be around 28%
Mental health indicators	Generally positive due to strong social networks, a sense of purpose ("plan de vida"), and active engagement in family and community life	Strong mental health indicators, including lower rates of depression and anxiety.	Rising concerns about stress and anxiety, particularly among urban populations	41% of the population has depressive symptoms (Estrada-Ancajima & Estrada-Ancajima, 2023)

Table 3 provides a comparative analysis of key health indicators across Nicoya (a Blue Zone), Blue Zones in general, Ica, Peru, and the national average for Peru. The data reveals sharp contrasts, particularly in life expectancy and rates of chronic diseases. Nicoya and the rest of Blue Zones demonstrate significantly higher life expectancies and lower chronic disease rates than Ica and Peru's national average. Notably, obesity rates and mental health indicators in Ica and Peru overall show concerning trends, with higher obesity rates and increasing mental health issues compared to Blue Zones.

Table 4: Sustainability challenges and recommendations for Ica, Peru, by production, processing, and distribution.

Food System Component	Sustainability Challenges	Recommendations
Production & access	<ul style="list-style-type: none"> • Water scarcity • Soil degradation • Disparities in access to fresh produce • Food insecurity • Heavy reliance on export markets • Local economy vulnerable to global fluctuations 	<ul style="list-style-type: none"> • Sustainable agricultural practices and crop diversification • Integrated water management • Promote local markets that sell fresh produce • Support for local farmers • Encourage climate-resilient farming practices
Processing	<ul style="list-style-type: none"> • High energy consumption in processing facilities • Pollution from processing waste • High water usage during processing 	<ul style="list-style-type: none"> • Local processing facilities to support smallholder farmers and reduce dependency on exports • Sustainable logistics and transportation methods • Partnerships between producers and local markets • Develop water-saving processing techniques
Distribution	<ul style="list-style-type: none"> • High carbon footprint from transportation of goods • Limited access to markets for smallholder farmers • Price volatility affecting small producers 	<ul style="list-style-type: none"> • Develop sustainable logistics and transportation methods • Create local food hubs to connect smallholder farmers with markets • Implement fair pricing mechanisms to protect small producers • Establish partnerships between producers and local markets

Table 4 outlines the sustainability challenges Ica's food system faces and provides corresponding recommendations for each component of the food system (except for the consumption food component, which is discussed separately in the following paragraphs). The table highlights significant issues across production, processing, and distribution, including the over-export focus that leads to water scarcity, soil degradation, high energy consumption, and

limited market access for smallholder farmers. The recommendations propose a shift towards more sustainable practices, such as integrated water management, crop diversification, and the development of local food hubs.

Table 5: Interview results on eating/dietary practices and patterns in Ica, Peru.

Demographic	Eating habits	Special practices	Cultural Influences	Family dynamics	Food production
20 years	Traditional lunch on weekends; three meals a day	Family members take turns to give thanks before meals	Traditional eating due to grandparents' background	Large gatherings are less frequent now than in childhood	Yes
55 years (lived in Okinawa for 9 years)	Takeout dinner; no sugary drinks due to diabetes; local fruits; three meals a day	None	Japanese food preferences due to connections to Japan	Lives with parents; breakfast is shared with parents; lunch is often with husband	No
20 years old	Prefers lighter dinners; traditional and non-traditional meals; three meals a day	None	None	Family meals only during special occasions (Christmas or birthdays); prefers eating alone	Yes
69 years old	Consumes some traditional dishes; three meals a day; prefers traditional beverages like alfalfa tea over modern options	Used to have family meals with music but gratitude practices have diminished over time	Values traditional recipes and ingredients; seeks out local foods when visiting Lima but finds it challenging to find them there	Family gatherings have decreased over time due to separation and loss; minimal gatherings now compared to her youth	Yes
27 years old	Fast food for dinner; prefers traditional	Makes the sign of the cross as taught by parents	None	Eats alone at night; participates in local	No

	foods but finds them less accessible at night; local fruits like			festivities where traditional foods are served	
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The results from the interviews of Ica's residents provide an understanding of personal food consumption and their perspective on modern challenges and traditional practices. Participants expressed a strong connection to local agriculture, with many supporting family or friend's vegetable or fruit production. For example, Participant 1 noted that her family collaborates with a friend's local producer to access fresh produce, which fosters community ties and supports local agriculture. Besides, traditional foods such as legumes and rice remain staples in the diets of the interviewees, reflecting that these crops are not produced for export but are grown mainly for local consumption. However, there is a shift in dietary patterns, particularly among younger participants like Participant 5, who reported an increasing reliance on fast food due to convenience, especially during dinner.

Moreover, some participants noted a decline in communal eating practices and family gatherings over time. For instance, Participant 4 shared that large family gatherings have become less frequent since her youth, diminishing the social connections in shared meals.

Additionally, health issues such as diabetes were mentioned by Participants 2 and 4, indicating a growing awareness of the impact of dietary choices on well-being. While there is a rich tradition of local food production in Ica, modern dietary shifts towards convenience foods represent significant challenges to maintaining healthy eating habits and preserving cultural food practices.

Discussion

Ica's lifestyle interview results illustrate how the lack of traditional eating habits affects social connections, well-being, and food consumption behavior. Because the food component is one of the essential principles responsible for the success of Blue Zones (Rosero-Bixby et al., 2014; Madrigal-Leer et al., 2020), addressing the food-related practices and associated culture is important in creating a sustainable food system.

Peru's processed food consumption has increased by 260% in the last decade (World Health Organization, 2015). This growth suggests an upward trend in demand for processed food, especially in urbanized areas, which could also be reflected in regions such as Ica, where most of their population lived in urban areas and according to independent Peruvian sources (*Inversión en la Infancia and Ipsos*) urban areas are the most affected by food insecurity. However, no data supports the increasing demand for processed food in Ica. However, Monteiro et al. (2013) state that the rise of ultra-processed food consumption is a global phenomenon linked to adverse health outcomes, including obesity and diabetes. This statement is evident in Ica, where easy access to ultra-processed foods leads to poor health outcomes. It contrasts the region's large export-oriented agricultural production, which could lead to thinking that Ica has better eating habits due to its potential.

The percentage of agricultural exports in Ica is 30%, representing 65% of Peru's agricultural exports. While some studies and organizations, such as *Diagnostico económico regional, Diagnóstico del crecimiento de la región*, Ministry of Agriculture and Irrigation (MIDAGRI), and The Institute of Statistics and Informatics (INEI), support export-oriented agriculture information, there is not much information on what happens locally. Information from the Central Reserve Bank of Peru states that agricultural and livestock production activities amounted to 10.7% in 2013. Although some data about Ica's production and exportation may

exist, there are no exact or updated statistics on what percentage of local agricultural production is consumed regionally. This uncertain data may reveal a significant problem that needs the focus of national and local entities. In order to achieve food system sustainability like that of Blue Zones, it is necessary to have control of the local food production to ensure that the local food needs are met first to ensure access to culturally appropriate and healthy food. The food component in Blue Zone fosters traditions, promotes cultural identity, and creates food memories (Panagiotakos et al., 2011; Wang et al., 2022; Terada, 2023). These are important for a healthy social life, promoting longevity and overall health.

In Ica, the opposite trend is an intense desire for access to traditional foods. Ica represents an interesting case, as none of the interviewees mentioned economic reasons for not being able to access healthy food. Moreover, Ica is among the regions with the lowest incidence of poverty in Peru, and food insecurity rates are below the national average (Food and Nutritional Security in Peru, 2020), indicating that prioritizing processed food over traditional food is not connected to economic access. The results demonstrate that this trend is more cultural and social. The study by Sadler et al. (2021) discusses how the increasing consumption of ultra-processed foods is associated with negative social and cultural impacts, such as the weakening of traditional food cultures, loss of culinary diversity, and declining family life. Even with sufficient economic resources, people in Ica may feel disconnected from traditional foods due to the dominance of processed foods, a food system that prioritizes exports over local food needs and modern lifestyles. Thus, the cultural value attributed to traditional foods and the social identity connected to these dietary practices highlights how food choices issue access and preserve heritage, community bonds, and a sense of belonging. For instance, interviews revealed that many participants expressed frustration with the lack of availability of traditional foods. However,

individuals consciously choose processed options due to convenience or perceived status associated with certain foods (Chen & Antonelli, 2020).

Regular community meals organized around local foods could be encouraged to help revitalize communal eating practices and strengthen social connections. Community leaders and local organizations might also consider hosting events celebrating traditional culinary practices and featuring shared meals. For instance, one of the interviewees recognized the existence of a celebration called the *vendimia*. This festival celebrates grape production, but almost all the interviewees were unaware of this practice. Therefore, boosting these events could strengthen bonds among the community members, teach them about locally available foods, and inspire a shared commitment to healthier, locally grounded food habits. All of this can contribute to the food sovereignty of the region.

In Blue Zone regions like Nicoya, food sovereignty is promoted through traditional agriculture and social engagement (Pes et al., 2022). Nicoya's socio-cultural emphasis on communal dining contrasts sharply with the shift towards solitary eating in Ica. The results show that family meals are becoming rare, especially among younger participants. Rehkopf (2018) and Madrigal-Leer et al. (2020) underscore how family-centered food rituals contribute to psychological and physical health, supporting a sense of belonging. Adapting these communal aspects could enhance Ica's collective well-being.

Some argue that incorporating traditional diets into people's everyday lives can address food insecurity. However, these initiatives face challenges; for example, Branellec's school gardens (2022) often struggle with limited resources and community involvement. Another initiative is *Qali warma*, a social program created by the Ministry of Development and Social Inclusion (Midis) of Peru that provides nutritious food to public school students of all regions.

However, this suffers from lousy administration and poor quality measures and resources. This challenge highlights the need for comprehensive strategies and the continuous support of national and regional entities to educate and improve access to traditional foods within the community and promote social interaction. Schools and community centers could play a role by organizing workshops on traditional recipes and nutrition using local ingredients. Those programs could encourage young people to appreciate and reconnect with their culinary heritage and benefit from healthier eating practices.

In addition to these cultural shifts, the incentives for household-grown agriculture underscore the potential benefits of integrating sustainable practices into Ica's food system. Countries like Bolivia, Ecuador, Mali, Nepal, Nicaragua, Senegal, and Venezuela have incorporated food sovereignty agendas into national legislation, emphasizing local food production and self-sufficiency (Enriquez, 2020). These policies often focus on sustainable agricultural practices, community-supported agriculture, and the right to produce food, collectively contributing to improved health and environmental outcomes. This comparison suggests that Ica could benefit from similar policies encouraging local agriculture while addressing environmental sustainability, such as land reform to redistribute land for local food production, support for local farmers, and initiatives to promote the cultivation of traditional crops.

Conclusion

This study aimed to investigate the agricultural practices and dietary habits in Ica, Peru, particularly in comparison to the Blue Zones known for their health and longevity. The literature review provided insights into the agricultural systems of Nicoya and Ica and environmental impacts of Blue Zones and Ica. Five residents of Ica were interviewed about their dietary and

eating practices to learn about consumption and social connections patterns. The main findings indicate a growing reliance on processed foods, a decline in traditional food practices, cultural shifts in eating habits among younger generations, an increase in solitary eating practices, and a strong desire for greater access to traditional foods.

To align Ica's food systems with Blue Zone principles, addressing the decline in social connections by promoting culinary traditions, communal meals, and over-exported agriculture by implementing policies that foster sustainable agricultural practices —crop diversification and climate-resilient farming—is essential. Key stakeholders, including policymakers and local market organizers, should collaborate to enhance local food security through fair pricing and resource-efficient techniques. Prioritizing resident's needs is crucial for improving access to nutritious, locally grown food. Additionally, sustainable food production, processing, and distribution methods must be emphasized to reconnect generations with traditional food. Ica can become a model for sustainable food systems in other regions by focusing on these areas.

Limitations

There may be some possible limitations in this study. The sample size and background of interviewees may lead to some biased answers, and economic implications were not taken into consideration. While five persons were interviewed for this study, not all lived in different districts in Ica, so the results may not fully represent Ica's consumption patterns. Additionally, the study primarily focuses on qualitative insights from interviews and available health and demographic indicators without extensive economic analysis or broader sampling across Peru's agricultural regions. The lack of extensive economic analysis and broader sampling limits the ability to compare Ica's situation with that of other regions facing similar challenges.

Future work recommendation

Future work in this area could explore the socio-economic implications of promoting a sustainable local food system, especially in regions where agriculture represents an important component of its economy.

Additionally, researchers could conduct comparative studies to evaluate the outcomes of similar sustainable food system models in other regions with comparable agricultural conditions. These studies could provide valuable insights into best practices for policy development and community-based initiatives to improve food security and sustainability.

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Index

Interview Questions

1. Can you describe a typical dinner for you on an average day? Please include where you eat, who you eat with, and any special practices like praying or giving thanks.
2. How often do you eat meals with your family or friends? How does eating together (or separately) impact your dining experience?
3. Are there any rituals or practices you follow before or after eating? Can you describe them and explain why they are important to you? If you don't have any, why do you think that is?
4. Is there any food or drink that you consume daily? What is it, and why is it a part of your daily routine?
5. How do you think you're eating habits compare to those of your parents or grandparents? Have you noticed any changes in local food traditions over time