

Article

When the Sugar Runs Out: Transitioning Agricultural Systems and Their Effect on Dietary Diversity in Yaguajay, Central Cuba

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Abstract: The past years have shown the widespread vulnerability of agro-food systems and rural diets to external perturbations such as wars, climate events, and pandemics. Experiencing numerous obstacles, Cuba constitutes an example of success in the transition to agroecological sustainability models. This article characterizes how processes of agricultural change, local development, and industrial degrowth have impacted food availability and dietary diversity among rural livelihoods in the municipality of Yaguajay, Sancti Spíritus, for the past forty years (1980s–2020s). It integrates findings from focus groups, repeated nutritional surveys, and interviews carried out between 2016 and 2022 among residents of the towns of Yaguajay and La Picadora. The goal is to identify effects and response strategies within agro-food systems of rural populations. Distinguishing between periods of abundance and shortage, our findings show two counterpoints: intensive sugar monocrop cultivation, which resulted in high dietary variety; and economic crises in the 1990s and during the last period of the pandemic, which have led to significant dietary adjustments. The article concludes by underscoring the importance of comprehensive assessments of dietary strategies to elicit what agroecological transitions mean for local realities and of the value of food consumption and small-holder production experiences to understand the limits to sustainable transformations.

Keywords: sustainability transitions; diets; agroecology; food system resilience; climate change



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1. Introduction

The year 2003 saw the closing of the last sugar mill in Yaguajay, Central Cuba. Once a lively municipality with over one-third of its population directly employed by the sugar industry, the region was swiftly transitioned into livestock farming, including small-scale, organic, and commercial production operations [1–3]. The shift in agricultural practices was nothing short of revolutionary for thousands of households, which saw their livelihoods profoundly changing in under two years. Beyond a reconversion of the working force and the introduction of sustainable development programs, local communities once again experienced instabilities and swings in dietary practices. The sugar-productive conglomerate, locally known as complejo agroindustrial azucarero, was the primary and often unique source of income for most families. With its disappearance, food provisioning programs stopped operating, and communities lost secure access to food supplies. While changes in diets are an expected after-effect of any agricultural transition process, scarce attention has

been paid in rural studies to the nature of dietary strategies among Cuban farmers. This is a surprising outcome for numerous reasons.

In a developing nation such as Cuba, which has been signaled as an example to follow toward the adoption of agricultural sustainability models under strenuous political and economic circumstances, scarcity is frequently documented by the government as a direct result of the long-standing embargo [4]. Lack of access to foreign markets has severely impaired the country's capacity to obtain key agricultural staples, such as seeds, fertilizers, spare parts, and diesel, which are crucial for self-sufficiency in food production. As a result, Cubans have seen severe food shortages in the 1990s and early 2000s. More presently, with events such as the Coronavirus-19 pandemic, the strengthening of sanctions by the United States government in the mid to late 2010s, and the loss of tourism, families are enduring a new set of challenging conditions.

In fact, retrospective studies of weight changes and morbidities from 1980 to early 2010s discovered an average loss of 4 to 5 kg across the adult population as an aftermath of the economic crisis that followed the dissolution of the Soviet Union in 1991 [5]. The reduction of foreign trade during the years 1991–1995 resulted in a 75% contraction of imports to the values of 1989. During the same period in the early 1990s, agricultural production saw a decline of 47%. Decreases in the availability of fuel and food items inaugurated multiple cycles of inflation and led to a 34 to 36% dip in consumption at the household level for the last decade of the twentieth century [6]. Franco et al. showed that, between 1988 and 1993, per capita daily energy intake decreased from 2899 to 1863 calories. Other authors indicate that the impact was immediate and grave, with a reduction in protein intakes between 37% and 42% in the early 1990s, and important deficits in vitamin B1 [6–8]. Simultaneously, the proportion of physically active adults increased from 30 to 67% [9]. Driven by the shortages in diesel, public transportation receded. People resorted to horses, bikes, and carts for transport, and to the walking of long distances when none of these were available. Sustained weight losses and changes in activity levels in the 1990s were considered important factors explaining changes in the prevalence of diabetes and coronary pathologies towards the early 2000s. Most importantly, findings reflected a change in the composition of diets, suggesting a shift in nutritional strategies in the population. In comparison to 1980, at the beginning of the crisis in 1991 through 1994, dietary profiles showed a higher proportion of carbohydrates originating in sugar cane and rice. Profiles also exhibited reductions in the proportion of fat and protein due to the lower consumption of animal products [9]. To substitute for the scarcity of animal protein, the state instituted new rations, with 7 eggs and 2 pounds of fish granted per adult each month [6]. To many Cubans, state solutions remained insufficient. Thus, the last decade of the twentieth century became known as the “special period”, the time when food security emerged as a strategic issue of concern not just for the revolutionary government, but also for the people [8].

Overall, and despite the many challenges, Cuba was able to recover its economy by the early to mid-2000s. The country exhibited in 2009 a prevalence of population malnourishment well below 3% and no presence of severe or chronic child malnourishment, a fact that distinguishes the nation from other Latin America countries. Whereas diets have been described as meeting nutritional goals according to the United Nations, food practices show a comparatively low dietary breadth and an ample reliance on private outlets to meet household demands [10]. Faithful to its socialist values, throughout the past several decades, Cuba has made significant investments in resources and capacity development to attain alimentary sufficiency. Numerous policies centering on food security such as the rationing and broad-scale distribution of key food groups to vulnerable populations have been the norm. Yet, some of these policies have remained unsuccessful. In this context, an understanding of the trade-offs faced by rural households during the economic and agricultural production transitions can shed important insights for public health and nutritional experts. This is a task that remains pending within rural populations in Cuba and that we seek to explore through this article.

Dietary Studies and Agricultural Production in Cuba in the Context of Sustainable Models of Agriculture

Until very recently, studies of dietary trade-offs in Cuba have been mostly conducted at a national scale with detailed descriptions only covering major urban centers such as Havana [11–15]. The latest 2010–2011 National Survey of Risks Factors and Prevention Activities of Non-Transmissible Diseases coordinated by the National Institute of Hygiene, Epidemiology, and Microbiology (Instituto Nacional de Higiene, Epidemiología y Microbiología INHEM), The National Bureau of Statistics (Oficina Nacional de Estadísticas, ONE), and the National Institute of Nutrition and Dietary Hygiene (Instituto de Nutrición e Higiene de los Alimentos, INHA), however, has included a study of rural populations [16]. Detailed findings are not accessible, restricting knowledge of rural diets to general comparisons and outdated reports. For example, at the regional level, some information can be obtained for six clusters of provinces in the Ethnographic Atlas of Cuba, which was compiled between 1980 and 1990. The latter document sought to assess the changes brought by the Revolution in traditional diets and habits by contrasting two rural surveys, one from 1957 and another from 1988 [17]. Although rich in details, this and other works do not inform on the specific strategies that farmers rely upon to deal with periods of scarcity or increased availability. Household strategies refer here to the deliberate set of planned actions to address changes in socioeconomic and environmental conditions imperiling the survival of a domestic unit [11,18]. Strategies capture practices adopted to procure resources during times of crises and to secure the reproduction of the family [19,20].

In addition to concerns about dietary sufficiency, over the past few years, the urgency to foment societal transformations that can support economic, social, and ecological sustainability in food production practices across developed and developing countries has become dire [21,22]. Within calls for change, agricultural production systems which are responsible for a third of total greenhouse gas emissions [23,24] have been at the center of discussions [25,26]. Modifications in agricultural techniques include changes in land use, fertilization, and crop selection to increase the amount of carbon stored in soil and vegetation. Organic agriculture and agroecological practices, which do not rely on industrial pesticides or agrochemicals and employ small-scale farming strategies such as crop rotation and minimum soil tillage, have been found to have a stronger potential for climate change mitigation when compared to conventional cultivation methods [27–29]. However, organic production can result in lower yields per hectare for some crops, creating the need for extensive land use to meet agricultural demand [30,31]. It can also increase production costs and, ultimately, consumer prices as it is more labor-intensive. Yet, this is only one among several socioeconomic concerns pertaining to the broad-scale adoption of sustainable organic practices, which may encompass certification issues and export dynamics [32,33].

Forced to transition its agricultural production to organic farming due to a complex sociopolitical scenario, Cuba has been one of the preferred case-studies among scholars of sustainability [4,34,35]. With the decline of the Soviet bloc in the early 1990s, the island lost access to export markets for its single most important commodity: sugar. Most significantly, Cuba was no longer able to procure key utilities such as chemical fertilizers, animal feed, and essential technology to support its agricultural sector. The sudden transition was heralded as a success in terms of social, ecological, and economic standards. Captured by sustainability indicators such as the Human Dimension Index or the Sustainable Society Index, the wide-scale adoption of organic policies has been seen by scholars and practitioners as largely positive [36]. To some, Cuba has become “an antidote to the hyper-commercialized and industrial food systems of the Global North” [37]. The success behind this shift has been attributed to the particular mix of strong institutional and policy frameworks that continue to scaffold Cuban development priorities [38,39].

A more nuanced view of the agricultural sector, however, illuminates other dimensions of the transition that can escape broad-scale policy analyses [40,41]. For example, even when the country embraced organic regimes to an unprecedented historical extent,

the growth in smallholder farming, peri-urban and urban agriculture, and state-sponsored production cooperatives were not without obstacles [42,43]. The process of decentralization and reconversion was very gradual, requiring the implementation of numerous territorial development programs over the past thirty years that have only recently gained momentum. The shift in production was disruptive of former local practices, requiring extensive participation of social movements and external actors such as universities, and the spearheading of a grassroots approach to development [37,44,45]. In addition, the transformation of the agricultural system only seems to have gained traction after the deactivation of the sugar monocrop industry in the early to mid-2000s [35,46]. As sugar factories were compulsorily shut down and the island lost access to food imports from other socialist countries, a large section of the population reverted to small-scale farming and ranching as a way of sustenance. It was indeed a strategic decision for agricultural workers at the lowest levels. The shifting from technological agriculture to sustainable production reflected a new reality: virtually inexistent industrial inputs such as oil for mechanized activities, decreasing imports of food items and prohibitive prices, and a complete lack of access to financial markets. Rather than a choice, the transition to organic and agroecological practices was made out of necessity and often required careful strategizing within households [4]. The expansion of smallholder farms was only attained in 2008, after the introduction and incentivization of usufruct policies that transferred state-idled lands to private individuals and cooperatives [2]. In 2013, about 70.8% or 4.5 million hectares of Cuba's arable land were in the hands of non-state parties, with roughly half of the land under cultivation [47]. By 2016–2017, the percentage of land under non-state tutelage increased to 80%. Of this proportion, 49% of the distribution fell under three types of cooperatives (Unidades Básica de Producción or UBPC; Créditos y Servicios, or CCS; and, Producción Agropecuaria or CPA), and 29% was held by individual farmers under usufruct contracts [48]. Presently, the process of political transformation of the agricultural system continues. Significant steps were introduced in 2012 and 2019 as a result of the new Cuban constitution, and more recently, with the Coronavirus-19 pandemic [49].

Because family-based agriculture is the largest producer of foodstuffs [50], exploring this sector further in terms of strategies and trade-offs becomes crucial to understanding the challenges to food security. Unfortunately, rural household experiences and decisions among Cuban farmers are not often documented in the academic literature (but see [37,51]). A small number of studies have looked at smallholder properties in Sancti Spiritus, the province where the current research takes place [1,50]. Machado and Fernandez as well as Moon et al. have also generally characterized some of the challenges seen in La Picadora, one of the communities focused on our long-term research program [37,52,53]. None of these works, however, have delved into the complexity behind household dietary trade-offs, a shortcoming that reflects the paucity of data in terms of rural nutrition beyond state publications and the national 2010–2011 census of risk factors, and the challenges of conducting long-term fieldwork. These challenges have increased in the past year, with the impacts of the Ukrainian invasion and the ongoing U.S. treasury embargo producing dire shortages of food and commodities and high prices [54]. Scarcity and the loss of the tourism industry, the main source of revenue for the state, has once again forced thousands to migrate in record numbers [55,56].

In this article, we aim to investigate the impacts of recent agricultural transformations in food availability, dietary composition, and food-nutrition-related labor and activities within two different population clusters: La Picadora, a rural farming community, and a group of urban fishermen from the town of Yaguajay in Central Cuba. Part of a transdisciplinary approach including ecologists, social scientists, and biological anthropologists, we rely on longitudinal data collected between 2016 and 2022 to interpret previous findings with more recent information to better explore nutritional strategies for these two clusters. To that end, the article describes the main dietary conditions, trade-offs, and challenges experienced by households in an ongoing agroecological transition that began in the early 1990s. We focus on this region due to its former importance in agricultural and industrial

sugarcane production, its distance from major urban centers such as Santa Clara or Havana, and its high level of reliance on manual labor for subsistence.

2. Materials and Methods

2.1. Study Site

The rural community of La Picadora is in the municipality of Yaguajay, province of Sancti Spiritus, Central Cuba. Comprising about 80 households (215 people), up until the early 2000s most inhabitants worked in the three sugar mills and a fertilizer plant, with only a small fraction of the population completely devoted to small-scale agriculture [57–60]. The community relies primarily on farming, ranching, and tourism as sources of employment. Like elsewhere in Cuba, there are different modalities that organize agricultural production in La Picadora, including CCS, CPA, and the UBPC [37]. There are also private smallholders who do not take part in any of the cooperatives. Despite some farmers concentrating on a particular crop such as sorghum for large-scale production, each household grows a set of diverse cultigens, including tubers and root vegetables (boniato, malanga, and yuca), grains (maize, rice, beans, and coffee), fruit trees (papaya, guayaba, mango, avocado, and bananas), and produce (garlic, onions, cucumbers, squash, tomatoes, carrots, and green leafy vegetables) [60]. An agricultural calendar, which has seen important alterations due to climate-related events such as drought, flooding, hurricanes, and changes in average temperatures, loosely systematizes activities [57]. The recent pandemic did not affect farming operations and sanitary provisions such as social distancing were followed.

The town of Yaguajay, about 20 km northwest of La Picadora, is located in proximity to coastal lagoons and shallow bays. With a population exceeding 6500 residents, its inhabitants are predominantly employed in a host of different occupations ranging from government and educational services to transport and agricultural tasks [61–63]. Unlike La Picadora, where most households work on farms, households in Yaguajay have mixed economic portfolios. For example, a small percentage of households within the town also rely on artisanal fishing as a complementary source of sustenance [58,61]. There is an association that congregates about 47 active fishers that operate in nearshore areas out of Playa Vitoria, Yaguajay's docking pier, and occasionally beyond the northern cays. The level of dependence on fishing varies, with only a handful of individuals fully dedicated to commercial fishing activities and much of the sample self-defined as opportunistic fishers. Because of their higher level of dependence on natural resources in comparison to other inhabitants, and their living proximity to fishing areas, we narrowed our study focus to this set of fishing households.

Over the past forty years, the towns of La Picadora and Yaguajay, have been at the center of rapid agricultural change [58,60]. Because most residents in both communities participated in the large-scale sugarcane industry, they were equally vulnerable to agricultural policies that regulated production and suffered major transformations in their way of living. In the next subsections, impacts from two agricultural transitions are identified at the domestic level. Complemented by historical sources, interviews and focus group discussions provide direct evidence of the effect of these transitions in diets and activities.

2.2. Ongoing Research

Part of a larger project seeking to explore rural adaptation in rapidly changing environments, the study was designed to develop a long-term comparison of the communities of La Picadora and Yaguajay to observe variations in dietary and energetic patterns among different households given the diversity of occupations. The research team includes researchers from Montané Anthropological Museum at Universidad de La Habana, Caguanes National Park, and Rutgers University. Ongoing activities began in 2016 and were interrupted during 2017 due to the passage of hurricane Irma, which brought significant damage [57]. While research was reestablished in 2018, the Coronavirus-19 pandemic restricted travel to the region between 2020 and 2021.

Participants for the study were recruited in both groups through snowball sampling. Given the small size of these clusters, we used a purposive approach to identifying individuals based on their residence location and engagement in subsistence activities. Following responsible research practices and ethical protocols from Universidad de La Habana, consent was requested before survey administration and to participate in discussions, interviews, and anthropometric or energetic measurements. When possible, discussions and interviews were recorded. Each group discussion had a duration of approximately 75 min and took place in the town hall of La Picadora or in the offices of Caguanes National Park in Yaguajay. Interviews lasted anywhere from 10 to 60 min. All recorded exchanges were later transcribed and analyzed with NVivo 12.

Repeated nutritional surveys, carried out initially in 2017 and 2018, and then in 2022, sought to assess diet composition among both populations and across time. The survey tool accompanied anthropometric measurements (not reported here) and was designed after the questionnaire used by the former Cuban National Institute of Nutrition and Dietary Hygiene (INHA). The adapted instrument considers weekly consumption patterns of seven basic food groups (grain and tubers; vegetables; fruits; animal protein, meats, and beans; dairy; fats or other sources of fat; and sugars). The other two modules within the instrument included the assessment of food frequency consumption for the past week for breakfast, lunch, and dinner, and ways of preparing, consuming, and storing food as well as cultural practices such as parties and food sharing. In the first implementation in 2017, a total of 19 male farmers and 14 male fishers participated in the survey. In March 2018, following the passage of Hurricane Irma in 2017, 28 individuals from the previous dietary survey repeated the nutritional assessment and participated in a reduced form of IPAQ, the international physical activity questionnaire. In 2022, we repeated dietary and physical surveys as described below, and conducted focus groups and interviews.

2.3. Research Design

The article complements previous findings reported elsewhere [16,58–60] with new information obtained through informal interviews, additional dietary surveys, and 2 focus groups conducted in 2022 (see Table 1 for details). To that end, we focus on findings from 2022 and reanalyze previous datasets from 2017 and 2018 to further enrich the interpretation of results. The combination of quantitative and qualitative methods seeks to create a holistic representation of the dietary practices, potential strategies, and health in these smaller subgroups. Yet, it is important to indicate that the external validity of the findings presented here is constrained by the small sample sizes that characterize the project. Whereas generalization is challenging, there are important initial results that paint a picture of the potential transitions undergone by these subgroups. Therefore, this study has substantial value in guiding research priorities in the area and underscores the need to expand future work. Ethical practices for research were followed as described above in data collection in 2022, with consent to continue participation requested among participants.

A dietary survey was re-administered in 2022 among 16 male farmers from La Picadora and 10 male fishers from Yaguajay who participated in the prior 2017 surveys. Findings have informed the development of more precise instruments to assess energetics in November 2022. An expanded sample of 40 rural workers participated in a physical activity 48-h recall and wore accelerometers to measure energetic expenditure. These results will be discussed in depth in future publications. However, we rely on anthropometric data from this activity to characterize the population in 2022 and assess potential changes in comparison to 2017 through non-parametric tests. Survey data on diets and 48-h activity recalls from 2017 and 2018 were re-analyzed for comparisons with the 2022 survey through parametric and non-parametric statistical techniques.

Finally, two focus groups (n : 16) and interviews (n : 25) were also administered in late 2022 to explore issues related to environmental change, extreme events exposure and impacts, agricultural activities and fishing, dietary availability, and, more recently, dietary

changes, the nature of physical activities, and labor. We relied on interview transcriptions and content analysis to elicit important themes and further complement survey data.

Table 1. Detail of research activities.

Activity	Year	Sample Size	Themes	Location	Full Reference
Interviews (exploratory)	2016	7	Fishing and agriculture	La Picadora and Yaguajay	[58,61]
I. Focus Group Discussion	2017	15	Climate change, environmental threats, agricultural calendar	La Picadora	[57–59,61]
II. Focus Group Discussion	2017	15	Climate change, environmental threats, fishing calendar	Yaguajay	[57–59,61]
Nutritional Surveys	2017	35	Dietary composition and frequency; anthropometry.	La Picadora (19) and Yaguajay (14)	[16,62]
Interviews	2018	7	Extreme events (post hurricane impacts on fishing and agriculture)	La Picadora and Yaguajay	[59,63]
III. Focus Group Discussion	2018	21	Extreme events (post hurricane impacts on fishing)	Yaguajay	[59,60,63]
Physical Activity Survey (IPAQ)	2018	28	Labor intensity post hurricane, anthropometry.	La Picadora (18) and Yaguajay (10)	[64]
Interviews	2022	11	Extreme events recovery	Yaguajay	
Nutritional Surveys	2022	26	Dietary composition and frequency, anthropometry.	La Picadora (16) and Yaguajay (10)	
IV. Focus Group Discussion	2022	8	Dietary change and physical labor	La Picadora	
V. Focus Group Discussion	2022	8	Extreme events, environmental impacts, agricultural and fishing changes	La Picadora	
48-h Activity Recall Surveys and Energetic expenditure measurements ¹	2022	40	Activity recall 48 h, physical activity measurement with accelerometers	La Picadora	

¹ Not presented in this article.

3. Results

3.1. General Population Statistics

On average, interviewed households in 2017 had a median of 3 inhabitants, with ranges between 1 and 5 individuals per home. Given our interest in energetic expenditure on arduous activities, anthropometry and measurement of activity levels were carried out with male subjects. Sampled individuals had all completed primary education, and had an age mean of 49.56 years (SD = 5.36) for fishers and 43.26 years (SD = 11.34) for farmers (see Table 2 for a characterization of the sample). No significant differences in Body Mass Index (BMI) calculations between groups (Wilcoxon Two Sample Test, $Z = 1.54$, $p = 0.12$) or in weight were found. Yet, when classified according to Cuban standards from the National Health Institute and the World Health Organization [65,66], fishers displayed a higher number of individuals possessing BMIs with values suggesting potential overweight or obesity [16,64]. For example, out of 14 individuals, 8 were found to have BMIs above 25, the cutoff for healthy weight. However, self-reports of activity indicated that fishers spent 8.2 ± 2.7 h a day carrying out agricultural labor tasks, on average 1 more hour of work per day in relation to farmers.

Table 2. Basic characteristics of the population in 2017 and 2022.

Measure	2017		2022	
	Farmers (19)	Fishers (14)	Farmers (16)	Fishers (10)
Weight (kg)	71.20 $\pm$ 13.38	75.48 $\pm$ 12.58	72.33 $\pm$ 15.63	71.21 $\pm$ 11.31
Height (cm)	172.83 $\pm$ 6.73	170.12 $\pm$ 5.72	170.88 $\pm$ 6.73	170.76 $\pm$ 5.72
BMI (kg/m ²)	23.78 $\pm$ 3.91	26.18 $\pm$ 3.53	24.69 $\pm$ 4.61	24.39 $\pm$ 3.33

Beyond attrition in sample sizes, repeated measurements from 2022 showed fluctuations with different levels of statistical significance. For example, the median number of household inhabitants decreased for farmers to 2 and increased for fishers to 4. This

suggests modifications in a household's capacity to support dependents or processes of migration. Weight increased for farmers by approximately 1 kg and decreased among fishers by a total of 4 kg. Changes in weight are also captured in an increase in average BMIs for farmers and a decrease among fishers. In 2022, the difference between BMIs for both populations shrunk, with a higher dispersion in BMIs observed among farmers indicating more variability. Differences in weight and BMI were not significant statistically for farmers in a matched pairs T-test. However, they were statistically significant in the case of fishers for weight, $p = 0.02$, and for BMI, $p = 0.02$. Unfortunately, given the small sample sizes, it is very difficult to infer whether these modifications between 2017 and 2022 are applicable to the whole population, and further research is needed to evaluate the potential implications of the findings.

3.2. Diets

Reflecting a mix of Spanish, African, and Caribbean influences, the composition of rural Cuban diets shows a relatively low level of variation in terms of ingredients and types of preparation [67]. The revolution, while creating important changes in the consumption of items such as *tasajo*, dried salted beef, or fish, and introducing other less common items such as yogurt or butter, did not essentially alter the character of traditional cuisine [68]. As a result, daily meals in rural areas such as Yaguajay are predominantly characterized by rice, black beans, and pork, the latter when available, which are complemented with a small portion of *viandas*, including tubers, root vegetables, and green beans, and salad. The most important meals are breakfast, lunch, and dinner, with occasional snacks in the afternoon.

Access to foodstuffs is mostly determined by seasonality and income as well as the existence of family plots, gardens, and/or livestock. In La Picadora, most households have a long history of farming along with lime production and timber extraction. Sharing and exchanges of food items are very common among neighbors and extended family members. As of recent, there is a farmer's market that has begun operating by the side of the main municipal road on Saturdays. In Yaguajay, on the other hand, respondents do not necessarily consider themselves as farmers, but as salaried workers with different occupations. Food is usually obtained from the local state-run markets or stores, from the local *organopónicos* or urban organic farms, by the cultivation of home gardens, or through bartering. As is the case for all Cubans, the state guarantees access to basic foods through a rationing program known as "la libreta". Depending on age, each Cuban citizen can get essential food items at subsidized prices in monthly or even bi-monthly installments. Items include rice, sugar, bread, beans, and some sort of animal protein such as eggs, chicken, or fish. Rich protein foodstuffs such as milk, meat, and eggs are also provided to individuals who require special diets due to medical conditions. The list of foods subsidized has, however, decreased over time along with the quantities that can be purchased. Availability of certain products is also tied to general macroeconomic conditions and general demand, making some of the items in *la libreta* virtually inexistent. In fact, many respondents mentioned that the quantities that are guaranteed through the system barely meet the needs of a family over a ten-day period and that products like fish have not been available for years. It is no surprise, then, that the sharing and exchange of foods has such an important role in both communities. Discussions about the availability of certain foods or their scarcity are elements of normal conversation, with respondents often narrating the difficulties and obstacles they must surmount in their search for food. The situation has deteriorated further in the past year with the war in Ukraine and the continuous pressure of the blockade creating shortages in items like oil and flour, animal protein, and dairy. Unfortunately, environmental factors tied to climate change and extreme events are also posing significant challenges to the nutrition of rural households. In addition to an increase in the frequency of tropical storms and episodes of salinity intrusion, farmers must contend with extended drought, higher temperatures, and floods, which have resulted in the loss of crops, fruit trees, and cattle.

3.3. Diets Transition

Interviews and conversations with participants in both groups allowed us to reconstruct two major historical moments or transitions in the implementation of agricultural programs. The first transition comprised sugar monocrop intensification and state centralization and occurred from the late 1970s to the early 1990s. During this period, the region saw an expansion and mechanization of its three *complejos azucareros* Obdulio Morales (Narcisa), Aracelio Iglesias (Nela), and Simón Bolívar (Vitoria). Along with industrialization, the area experienced losses in agricultural diversity and deforestation. In the 1980s, hydrological changes and the drainage of the final residual swamp forests extended cane fields to the line of coast. The second transition began in the 1990s with the Third Agrarian Reform, which led to the decentralization and diversification of agricultural practices. The process was decanted in the dismantling of sugar mills in the early 2000s and the expansion of agroecological and local development models in the municipality [69,70]. As a result, a highly qualified working force of more than 3000 engineers, mechanics, and specialists along with the permanent agrarian workers who tended to the sugar plantations lost their jobs [71]. Whereas a large proportion of those unemployed turned to agriculture, close to one-quarter of the working-age population found employment in the tourism sector [72]. To facilitate the finding of alternative means of subsistence, the Cuban state maintained average salaries for up to six or seven years after the closing of the mills incentivizing education at all levels. The process of reorganization of sugar production was known as “Tarea Álvaro Reynoso”. Former sugar workers completed their elementary or high school diplomas and became lawyers, accountants, technicians, teachers, and agricultural engineers. Once the Álvaro Reynoso program came to an end, many found employment in agriculture. Old sugar cane fields were turned into rangelands and cooperatives were established to organize production. Furthermore, access to higher education created an outflow of migration of the available and now highly qualified working force to other provinces. New jobs in tourism and migration contributed negatively to the aging group of agricultural smallholders in Yaguajay who continued to produce essential foodstuffs for the district. Nowadays, La Picadora produces a myriad of different crops including rice, beans, produce, tubers, and coffee, and seasonal vegetables such as tomatoes, lettuce, carrots, and onions.

Matching the two agricultural transitions outlined above, interviewees and focus group participants from both locations made a clear distinction in the quality of dietary diversity between the time during which *complejos* ran agricultural production in the district before the fall of the Soviet Union and what followed to the closing of the mills in the mid-2000s and the incentivization of usufruct in non-cultivated state lands. They also recognize episodes of scarcity brought about by the 1990s economic crisis and the changes introduced by the adoption of agroecological policies. More recently, interviews mentioned food shortages because of climate-related factors such as hydrological drought, flooding, and hurricanes.

3.4. Periodization of Agricultural Transitions and Dietary Oscillations

1. Diets and labor before 1989/1990

The period that followed the revolution, and specifically, the 1980s was described by interviewees as a time of bounty. The USSR provided an extensive market for sugar, financing the transformation of the sector into a modern agrotechnical industry. As part of these technological exchanges with socialist countries such as Bulgaria, Czechoslovakia, and Mongolia, Cubans received items ranging from fridges, engines, and cars to canned fruits and meats. The island provided in return sugar, citric products, and nickel, along with non-skilled and qualified workers and medical professionals. Thus, it was not unusual to find Cubans working in Eastern Germany and Czechoslovakia or touring Moscow, Hungary, and Bulgaria as part of cultural programs. During these years, sugar factories in Yaguajay were complex conglomerates that included, beyond extensive cane fields, living quarters, mechanical workshops, and agricultural and ranching lands. This was

termed a “*distrito cañero*” and referred to the agglomeration of population settlements with industrial buildings. Workers were divided into different teams according to their tasks and received a salary and incentives. This type of organization of production activities was not unique to the municipality, it was also replicated with some minor adjustments in other provinces.

As part of an arrangement with the groups of labor known as “*centros de trabajo*”, the workers had arduous days of planting, tending, harvesting, transporting, and processing cane. The central had its own food production groups known as “*brigadas de autoconsumo*” (self-sufficiency brigades) responsible for farming, processing, and obtaining the necessary food for all employees. The central also provided access to workers to what was known as the “*cuota cañera*”, a big sac of products that included rice, canned products, rum, cigars, and even soap that operated as an incentive and allowed households to buy subsidized foods at a marginal price. In fact, some of the respondents described the sac as “*una salvajada*”, an excess of items that were shared beyond close family, friends, and neighbors. As a result of exchanges and their work in the sugar sector, rural households became acquainted with the famous Russian meat, a can of boiled beef that sometimes included pork or ham, along with sardines and anchovies, black bread, borscht, candied peaches, lichi, boiled vegetables, and milk from local producers. In some cases, the cuota was calculated to last for the most intensive periods of labor such as the harvest. However, because the availability and variability of products were determined by foreign trade relations, there was a list of more common items that were locally consumed and could not be bought through the program, such as tubers, vegetable roots, or butter. In those cases, households exchanged products, bartered, or purchased desired foodstuff in informal markets. Respondents also mentioned that during agricultural labor they received breakfast, lunch, and snacks. The food in the fields was very good and reflected what was available at the time. The tradition of cultivating sugar introduced an important habit among farmers and salaried workers: the consumption of sugar in all diverse variants such as guarapo (sugarcane juice), molasses, and even stalks from the plant. The stalks, which were frequently chewed while conducting field labor, left a permanent imprint in the form of tooth decay and wear. Among interviewees, for example, 75% of farmers mentioned that they had regularly consumed sugarcane stalks throughout their childhood and as adults. Some of them also recalled the habit of skinning the stick of cane with their teeth (*pelar la caña con los dientes*), which explains observed dental deterioration. In all, rural households had several sources or means to access low-price foodstuffs: through small-scale production or barter, through the national ration system, by purchasing independently in state markets, and the cuota cañera. As a farmer indicated, “*se comía bien. . . uno trabajaba mucho pero siempre había. . . se vivía como ricos*” (they lived like wealthy people, work was hard but there was always food, they ate well).

2. The Special Period (1990–1999)

The year 1989 marks the beginning of a change in diets, with canned goods replaced by fresh meat and produce when available. This period lasted until 1991 when the crisis deepened and access to foodstuffs became arduous. Items such as milk, chicken, beef, and oil completely disappeared from local bodegas, also known as state stores [73]. The cuota cañera shrunk and other rationing systems considerably reduced their inventory and the proportion subsidized to a handful of products. Despite challenges, farmers and sugar industry workers found alternative strategies to survive. After a long shift in the central, many reverted to agricultural labor, extending crops and planting surfaces. They began cultivating in the little land that could be found around their houses, in gardens, and in former wastelands. They bartered and sold whatever excess they produced in informal markets. Clothes and goods were also traded, long-term storage facilities were built, and food processing and conservation techniques such as preserves were improved. Some ventured into manufacturing their own laundry and toiletry products. Other strategies among farming households included polycultivation and crop diversification, the planting of short-term crops, the joining of production cooperatives, the cultivation of animal fodder,

and the participation in agricultural fairs. Not surprisingly, the implementation of strategies depended on access to land among other resources. As one of the respondents indicated, despite adversity, they still managed to eat. The days of past bounty seemed like they never happened.

In the meantime, in late 1992 and 1993, the state introduced a process of reorganization of the sugar industry into smaller farms or UBPCs (Unidades Básicas de Producción Cooperativa), representing about 10 to 15% of the original extension [74]. In this new form, farms were in charge of managing production through the liberalization of the ownership of agricultural means, with the exception of the land [75]. The UBPC had now the tasks of securing total production goals as well as attaining self-sufficiency in food, implementing agroecological techniques, and growing a wider variety of seasonal crops [76]. A similar process of destatization of livestock production was introduced in former rancherías, vaquerías, and dairy centers, which now became small farms holding 10 to 60 cows, or 1.2 to 2 cattle per hectare. The decline in productivity experienced in those years meant a decrease of almost 60% in total crops. With scarcity endangering the health of the population, thousands of dairy cows were re-directed to slaughter. Almost half of all grasslands on the island were covered by invasive species like marabú (*Dichrostachys cinerea*) and the average daily production of liters of milk per cow fell from 6.1 in 1990 to 3.1 in 1992 [75], a value that has not yet improved according to respondents. To recover the sector, more attention was paid to the generation of alternative production inputs such as organic pesticides and fodder, along with a revitalization of organopónicos or urban farms. However, as some respondents indicated, the solutions that were implemented were to a large extent of a centralized nature and disregarded local particularities.

For example, some of the variants that self-sufficiency brigades were responsible for growing in complejos did not match dietary habits. As a result, produce was sent elsewhere or left to rot. It would take several more years before the country was able to bounce back to production levels modestly approaching those of the late 1980s. In this light, the record crop of tubers in 1999 indicated the change in agricultural varieties [74]. Progressively, as the situation improved and with the deactivation of the industrial conglomerates, rural households began applying for newly available agricultural parcels. Access to land was recognized by respondents as a key buffer to scarcity, allowing for the cultivation of staples that could be traded for essential items. Simultaneously, the country invested significant effort in developing the tourism and services sector in a bid to increase the inflow of foreign capital and currency [77]. Changes affected the municipality when the neighboring province of Villa María opened an international tourism hub in the early 2000s that offered salaried jobs.

As it was noted, the special period had a remarked effect on women who were historically responsible for household nutrition [73,78]. In urban areas such as Havana or Santiago, the need for resources led many to open paladares and small restaurants, which are increasingly run by women. In addition, women adopted new strategies to diversify their income. For example, they began preparing and selling snacks on the street or in their houses, working as vendors going door-to-door and trading key foodstuffs, or even commercializing the bolsa negra, a gathering of items bought directly from state workers at discounted prices [51,79]. According to interviewees and accounts from the literature, this return to the domestic sphere of production remained to a large extent informal. Shortages in electricity and scarcity of petrol and kerosene resulted also in prolonged domestic tasks [80]. Women had to rely on timber or wood, coal, and diesel to cook. As water pumps stopped working, women had to contend with obtaining clean water for preparing food, drinking, bathing, laundry, and cleaning. The absence of common ingredients, and the shutting down of state-sponsored diners, cantinas for workers, and cafeterías in schools, also created stressors for household heads who had to devise inventive ways of coming together with a complete meal. In the countryside, while options for alternative employment were limited and tourism virtually inexistent, women had access to gardens and orchards that helped provide for family needs. Beyond food, the lack of goods extended

to hygiene and cleaning products, linens and clothes, shoes, sanitary towels, toothpaste, and domestic appliances.

To meet these needs, households became creative and deployed a set of ingenious tactics. For instance, lemon juice was used for toiletries and shampoo. Support among neighbors and friends allowed households to cook together, exchange items such as coffee for beans or rice for medication, or even collaborate in production activities. The high level of solidarity in agricultural labor distinguishes La Picadora from other towns in the region [70,81]. In fact, many respondents mentioned the importance of working together and helping each other beyond the formed cooperatives as a key strategic factor in overcoming challenges. Considering these arrangements, during this time, participants alluded to the high prices of foods that made any purchase in markets almost prohibitive. Local networks of neighbors and family would constantly share information regarding the availability of products in local stores or among other households to facilitate access. Beyond the search for better prices, in private domestic settings, strategies also included the careful planning and reallocation of resources to primary needs such as food, the prioritization of the nutrition of elderly, children, and sick, the skipping or reduction in portions in meals, and the fixing of wardrobe items and shoes.

3. Post-Sugar Monocrop (2000–2020).

In the early 2000s when activities from the sugar industry largely ended, the municipality put forth a strategy to achieve nutritional self-sufficiency, boost agricultural production, and expand forestry programs. New plans were launched to develop the dairy industry, which included the introduction of water buffaloes along with traditional livestock. The strategy sought to increase the production of fruits and vegetables by about one-third in comparison to the previous years, with other staples like rice and grain crops expected to grow between 4 and 5% [82]. As a result, 3 state-run empresas were created with 9 cooperatives specifically focused on agriculture and livestock (CPAs) and 21 UBPCs also concentrated on food production. Infrastructure was built to optimize pig rearing as a source of animal protein, and smaller farms were dedicated to poultry. The Cuban Food Ministry also incentivized freshwater aquaculture providing support for species like *Claria* (Claridae family) and *Tilapia* (Cichlidae family) to be grown in dikes and ponds throughout the province. Finally, the community of La Picadora collectively made the strategic decision to open an agrotourism business in 2015 that houses foreign tourists on a regular basis. Most households participate in the effort by providing services such as cooking or sharing agricultural resources to support the visitors. Earnings are shared equally.

In terms of dietary diversity, our surveys from 2017 showed that ingestion of rice occurred among farming households every day (see Table 3). Bread and crackers were consumed by approximately 80% of the sample daily, and viandas by 60% of respondents. Close to 40% of households made use of other vegetables such as spinach or lettuce, and 42% also consumed fruits. These figures are roughly similar among fishing households in Yaguajay, which reported a higher use of vegetables and fruits. However, differences arose when observing the sources of animal protein in both diets. Only 33.3% of fishing households consumed pork between two to three times a week. Comparatively, among farmers, the proportion was 81.2% for pork in the same frequency, with 50% of the sample also consuming chicken and processed meats twice or three times weekly. The latter were rarely consumed among fishing households. On the other hand, fish was seldom eaten in La Picadora. Yet, close to 82% of the households in Yaguajay relied on fish at least once a week, with 31% of homes consuming this food daily. Differences are highly significant with a Fisher Exact Test for consumption between groups of pork, $p < 0.01$; chicken, $p < 0.02$; and fish or shellfish, $p < 0.00$. Eggs were also used daily in preparations by 47% of farming households and 36% of fishing households. Although not statistically significant, there was also a relatively higher consumption of dairy, about twice the amount, for products such as milk and cheese among respondents in Yaguajay. In addition, fishing households relied on vegetable fat, while farmers relied on animal fat in their preparations (Fisher Exact Test for

consumption between groups of animal fat, $p < 0.01$; and vegetal fat, $p < 0.00$). The whole sample exhibited a high ingestion of sugary drinks like sodas on a daily frequency.

Table 3. Diet comparison between residents of La Picadora and Yaguajay in 2017.

Yaguajay (N: 14 Fishing Households)						La Picadora (N: 19 Farming Households)						Item	Food Group
Never	Rarely	1 Wk	2/3 Wk	4/5 Wk	Daily	Never	Rarely	1 Wk	2/3 Wk	4/5 Wk	Daily		
0	0	0	0	0	100	0	0	0	0	0	100	Rice	Group 1
21	43	21	7	0	7	21	37	5	32	0	5	Maize	
0	14	7	0	0	79	0	5	0	0	11	84	Bread	
7	43	29	21	0	0	0	21	32	42	0	5	Pasta	Group 2
0	7	7	36	7	43	0	0	6	11	22	61	Vianda	
7	7	0	29	14	43	5	16	11	21	5	42	Vegetables	
0	21	0	14	7	57	0	5	5	11	37	42	Fruits	Group 3
0	15	23	38	8	15	0	0	5	74	21	0	Pork **	Group 4
64	36	0	0	0	0	68	26	0	5	0	0	Rabbit	
0	21	14	50	0	14	5	0	37	42	16	0	Chicken **	
43	21	29	7	0	0	16	11	21	42	11	0	Processed Meat	
7	7	7	21	29	29	16	58	21	0	5	0	Fish **	
21	57	14	7	0	0	84	16	0	0	0	0	Shellfish **	
57	29	14	0	0	0	32	21	32	11	5	0	Entrails/Viscera	
0	14	0	36	14	36	0	0	5	26	21	47	Eggs	
0	0	0	0	7	93	0	0	0	5	5	89	Grains/Beans	
29	0	0	0	7	64	42	5	5	5	11	32	Milk	Group 5
43	21	7	7	0	21	26	5	5	32	11	21	Yogurt	
21	21	7	21	0	29	21	11	5	42	11	11	Cheese	
0	0	7	7	0	86	42	0	5	21	11	21	Vegetable Fat **	Group 6
29	36	0	0	0	36	5	5	0	5	11	74	Animal Fat **	
14	7	7	29	14	29	5	11	21	16	11	37	Sweets/cakes	
0	0	0	14	21	64	16	5	0	0	5.5	68	Sodas/Drinks	Group 7

All values expressed in percentages. **: indicates significance in a Fisher's Exact test for comparing non-parametric samples, with alpha level set at $p < 0.05$.

In all, despite the higher use of marine and coastal products, fishing household diets captured a mix of traditional rural cuisine. For example, the preferred food for parties and special events continued to be pork both slow-roasted or in different kinds of preparations such as fricassee; in conjunction with a small portion of raw vegetables, boiled yucca with a garlic and vinegar dressing, and congris (a mix of black beans and rice). Regarding cooking techniques, vegetables and viandas tended to be consumed raw or boiled. Like pork and different meats, fish were fried, baked, or roasted. There was also consumption of highly processed meats such as sausages or croquettes, which can also be made of chicken and fish. The availability of these kinds of preparations varied depending on what is sold at the state Acopio store or available through the market. The same is to be said for flour-based products such as bread and crackers.

4. Most Recent Years (2020–2022).

Nowadays, as elsewhere on the island, rural households are experiencing food shortages. Despite government efforts, agricultural and aquaculture outputs remain insufficient to meet local needs and imports have dwindled [83–85]. During recent conversations, farmers discussed the low level of milk productivity that is reported among livestock and shortages in the availability of animal protein, flour, and grain. While international sanctions continue to severely limit access to global markets, some of the difficulties affecting the agricultural sector, in the long run, are to be found in the interaction of low government investment, anthropogenic degradation, and climate-related pressures such as extreme events and prolonged droughts. Heat stress, water scarcity, and hurricanes have particularly affected cattle, fruit trees, and rice. Over the next century, the region is expected to experience significant losses in hydrological resources [86,87], which may aggravate the current economic situation.

In comparison to 2017, our repeated survey from 2022 (see Table 4) elicited some potential modifications in diets in La Picadora reflecting the new conditions. Preliminary findings show overall decreases in the frequency of consumption of a total of fifteen food items, including pork, meat-derived products, viscera and entrails, eggs, dairy, maize, sweets, and flour-based products, such as bread, pasta, and crackers. This finding matches

what was reported during conversations in focus groups and interviews. Although not statistically significant, a decrease in the consistent use of vegetables and an increase in the daily consumption of fruits was mentioned by participants and is also observed in the dataset. Probably, the most important finding is the decline in the consumption of pork and its partial replacement by chicken and/or fish. For example, a matched samples Wilcoxon Signed Rank test for pork use between 2017 and 2022 for both groups combined was highly significant in evaluating the difference in consumption ($Z = -3.30$, $p = 0.00$). The decline in pork is also seen as a decrease in the use of viscera ($Z = -2.04$, $p = 0.04$) and an increase in the use of vegetable fat ($Z = 2.56$, $p = 0.01$), which has become the staple for food preparation, showing processes of substitution as well as changes in the frequency of previously marginally employed items. For instance, even when not statistically significant, fish has become consumed more frequently during the week. The lack of statistical significance in this case may result from the small sample size and the redistribution of responses along broader categories. Whereas, in 2017, more than half of the sample rarely ate fish, in 2022, the proportion decreased to a third with individuals reporting an increase in use of at least two or three times a week or weekly. Moreover, while not statistically significant, in the case of viandas, fruits, and chicken, these items are now consumed with a higher weekly frequency, indicating processes of replacement of more expensive foods. Thus, even when some important decreases in foodstuffs dominate findings, increments in the use of items such as produce, tubers, and processed meats are also observed. To sum up, while in 2017 the most predominantly used items included grain and pork, in 2022, the composition of meals changed to grain, fish, and chicken along with other less popular foodstuffs. Furthermore, there is a decrease in store-bought items such as pasta ($Z = -2.64$, $p = 0.00$) and sodas ($Z = -3.08$, $p = 0.00$), alluding to a reshifting of monetary resources at the household level.

Table 4. Diet comparison between 2017 and 2022 among farming households in La Picadora.

La Picadora (N: 16 Farming Households) 2022						La Picadora (N: 19 Farming Households) 2017						Item	Food Group
Never	Rarely	1 Wk	2/3 Wk	4/5 Wk	Daily	Never	Rarely	1 Wk	2/3 Wk	4/5 Wk	Daily		
0	0	0	0	0	100	0	0	0	0	0	100	Rice	Group 1
29	21	14	36	0	0	25	38	6.2	31	0	0	Maize	
13	0	0	6.2	6.2	75	0	6.2	0	0	13	81	Bread	
6.2	44	25	19	6.2	0	0	19	31	44	0	6.2	Pasta **	Group 2
0	6.2	0	13	6.2	75	0	0	6.7	13	27	53	Vianda	
6.2	25	19	25	6.2	19	6.2	19	13	19	6.2	38	Vegetables	
0	19	6.2	19	0	56	0	6.2	6.2	6.2	38	44	Fruits	Group 3
6.2	25	25	44	0	0	0	0	6.2	81	13	4.5	Pork **	Group 4
100	0	0	0	0	0	75	19	0	6.2	0	0	Rabbit	Group 5
6.2	6.2	6.2	69	13	0	6.2	0	21	50	13	0	Chicken	
13	19	38	31	0	0	19	13	13	50	6.2	0	Processed Meat	
25	31	31	13	0	0	19	56	25	0	0	0	Fish	Group 6
94	6.2	0	0	0	0	94	6.2	0	0	0	0	Shellfish	
56	38	6.2	0	0	0	38	19	31	13	0	0	Entrail/Viscera **	
6.2	0	0	50	25	19	0	0	6.2	31	19	44	Eggs	Group 7
0	0	0	6.2	0	94	0	0	0	6.2	0	94	Grains/Beans	
56	6.2	0	13	0	25	44	6.2	6.2	6.2	13	25	Milk	
31	25	13	19	0	13	31	6.2	6.2	31	6.2	19	Yogurt	Group 8
19	25	19	25	13	0	25	6.2	0	50	13	6.2	Cheese	
0	0	0	0	0	100	44	0	6.2	25	6.2	19	Vegetable Fat **	
6.2	6.2	0	0	0	88	6.2	6.2	0	6.2	6.2	75	Animal Fat **	Group 9
38	0	0	31	25	6.2	6.2	6.2	19	6.2	6.2	44	Sweets/cakes	
56.2	12.5	12.5	18.8	0	0	18.8	0	6.2	0	6.2	68	Sodas/Drinks **	

All values expressed in percentages. **. indicates significance in a Wilcoxon Matched Pairs Signed Rank test comparing 2017 to 2022, with alpha level set at $p < 0.05$.

The replacement of what are seen as culturally important items like pork with lesser valuable ones is a necessary yet negative strategy as discussed by interviewees. According to respondents, the observed dietary changes are not just explained by preferences or environmental stressors, but by the domestic economic situation, the deacceleration in tourism visits due to the pandemic, financial volatility, and by the lack of access to foodstuffs in general. In fact, a reduction in alimentary imports and mounting economic deficit produced by low export levels [88] may account for the diminished consumption of dairy

products such as powdered milk, deserts, and milk-based puddings, and store-bought foods such as sugary drinks, cookies, and sweets as shown in the survey. It is important to observe that respondents compared the special period to present days, with current conditions being described as a bit worse than in the past (“estamos más apretados”, we are more pressed). Despite difficulties, some rural households were still able to maintain a traditional “Cuban” diet including pork two or three days of the week. Such a finding is not necessarily surprising given the relatively low variation in foodstuffs that characterize this cuisine and the high level of internalization that certain ingredients have in culinary practices. On a positive note, the continuation of the traditional rural cuisine that is to a large extent homogeneous across the Cuban provinces provides mechanisms to implement nutritional programs in a cost-effective and uniform way [89]. On the other hand, the persistence of this traditional “Cuban” diet may suggest the thesis that this constitutes a population with high levels of consumption of sugars and carbohydrates when animal protein availability decreases. Without government support and protection of key foodstuffs like milk in rationing programs, the country may place below recommended standards for dairy or micronutrient ingestion. Continuous research is needed to evaluate this hypothesis and the role of what is known as the “Cuban” cuisine in undermining new government-led strategies that seek to introduce alternative dishes and preparations.

Overall, we observe that current strategies, the set of deliberate actions seeking to maintain the family unit during times of stress, vary according to access to land, foreign currency, collective work, participation in cooperative groups, and partaking in state-funded ration systems beyond *la libreta*. Most actions are centered around securing the necessary resources to meet household needs and comprise the substitution and replacement of culturally valuable items by more economical ones. Some of these changes result in the consumption of foods of lower nutritional value but may also underscore the use of less preferable yet protein-rich items such as viscera or fish. The search for better prices for subsistence items dominates most of the daily chores at the household level, with values for produce and animal products much lower in the countryside or in rural areas. A significant amount of time and energy is invested in attaining what are perceived as dietary needs, with exchanges of information and partnerships acquiring strategic importance. The ability to trade and barter has become essential, which explains the more recent opening of an agricultural market in La Picadora. Strategies, however, are not just reduced to dietary adjustments, food procurement activities, or additional cultivation of new varieties. In these two clusters, they also involve issues related to improving living conditions such as housing and access to basic items of necessity like hygiene products, fuel, and reliable transportation to and from working sites or in maintaining agricultural labor at valuable production outputs. The latter constitutes a significant impediment that is scarcely considered in current nutritional initiatives in this region that emphasize sustainability above the reality of energetic demands.

4. Discussion

The article presents a detailed exploration of rural diets among two clusters of residents (farmers and fishers) in two communities of Yaguajay, Sancti Spíritus, Cuba. It is important to indicate that the external validity of the results discussed below is constrained by the small sample sizes that characterize the project. Yet, findings provide valuable insights to be further explored. In short, analysis of interviews, focus groups, surveys, and additional historical sources may indicate that rural communities in this region, and to some extent in central Cuba, have undergone two different transitions in the adoption of agroecological practices. The first period comprised sugar monocrop intensification and state centralization (1970s to early 1990s), while the second transition began in the 1990s with decentralization and diversification of agricultural practices. As a result of these changes and a forbidding economic blockade, households have suffered different instances of nutritional vulnerability. To improve conditions, the Cuban state has responded through numerous policies that have fostered industrial degrowth in the sugar sector and have

scaffolded the expansion of an organic agricultural and ranching system through education and rural development. Yet, it is in the nature of self-constituted cooperatives, small-holder state support, and social reciprocity that coping and adaptation strategies are to be found. As suggested by cultural studies of food and dietary practices, familiarity with how local actors may access, produce, and exchange food stuffs can provide essential knowledge on the inner workings of societies, creating avenues for intervention [90]. Most importantly, within the Cuban context, such information can help elicit limitations or shortcomings in state-driven agroecological policies. As many insular Caribbean countries are engaging with climate-resilient development frameworks, rural coping strategies adopted in Cuba can also shed light on the need to adopt precautionary or mitigating measures that can increase the success of proposed adaptations [91]. To that end, in this section, we analyze the diversity of tactics or strategies adopted and what they mean in terms of reforming a traditional agricultural production system into a sustainable sector.

Beginning as early as the 1600s, sugar cultivation has constituted one of the most important economic undertakings in Yaguajay. Also known as a livestock-producing region, sugar monocrops came to dominate all agricultural activities after the revolution, with long-standing influences on dietary habits and culinary practices. Whereas conditions were highly satisfactory in the 1980s according to interviews, political and economic crises largely compromised households' sufficiency in the 1990s. The triumph of the revolution in attaining better living conditions, including major housing and health programs for all Cubans, was tested for the first time by widespread shortages. Memories of the challenges and strategies that households adopted in the early 1990s remain very much present among interviewees. For example, some of the actions discussed included the careful planning and reallocation of resources to meet essential needs, the prioritization of vulnerable population sectors, meal reduction, skipping collective work practices, and information sharing. The economic crisis led the government to the adoption of agroecological solutions, with some recoveries observed towards the end of the twentieth century.

After sugar mills and other industrial centers were discontinued in the early 2000s, the population of Yaguajay began to feel additional economic pressures that led to the reintroduction of small-scale diversified agriculture, house gardens, ranching and livestock practices, and tourism. Changes in production in the mid-2000s and 2010s had additional consequences for dietary habits, with increases in the use of green leafy vegetables, seasonal crops, and fish in comparison to traditional cuisine. These modifications are shown in the first 2017 survey. More recent instabilities brought in by hydrological drought, extreme events, the Coronavirus pandemic, and the war have also led to significant alterations in consumption patterns, with decreases in the use of pork and the introduction of dietary substitutions.

In all, nutritional oscillations in the past four decades speak of the challenges faced by rural households. Most importantly, dietary changes paint a picture of how processes of agroecological transitions rely heavily on individual ingenuity and flexibility to achieve success. The abilities of small actors, such as household heads, work groups, and cooperative leaders, to adjust or to innovate under uncertain conditions are in this specific case supporting and accommodating major transformations. To some extent, the Cuban state has been able to recognize the significance of empowering these smaller actors through educational policies and extension activities. However, state support has not been enough to buffer some of the costs associated with agroecological models that may require substantial changes in the productive sector. In conjunction with economic and financial barriers that limit options, high levels of precarity have compounded perceptions of insecurity among rural homes as interviews elucidate.

As an illustration of the increasing importance of individual actors, the type of strategies adopted during the special period and more recently suggest the progressive involvement of household members in income-generating activities independent from state employment. The ability to juggle between different sources of money allows some households to improve the likelihood of meeting their needs; however, it is subjected to both

external and internal factors beyond their control. In the first case, macroeconomic conditions and state policies can create very unstable configurations that have difficult access to food. For example, the reduced variety of imports in the context of rationing, with fixed schedules and distribution stores, results paradoxically in unpredictable timing and locations for the supply of eclectic items. In the municipality of Yaguajay, we observed during the weekend, long queues at gas station stores not just to buy gas but also to purchase chicken or a handful of other products such as beer or diapers. While items trickle down through the distribution chain like a broken faucet, as some respondents voiced, the ability to prepare a full meal depends on long-distance travel and money. Referenced by Moon et al., economic pressures critically shape access as well as consumption patterns in La Picadora [53]. Despite individual or cultural preferences and continuous efforts at procuring a “decent meal”, farmers eat what is available, indicating that subjective appreciations are subordinate to concrete productive realities. And even when agricultural production may dictate what is available, other needs may cause households to forfeit consumption of desirable items to address more pressing needs related to economic contraction and isolation from the world market. Thus, in a municipality that has been devoted to agricultural and livestock production for at least five centuries, some of the common shortages include pork meat, eggs, butter, oil, and flour along with locally grown items such as boniato.

In addition to identified strategies, findings regarding the persistence of the Cuban cuisine mirror what other researchers have discovered elsewhere on the island [11,13,51]. The rationing system, which provides citizens with subsidized foods according to what is available at the time, has helped in the long run to homogenize cuisines, ultimately weakening local food production systems with a higher variety [51,53]. This is captured in our interviews and conversations with household members from La Picadora describing the need to consume non-traditional products such as fish croquettes, instead of chicharrones and roasted pork, as a negative experience. It also signals an interesting byproduct of the special period, where culinary preferences and local cultural identities associated with food reemerged after two decades of revolutionary policies that sought the standardization of alimentary practices [78].

As discussed among respondents, the decline in dietary diversity that is experienced now is probably felt more keenly in urban centers where agricultural cultivation is limited in its capacity (urban gardens are reduced to 0.25 hectares per person) to offset scarcity. Despite repeated efforts by the Cuban government to implement nutritional substitution policies and liberalize non-commercial imports of foods and medication [49,92,93], in early August 2022, it was estimated that close to 80% of the food consumed on the island was imported [94]. This ranks Cuba as the second largest importer behind Panama, a position of high vulnerability to price fluctuations and disruptions in logistics and transport [54]. Recent analyses have suggested that shortages and high prices are the result of a stale underdeveloped food production system that cannot provide for all [95]. The current loss of revenues associated with weakened tourism due to the pandemic restriction also underscores important limitations in the Cuban industrial system and provides a glimpse of the structural crisis permeating agricultural production [95]. The concentrated focus on service industries and construction to the detriment of agriculture and manufacturing capacities—between 2017 and 2021, state investment in agriculture was a mere 2.8% while hotel and real estate received 50% of the budget—has contributed to both food insecurity and scarcity [96]. Most importantly, it has aggravated the energetic crisis that has affected mechanized labor in the municipality. With frequent blackouts and interruptions in the flow of electricity that last between 6 to 8 h per day, farmers have increasingly relied on animal traction for agricultural labor. In this same light, many have observed a worrisome inflation trend throughout Latin America, and especially in Cuba, that endangers nutritional health among lower-income households [97]. The slow recovery perceived in labor markets and the economic degrowth experienced due to the Coronavirus pandemic interact with food insecurity to create the conditions for migration [55]. Compounded with this situation is an

aging population that has very limited access to foreign capital [46,74] and must rely on manual labor to meet essential needs.

As this exploratory case study seeks to illustrate, comprehensive mixed methods assessments of dietary strategies are key tools to elicit the local realities of agroecological transitions. Experiences of food consumption and production, oscillations in food sufficiency, and nutritional vulnerability among rural households are clear examples of how challenges in adopting sustainable transformation models may evolve over time in a process of fits and starts. It is important that climate-resilient development programs take into account the dynamic nature in which adaptation decisions are made, and how many of these coping strategies are not only a result of perturbations but are the foundation in which transformational change happens [98–100]. Unpacking the decisions made at the smallest scale of production, comprehending the trade-offs and limitations that the most vulnerable experience in the struggle to make a worthy living on a damaged planet, is an essential task in designing an inclusive future [91].

5. Conclusions

Distinguishing between periods of abundance and shortage, our findings show two counterpoints: a wider variety of dietary options available during intensive sugar monocrop cultivation and the scarcity experienced during the early 1990s, and more recently, during the last period of the pandemic, which has resulted in nutritional and activity adjustments. Constrained by the small sample sizes that characterize this project, findings present an initial picture that must guide research in the region. They underscore the need to expand future work. In all, comprehensive assessments of dietary strategies are key to eliciting what agroecological transitions mean for local realities and the value of experiences of food consumption and production to better understand the limits to sustainable transformation models.

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