

HOME GARDENS AS A LIVELIHOOD STRATEGY IN A COASTAL COMMUNITY: THE CASE OF BAHÍA DE KINO, SONORA

Berenice Zapata-Jaime¹, Karla Denisse Murillo-Castillo¹, Edward A. Frongillo², María Alba G Corella-Madueño¹, René Urquidez-Romero³, Trinidad Quizán-Plata^{1*}

¹Universidad de Sonora. Hermosillo, Sonora. México. 83000.

²Department of Health Promotion, Education, and Behavior. Arnold School of Public Health. University of South Carolina. Columbia, South Carolina. United States. 29208.

³Instituto de Ciencias Biomédicas, Universidad Autónoma de Ciudad Juárez, Chihuahua, México. 32315.

*Corresponding author: trinidad.quizan@unison.mx

ABSTRACT

Home gardens are a livelihood strategy that has improved food security of rural and agricultural households. People in fishing communities are vulnerable to food insecurity because their income depends on the fishing season. Therefore, this study aimed to evaluate the implementation of home gardens as a livelihood strategy among households in the fishing community of Bahía de Kino, Sonora. Through semi-structured interviews, 91 households were asked about their perspectives regarding the benefits of having a home garden and their experiences after implementation and analyzed using the constant comparison method. The Mann-Whitney test was used to measure differences in kilograms of vegetables harvested in households with food security and food insecurity and changes in vegetables consumed by children were also estimated using the Wilcoxon signed rank test. About 80% of households harvested and consumed from their own crops. The contribution of the garden to food security was 164.1 kg of vegetables in households with food insecurity and 63.6 kg in households with food security ($p=0.03$). Also, vegetable consumption increased about 300 g per day in children from food insecurity households ($p<0.001$). After the implementation and the harvesting of vegetables, households experienced increased availability of vegetables, integration, and family well-being. The implementation of home gardening met household expectations and had positive benefits on diversifying the diet of households in the community of Bahia de Kino including vegetable consumption by their children.

Key words: children, food security, fishing community, vegetable consumption.

INTRODUCTION

Throughout history, home gardens have been a great resource for households, providing fresh food such as fruits and vegetables year-round, primarily for personal consumption. The implementation of home gardens has been shown to increase the consumption of fruits and vegetables in households with food insecurity (FAO, OPS, WFP, and UNICEF, 2018).

Food insecurity is considered endemic in artisanal fishing communities, including those in Mexico (Béné, 2006). As in other countries, fishing in Mexico is underdeveloped, with problems in the techniques of catching, distributing, and marketing marine products. However, this economic activity is an important source of income and food for the households that depend on small-scale fishing for their livelihoods (Adetoyinbo and Otter, 2022). The Special Program for Food Security in Mexico “Sembrando Vida” supports the

Citation: Zapata-Jaime B, Murillo-Castillo KD, Frongillo EA, Corella-Madueño MAG, Urquidez-Romero R, Quizán-Plata T. 2024. Home gardens as a livelihood strategy in a coastal community: the case of Bahía de Kino, Sonora. *Agricultura, Sociedad y Desarrollo* <https://doi.org/10.22231/asyd.v21i4.1643>

ASyD 21(4): 472-489

Editor in Chief:
Dr. Benito Ramírez Valverde

Received: August 9, 2023.
Approved: December 5, 2023.

Estimated publication date:
September 27, 2024.

This work is licensed
under a Creative Commons
Attribution-Non-Commercial
4.0 International license.



establishment of home gardens in agricultural communities and in highly marginalized rural and urban communities, by promoting food self-sufficiency through actions that favor the reconstruction of the social networks and the recovery of the environment through the implementation of agroforestry production systems. The program seeks to address two problems: rural poverty and environmental degradation. In this way, it aims to save the countryside, reactivate the local economy and regenerate the social structure of the communities (Secretaría de Bienestar, 2020). This support is not available to Mexican artisanal fishing communities, whose income depends on the season, making artisanal fishing a vulnerable activity in terms of access to healthy food (Quizán-Plata *et al.*, 2020). A study carried out in households engaged in artisanal fishing reported that more than 60% of households have been found to experience food insecurity associated with negative effects on their nutritional and health status and the dietary quality of mothers and their school-age children. In both groups, food insecurity has been associated with lower consumption of fruits and vegetables (Murillo-Castillo *et al.*, 2018; Murillo-Castillo *et al.*, 2020).

In the study by López-González (2019), home gardens were reported to be an important contributor to food security for families with incomes below the basic food basket.

In addition, the gardens are a “meeting place” that allows family or community members to socialize with each other, share knowledge, or help with irrigation and care for the seedlings. At the same time, it is a recreational space that contributes to the physical and mental health of those involved in this work (Esteban-Ibáñez and Amador-Muñoz, 2020). Hence, home gardens are an adequate strategy to promote the maintenance of agrobiodiversity while ensuring households food security in a sustainable and resilient way, an important area of UN’s Second Sustainable Development Goal (Reyes-García *et al.*, 2013; United Nations, 2019).

In light of the important contributions that a home garden can offer about food security and resilience in marginalized communities, this research aimed to evaluate the implementation of home gardens as a livelihood strategy among households in the fishing community of Bahía de Kino, Sonora.

THEORETICAL FRAMEWORK

Food insecurity is a global problem. In Mexico, it affects 60.8% of households, with 25.9% of them reducing the amount of food they normally consume or, in the worst case, not eating for a day (in the three months prior to the survey) due to a lack of money or other resources (Shamah-Levy *et al.*, 2022). The risk of food insecurity is even higher for artisanal fishing families with limited access to productive resources, infrastructure, and participation in decision-making. Their food and nutrition security depends on consuming the food they catch and selling it to obtain other food. (Gibson *et al.*, 2021). There is evidence that food insecurity can lead to a substitution effect of higher quality foods (such as fruits and vegetables) for calorie-dense foods, mostly high in simple carbohydrates and saturated fats, which are generally more affordable (Morales *et al.*,

2016). These changes in diet can have an impact on an individual's nutritional status and contribute to the development of various forms of malnutrition. (Gibson *et al.*, 2021). Therefore, effective and widely available interventions are needed to reduce food insecurity, alleviate poverty, support economic stability, and thus protect health, especially among vulnerable populations, such as those living in fishing communities (Hartline, 2017). In this context, home gardens have been proposed as interventions to improve food security among vulnerable population groups (Domínguez-Hernández *et al.*, 2021), as they can serve as an alternative to meet their basic needs, primarily in terms of food (Cruz-Yáñez, 2016).

Home gardens can provide consistent access to fruits and vegetables, contributing to a varied and balanced diet. In addition, the plant diversity in these systems provides other benefits, such as medicinal plants, spices, ceremonial and ornamental plants, ritual plants, products for sale in local markets, fodder for domestic animals, fuel (wood), and materials for construction (Cruz-Yáñez, 2016).

Globally, in addition to providing fresh food, home gardens have been documented to have multiple benefits for low-income populations, including savings on food purchase and additional income from the sale surplus produce (Eigenbrod *et al.*, 2015; López-González *et al.*, 2019). Therefore, home gardens influence the availability, access, utilization, and stability of food at home, and their implementation would help to reduce the direct impact of food insecurity (Eigenbrod *et al.*, 2015).

In addition, home gardens have been observed to promote family and social integration and can be seen as a form of recreation that helps people improve their physical activity levels and recover from daily stress, anxiety, and fatigue (Laleci *et al.*, 2017; Palar *et al.*, 2019).

Considering that home gardens contribute to food security and the physical and mental well-being of families, the implementation of home gardens as a livelihood strategy among households in the fishing community of Bahía de Kino, Sonora was evaluated.

METHODS

The research was conducted from September 2019 to June 2021 in 91 volunteer households engaged in artisanal fishing, residents of the Community of Bahia de Kino, Sonora, located in northwest Mexico. All of whom provided a signed informed consent. A quasi-experimental study with pre-post design and mixed qualitative and quantitative methods was used. The study was approved by the Research Ethics Committee of the University of Sonora, Mexico (approval number: CEI-UNISON 1/2017).

Stage 1. Pre-intervention

Semi-structured interview about expectations of implementing a home garden

A semi-structured interview was conducted in mothers, as representatives of the household. The interview included questions about the perspective of implementing home gardens, benefits for household economy, health, family integration, and environmental

impact. The interviews were audio recorded with the authorization of the participants. The information was transcribed in its entirety, preserving the original narratives of the interviewed and it was classified into emerging themes and subtopics. The information was triangulated with experts on food security. The entire qualitative data procedure was performed considering Krefting's recommendations for trustworthiness (Krefting, 1991), while using the constant comparison method (Glaser and Strauss, 1999; Strauss and Corbin, 1997).

Socio-economic and demographic survey

A socio-economic and demographic survey was applied to know the size of the household, number of children, marital status, parents' education level, head-of-household gender, employment status, subscription to medical services, social welfare support, monthly family income, and food expenditure (INEGI, 2010).

Food security information

To assess food security status, the Mexican food security scale was applied to each household. The scale consists of 12 items that assess whether in the last three months prior to the interview, households have experienced changes in the quality and quantity of food due to lack of money or resources and, in severe situations, have experienced hunger. The questions make it possible to distinguish between access to food for adults and those under 18. Each item can be answered affirmatively or negatively. If all responses are negative, the household is food secure. The positive responses are added together to determine the household's category of food insecurity, which can be mild, moderate, or severe (Carrasco *et al.*, 2010).

Semi-quantitative food frequency questionnaire

A short food frequency questionnaire validated for school-aged children from northwest Mexico was applied to 35 children of the households that participated in garden's implementation. The survey was conducted in the company of their mothers and children were asked about the frequency of vegetables consumed in the previous year. Questions referred to three portion sizes in grams as small, medium, or large and a frequency of consumption as daily, weekly, monthly, yearly, or never (Quizán *et al.*, 2016). Intake was calculated in grams per day of each item for each child, following the procedure of the Dietary Intake Manual, which specifies the steps for estimating grams consumed from a frequency of food consumption (Ortega *et al.*, 1999).

Stage 2. Intervention

Presentation of the home garden, training, and delivery of printed material

The 91 participating households (which represent 452 people) received a theoretical and practical training for the development and maintenance of a home garden, using an informative manual prepared by the work team. The information was adapted from

the Food and Agriculture Organization of the United Nations (FAO, 2014) technical and self-instruction manuals, as well as information obtained during formative research (Figure 1) with local agronomy experts from the Department of Agriculture and Livestock of the University of Sonora prior to the development of this study (IPES and FAO 2010; FAO, 2014; SEDEMA, 2016).

The training of the 91 participating households was carried out directly in their homes from September 2019 to February 2020. During the training, the concept of a home garden and its main benefits were explained. With the help of pictures, the steps for the implementation of the garden were shown, including the selection of an exclusive space within the family land, conditioning and cleaning, land preparation, preparation of planting beds, and carrying out direct sowing of seeds according to the type of plant, the depth of sowing, and the distance between them. They were also trained on garden care and maintenance, including irrigation frequency, covering the soil, weed control, disease prevention, and pest control. In addition, they were instructed on how to make organic pesticides (based on garlic or the seeds and leaves of the neem tree) and compost, as resources that will benefit crop growth. Overseeding techniques were also imparted as a way to process and fill available soil with minor alterations (Figure 2).

Implementing the home garden

At the end of the training, the development of the home garden began, where all members of the household were invited to participate by carrying out the activities together with the trainers, such as identify and cleaning the area, marking, and digging the furrows, applying the water, and sowing the seeds.

A space of at least four-square meters was selected, close to a large tree to filter indirect sunlight and protect the seedlings from direct sunlight. To soften and oxygenate the soil, it was turned with a garden shovel and rake. The space was also cleaned by removing large objects such as stones, weeds, and grass; after cleaning, the furrows were dug and prepared



Source: author's elaboration.

Figure 1. Training of the work team before the implementation of the study.



Source: autor's elaboration.

Figure 2. Training of participating households in the development of a home garden.

with a shovel and spade, and the seeds were sown, respecting the distance according to the type of plant.

A total of nine vegetables were sown through direct sowing. The arrangement of the species and the characteristics of depth and distance between plants were as follows: chard (sowing deep: 1.5 cm; distance between plants: 10 cm), broccoli (sowing deep: 1-1.5 cm, distance between plants: 50 cm), radish (sowing deep: 1.5 cm; distance between plants: 2-3 cm), coriander (sowing deep: 2 cm, distance between plants: 10 cm), saladette tomato (sowing deep: 1-1.5 cm; distance between plants: 25 cm), chambray onion (sowing deep: 1-1.5 cm, distance between plants: 10 cm), carrot (sowing deep: 1-1.5 cm, distance between plants: 5-7 cm), cabbage (sowing deep: 1-1.5 cm, distance between plants: 50 cm), and, romaine lettuce (sowing deep: 1.5 cm, distance between plants: 30 cm).

After the seeds were sown, the soil was moistened. In addition, each family received a sketch showing the location of the seeds planted (Figure 3).



Source: autor's elaboration.

Figure 3. Implementation of a home garden.

Monitoring the home garden

From September 2019 to February 2020, follow-up visits were made to the households every three weeks for the control and maintenance of the home garden. A format was developed to assess the plants' growth, development, and care. The data included plant quantification, growth stage, nutrient deficiency, and detection of pests. The gardens were inspected to determine the adequacy of plant support structures, irrigation systems, and fence protection in each of the 91 households. In addition, the cleanliness of the gardens was checked, as well as the availability and use of homemade compost and organic pesticides (Figure 4).

Stage 3. Post-intervention

At the end of the garden implementation, the quantity of each vegetable harvested was recorded, as well as the quantity of vegetables harvested in food secure and food insecure households. Also, a second brief food frequency questionnaire was applied to estimate the vegetable consumption of the children. Finally, a semi-structured interview was conducted to analyze the households' experiences.

Statistical analysis

Descriptive analyzes were performed to estimate the mean, median, standard deviation, interquartile range, and percentage of the variables. The responses to the semi-structured interview were analyzed using the constant comparison method that consists of collecting, grouping the information from the interviews into categories, and systematically analyzing the data in the economic sphere, food variety, physical and emotional health, family integration, and environment. To analyze differences between the quantity of vegetables harvested in household food security and households with food insecurity the Mann-Whitney test was used. The consumption of grams of vegetables in children pre and post implementation of home gardens were evaluated using a Wilcoxon's test. Data entry and



Source: autor's elaboration.

Figure 4. Follow-up visits to the home garden.

analysis were carried out in Microsoft Excel 2013, Stata version 11 and SPSS 19. A p-value ≤ 0.05 was considered as statistically significant.

RESULTS

Pre-intervention: socio-economic and demographic characteristics of households

All 91 households implemented the home garden. The average number of family members was 5 ± 1.3 . About a third of mothers (36%) and fathers (33%) have elementary school. Just over 90% of these parents are married or living in a common-law marriage. A 35.2% of the mothers have a job, while 13.2% of them are the main breadwinner of their household. The average monthly family income was US $\$385.9 \pm \186.3 , and a large portion of the income is spent on basic food basket items (66.4%); the remaining income is spent on other basic family expenses, reflecting the lack of access to an adequate variety of food. Consequently, 66% of the households had some degree of food insecurity: 36.3% mild, 19.8% moderate, and 9.9% severe food insecurity, respectively (Table 1).

Requirements and investment to provide vegetables at household level

To provide a better variety of food in the diet each household received free seeds, specially prepared soil and compost. In addition, they were supported with shovel, hoe and rake, regardless of whether they had. Each households required an investment of US $\$31.07$ for the development and long-term maintenance of the home garden. All the family participate in the implementation of the garden with a range of participation of 1 to 6 participant, including children; about 60% of the households fenced their garden with materials available at home.

Perspectives of implementing a home garden

Based on the process of categorization and systematic analysis of the data from the semi-structured interviews, six emerging themes of having a home garden were identified (Table 2). The six emerging themes show the interest of the households in participating and having a home garden in their homes because of the various benefits it could bring to them. The information provided by the households is presented below.

First. 100% of the households agreed that this measure would contribute positively to their family economy by saving the money they would use to buy the vegetables they would now harvest in their own backyard:

“Spending on food purchases would be less”.

“If you sowed it, it would be cheaper; if you harvested the vegetables, it would be cheaper for you”.

“When we plant fruits, we don’t buy them anymore. They go and pluck them themselves; and then we get them ourselves”.

Second. Nearly all (98.9%) mentioned that it would help the health of all family members:

“Because it would be more natural, it wouldn’t have as many chemicals”.

Table 1. Socio-economic and demographic characteristics of the families that participated in the home garden (n=91).

Variables	Mean $\pm$ SD or % ^a	Range
Household size	5.0 $\pm$ 1.3	2-9
Number of children	2.5 $\pm$ 1.1	1-8
Monthly family income	385.9 $\pm$ 186.3	73.60-978.9
Education of mother		
Incomplete elementary school	45.0	
Elementary school	36.3	
High school or superior	18.7	
Education of father (n=82)		
Incomplete elementary school	53.7	
Elementary school	32.9	
High school or superior	13.4	
Marital status		
Married or living in a common law marriage	92.3	
Single, separated, widowed, or divorced	7.7	
Working mothers	35.2	
Main provider at home		
Mother	13.2	
Father	76.9	
Both	9.9	
Medical service	92.3	
Social program beneficiary	38.5	
Monthly food expenditure	66.4	
Food security	34.0	
Mild food insecurity	36.3	
Moderate food insecurity	19.8	
Severe food insecurity	9.9	

^aValues are mean $\pm$ SD (standard deviation) or percentages.

Source: autor's elaboration with data obtained from the survey.

“Well, because when they see the planting, children often feel like eating the fruits or vegetables”.

“We are not going to buy because the store is too far away; and if you have it here, you can get it from here”.

Third. The 96.7% considered that having a home garden could have benefits in physical health:

“Because I would also eat, and it serves to nourish me, to be healthy”.

“Because vegetables and fruits have many vitamins”.

“That they (her children) get more exercise by cleaning it (the garden). And for the nutrients that vegetables provide”.

Fourth. 97.8% said that it could benefit their mental health:

“Because instead of thinking, you relax and get there to remove the soil, to water it ...

Table 2. Categorization and conceptualization of emerging themes from semi-structured interviews.

Emerging theme	Concept	Pre-intervention ^a	Post-intervention ^b
Economic benefit	Statements that indicate how the availability of vegetables through home gardens could help to save economic resources.	91	51
Family feeding	Statements that indicate how a home garden would help increase household vegetable consumption and statements regarding the consumption of chemical-free vegetables.	90	51
Physical health	Statements that indicate the nutritional benefit of vegetable consumption and the physical activity that would be generated from the maintenance and care of a home garden.	88	75
Emotional well-being	Statements that indicate that a home garden could relieve stress due to lack of access to vegetables and statements about the relaxation and tranquility that could be experienced when carrying out home garden activities.	89	76
Family integration	Statements that indicate that the activities necessary to carry out the maintenance of a home garden would contribute to family integration as an opportunity to spend time with the family and transmit such knowledge to children.	89	79
Environment	Statements that indicate the positive perception of having a home garden by improving air quality, the use of all organic resources from the garden and the reduction of garbage in their homes.	86	28
Having a home garden during the COVID-19 contingency ²	Statements that indicate the perceived benefit in access and availability of vegetables from having a home garden during a contingency.	--	23

^aNumber of families mentioning the emerging theme during the semi-structured interview. ^bFor this topic, a subsample consisting of 35 participants from the total sample was selected.
Source: Autor's elaboration with data obtained from the survey.

you get motivated because you see that you have your own little plants”.

“It serves as a distraction, it serves as a peace of mind, you release stress; you make sure that what your children are going to eat, is natural”.

Fifth. Nearly all (97.8%) mentioned its implementation as a form of family integration:

“Like to teach them (her children) something and share with them”.

“I believe that the family must be involved in the garden and help me take care of it”.

“Yes, because they (her children) are also going to come with me and they are going to do it, they will like to come and put water on it and be there”.

Finally, the 94.5% considered that it could have a positive impact on the environment of their community:

“You help the environment because you are not contaminated, maybe, just like what you harvest from there, the peel and that can also be recycled and you can throw it on the same plants”.

“What we buy in the store comes with wrappers, with boxes so we would avoid that”.

Intervention and monitoring the home garden

During the process of growing and maintaining the vegetables, irrigation and care of the plants was essential to achieve the harvest of vegetables. Nearly all (92.6%) reported watering their home garden, out of which 63.5% watered it every day or every two days; 17.5% created an irrigation system. Otherwise, nearly half (45.6%) of the households expanded the garden, sowing more seeds of the same crops provided, as well as other ones, particularly garlic, celery, potato, nopal (prickly pear cactus), cherry tomato, and corn were also chosen. Finally, 36.7% and 42.6% of these households looked for ways to enhance the growth of their home garden, such as adding soil from under the mesquite trees, making compost from eggshells, fruits and vegetable peels, and coffee, respectively.

Post-Intervention

Vegetables harvested in household with food security and food insecurity

About 80% of households harvested a total of 227.8 kilograms of vegetables and a significant difference was found in the quantity of vegetables harvested by household type (Table 3). Food insecurity households harvested 164.1 kilograms compared to 63.6 kilograms harvested in households with food insecurity ($p=0.03$).

Home garden effects on vegetable consumption among children

After the implementation of the home gardens, vegetable consumption increased about 200 ($p=0.02$) and 300 ($p<0.001$) grams per day in children from food-secure and food-insecure households, respectively (Table 4).

Experiences of households about implementing a home garden

After vegetable harvests, households experienced benefits in: a) dietary, b) family integration, c) physical and mental well-being, d) economic, and e) during the COVID-19 contingency.

Table 3. Kilograms of vegetables harvested in 80% of households with food security and food insecurity.

Vegetables	Harvest ^a (kilograms)	
	Food security	Food insecurity
Chard	8.0	34.4
Radish	10.2	31.8
Broccoli	5.4	13.2
Coriander	3.7	8.1
Saladette tomato	12.5	27.5
Cabbage	21.0	29.0
Cambray Onion	1.0	2.5
Carrot	1.4	5.5
Letucce	0.45	12.15
Total	63.6	164.1
P ^b	0.03	

^aValues are kilograms of vegetables. ^bDifferences by Mann-Whitney test considering the total kilograms of vegetables by category of food insecurity.
Source: autor's elaboration with data obtained from the survey.

a) Dietary. The gardens were allies of their diet, as the garden was able to contribute to dietary diversification, obtaining a greater variety and quantity of vegetables that they rarely consumed; the vegetables were consumed raw or cooked in typical regional dishes:

“Of course. Also, as I told you last time, what we ate the most was chard and we hardly consumed before”.

“Well, they (her children) were encouraged to taste, for example, carrots. It was something they hardly ate”.

“Yes, it helps us because we eat more vegetables”

“With the vegetable and that which was coming out (from the garden) we completed a meal. In fact, the other time I didn't have any onion and there was one, only one was left in the garden and it was the one we took out. Yes it has helped us too”

Table 4. Change in vegetable consumption in children before and after the implementation of the home garden (n=35).

Variable ¹	Food security (n=10) ^a	Food insecurity (n=25) ^a
Vegetables, g per day		
Pre-intervention	100.4 (44.1, 118.9)	88.3 (47.8, 131)
Post-intervention	308.4 (214.6, 392.3)	387.8 (257.8, 516.3)
P ^b	0.02	<0.001

^aValues are median ± interquartile range or percentages. ^bDifferences by Wilcoxon signed rank test.
Source: autor's elaboration with data obtained from the survey.

b) Family integration. Households considered the home garden as an activity that allowed them to spend quality time with the family.

“Yes, because my husband is the one who moves them (the children), he tells them we are going to do this (working in the garden), and he takes them there, and together they move the soil, water the garden, check for pests and pick the vegetables, which are ready to eat”.

“What I experienced is that the garden helped us to be aware as a family (of the importance of having a garden) because we are all attending when the garden grows (because it would give them vegetables)”

I think gardens helps the community here, the neighbors, because when they saw that it was growing, they were motivated. The neighbor on one side said to me: “Oh, I am going to make one too...And she did!”

c) Physical and mental well-being. Households also reported benefits in both physical and mental health, as they had a greater amount of healthy and natural food ready for eating and also the tasks for the maintenance of the gardens was a family wellness and a space to release stress:

“The truth is that it is satisfactory to be able to see how it grows, and that you feed from right there”.

“It does help us to distract ourselves for a while, having the garden, cleaning it, watering it, removing weeds and all that”.

“The garden keeps me busy, so it is something that had me perhaps unconcerned about other things”.

“I liked it a lot because if the planting beds were unmade, we would make them again”

d) Economic. After the intervention of the gardens, households reported experiencing economic benefits due to savings in food purchases:

“Well, I no longer spent so much buying vegetables”.

“Yes, I never bought tomatoes” (Because they harvested it from the garden).

e) During COVID-19 contingency. Because the households were able to harvest and consume vegetables from the garden during the COVID-19 health emergency contingency, it was possible to learn about their experiences regarding the benefit of the home gardens. Households reported that the home garden improved their availability and access of vegetables during the contingency:

“The first month, almost, that this started, I don’t work and then we did have a hard time but we still got on as well as we could. So, it was when the home garden helped us”.

“There are times (during COVID-19 pandemic) when I have tomatoes and onions (from the garden) and with a few warm tortillas, it is enough to eat. There are times when the situation is very difficult, but the garden has helped us to face this situation”.

“With the vegetable and that which was coming out (from the garden) we completed a meal. In fact, the other time I didn’t have any onion and there was one, only one was left in the garden and it was the one we took out. Yes, it has helped us too”.

DISCUSSION

This study evaluated the implementation of home gardens as a livelihood strategy among households in the fishing community of Bahía de Kino, Sonora. The 91 participating households had a physical space for the development of a home garden. It has been documented that the scale of horticultural production and the size of the garden can be quite flexible and adaptable to the variety of spaces available in homes. Therefore, even a small yard can accommodate a variety of edible crops and fruit trees (Poot-Pool *et al.*, 2018).

In addition, while all households had the water they needed to maintain their gardens, 30% of them did not have a tap and relied only on water stored in water tanks that were periodically replenished, so they sought strategies to use as little water as possible, such as making homemade watering cans for the garden. Paletta *et al.*, in 2022 analyzed the creation of homemade artifacts for growing plants in homes in Brazil. Through home visits, they observed that families not only used the traditional watering can to water their plants, but also that milk bottles, feeding bottles, and glasses were conditioned for this function. This confirms the households' interest in looking for alternatives to irrigate the gardens, adjusting to their available resources.

Household reported that home garden contributed to the increase in the consumption of vegetables, especially households with food insecurity were conscious that their garden would provide them vegetables that they would not usually buy due to lack of money. The vegetables harvested were prepared mainly in salads, as an accompaniment to typical regional dishes including breaded fish and fish mash, as well as in the preparation of broths, sauces, soups, and creams. Households even mentioned that they introduced chard into their diet, a food they hardly ate, and were surprised by the taste of carrots they had grown and harvested from their own garden. In the study by Algert *et al.*, (2016), participating households saw their gardens as a source of healthy, fresh, organic, and more nutritious foods than those bought from stores and that their vegetables also tasted much better than those bought from stores.

It should also be noted that with the current health crisis in COVID-19, families experienced a decrease in their income. However, they mentioned that the garden was a great ally in providing them with food, and that sometimes the vegetables they harvested were the only food they ate during the day, accompanied by corn tortillas. In general, households mentioned that they were able to eat a wider variety of vegetables than before having gardened. In previous research, carried out in this community, low consumption of vegetables was reported, particularly in households that experience some degree of food insecurity (Murillo-Castillo *et al.*, 2018; Murillo-Castillo *et al.*, 2020; Quizán-Plata *et al.*, 2020). Home gardens were an efficacious and adequate strategy for households in this community where a high percentage of them are food insecure, and the garden contributed to vegetable consumption. In our study, children benefited from the vegetables harvested. Their consumption was twice as high, especially among children from food insecure households. A study conducted to improve eating behavior in children with

garden-related activities found that after the program, the preference and consumption of vegetables increased significantly in children who received the intervention program ($p < 0.001$) (Kim *et al.*, 2020).

Pais *et al.*, 2022 suggest the importance of promoting diets rich in plant-based foods, not only because they are healthy and sustainable, but also because they are economical, being a great support for low-income populations to achieve food security.

The households also reported benefits in family mental health through the relaxation and tranquility that could be experienced when carrying out gardening activities at home. Therefore, having a home garden helps to reduce the stress of not having enough income to buy food; the garden also serves as a hobby, which contributes to personal well-being. Carney *et al.*, (2012), reported that garden-tending activities of 38 agricultural workers provided them with mental benefits as a recreational activity to spend time taking care of their plants. They enjoyed such activity and it helped reduce stress after work hours by packing produce or other farm activities.

Households also considered the garden to promote family integration, since it was an opportunity to spend time with the family as well as an opportunity to transmit knowledge to children. Calvet-Mir *et al.*, (2016) found that home garden knowledge is mainly transmitted from parents to children. In particular, on issues related to crop sowing and harvesting, fertilization, pest and disease management, and crop uses.

Also the households expressed that the gardens would have a positive impact on the community's environment, by improving air quality and using organic resources from garbage for their maintenance. Sonti and Svendsen (2018) found that among the reasons for implementing a garden are to restore the environment in general and to improve local ecology by establishing native plants.

In terms of technical and financial resources, households required minimal investment in tools and raw materials to implement home gardens compared to other studies (Asqui-Yuquilema, 2018). In addition, most households had some of the necessary tools. Also, because the soil type in the community is sandy, the gardens were enriched with soil extracted from mesquite trees (endemic to the region) to favor the growth of vegetables. Household members contributed to the implementation of their own garden including children and their neighbors. Home gardens, including community gardens, have been shown to provide a space for activity, socialization, and the development of social networks that contribute to family time as a source of social bonding (Algert *et al.*, 2016). In addition, a quarter of households not only met their own needs, but also shared their harvest with members of their immediate family and with their neighbors. People who have established gardens have been observed to share excess produce with others, with some even trading vegetables for other types of food (Algert *et al.*, 2016). This demonstrates the bonds of solidarity that can be formed through the development of home gardens, as well as the potential for households to sustainably maintain their garden.

The present study also observed children's interest in taking actions to protect, maintain, and contribute to the improvement of their home gardens; these actions included the

construction of a fence, homemade garden watering cans, and irrigation systems, using materials that the family had at home. Some studies have reported that family ties are an important element in involving children in garden maintenance. In the study by Carney *et al.*, (2012), they reported that in more than two-thirds of the households that participated in the implementation of home gardens, children under the age of 18 contributed throughout the gardening process.

Although one of the limitations of this study was its quasi experimental nature, 80% of the participating households were successful in developing and harvesting vegetables from their own home gardens. In particular, there was greater interest among food-insecure households who knew that the garden would benefit them with vegetables that they do not eat because their income is insufficient to purchase them. Some of them used the knowledge gained to expand the garden by planting crops other than those included in this study, which contributed to better meeting basic food needs. Thus, home gardens can be a way to supplement the food supply, strengthen family ties, and provide individual well-being.

CONCLUSIONS

This study is one of the few that has analyzed the perspectives and effects of implementing home gardens in Mexican communities whose main economic activity is fishing. One of the advantages of this study was the ability to provide households with the supplies and materials to begin implementing home gardens.

In summary, the implementation of home gardens in a Mexican fishing community met household's expectative for gardening and had a positive effect on diversifying the diet of households from the community of Bahia de Kino, as well as increased vegetable consumption among their children. The garden, therefore, offers greater availability of healthy food consumption. However, it is important that the promotion of the implementation of home gardens, as a strategy to improve food security, be a permanent activity. By disseminating the results of this research, it is hoped that the development of home gardens can be replicated in other fishing communities from Mexico.

ACKNOWLEDGMENTS

We would like to thank to the Interdisciplinary Faculty of Biological Sciences and Health and to the Department of Scientific and Technological Research of the University of Sonora (DICTUS) for technical assistance, and all study participants for their contribution to this work.

REFERENCES

- Adetoyinbo A, Otter V. 2022. Can producer groups improve technical efficiency among artisanal shrimpers in Nigeria? A study accounting for observed and unobserved selectivity. *Agric Food Econ* 10:1-33. doi: <https://doi.org/10.1186/s40100-022-00214-x>
- Algert S, Diekmann L, Renvall M, Gray L. 2016. Community and home gardens increase vegetable intake and food security of residents in San Jose, California. *Calif Agric* 70:77-82. doi: <https://doi.org/10.3733/ca.v070n02p77>
- Asqui-Yuquilema BF. 2018. Estudio de factibilidad para la implementación de huertos orgánicos familiares

- en el barrio san José del Vínculo, parroquia de Sangolquí, cantón Rumiñahui. Master's Dissertation, Universidad Central de Ecuador
- Béné C. 2006. Small-scale fisheries: assessing their contribution to rural livelihoods in developing countries. FAO Fisheries Circular. Rome.
- Calvet-Mir L, Riu-Bosoms C, González-Puente M, Ruiz-Mallén I, Reyes-García V, Molina JL. 2016. The transmission of home garden knowledge: safeguarding biocultural diversity and enhancing social-ecological resilience. *Soc Nat Resour* 29:556-571. doi: 10.1080/08941920.2015.1094711
- Carney PA, Hamada JL, Rdesinski R, Sprager L, Nichols KR, Liu BY, Pelayo J, Sánchez MA, Shannon J. 2012. Impact of a community gardening project on vegetable intake, food security and family relationships: a community-based participatory research study. *J Community Health* 37:874-881. doi: 10.1007/s10900-011-9522-z.
- Carrasco B, Peinador R, Aparicio R. 2010. La Escala Mexicana de Seguridad Alimentaria en la ENIGH: Evidencias de la Relación entre la Inseguridad Alimentaria y la Calidad de la Dieta en Hogares Mexicanos. Presented at the X Reunión Nacional de Investigación Demográfica en México de la Sociedad Mexicana de Demografía, México, 5 November 2010.
- Esteban-Ibáñez M, Amador-Muñoz LV. 2020. El huerto social como estrategia para la educación ambiental. *Agricultura, sociedad y desarrollo*. 17(2): 321-347.
- FAO, OPS, WFP, UNICEF. 2018. Panorama de la seguridad alimentaria y nutricional en América Latina y el Caribe. Santiago. Licencia: CC BY-NC-SA, 30.
- FAO. 2014. Una huerta para todos. Manual de auto-instrucción. Organización de las Naciones Unidas para la Agricultura y la Alimentación, Santiago de Chile.
- Glaser BG, Strauss AL. 1999. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge. doi: <https://doi.org/10.4324/9780203793206>
- Instituto Nacional de Estadística y Geografía INEGI. 2010. Encuesta Nacional de Ingresos y Gastos de los Hogares 2010 cuestionario de hogares y vivienda.
- IPES, FAO. 2010. Biopreparados para el manejo sostenible de plagas y enfermedades en la agricultura urbana y periurbana, 1st ed.; IPES-Promoción del Desarrollo Sostenible: Lima, Perú.
- Kim SO, Park SA. 2020. Garden-Based Integrated Intervention for Improving Children's Eating Behavior for Vegetables. *Int J Environ Res Public Health*. 17(4):1257. doi: 10.3390 / ijerph17041257
- Krefting L. 1991. Rigor in Qualitative Research: The Assessment of Trustworthiness. *Am J Occup Ther* 45:214-222. doi: <https://doi.org/10.5014/ajot.45.3.214>
- López-González JL, Álvarez-Gaxiola JF, Rappo-Miguez SE, Damián-Huato MA, Méndez-Espinosa JA, Paredes-Sánchez JAP. 2019. Huertos familiares y seguridad alimentaria: el caso del municipio de Calpan, Puebla, México. *Agricultura, Sociedad y Desarrollo*. 16(3):351-371. doi: <https://doi.org/10.22231/asyd.v16i3.1234>
- Murillo-Castillo KD, Frongillo EA, Corella-Madueño MA, Quizán-Plata T. 2020. Food Insecurity Was Associated with Lower Fruits and Vegetables Consumption but Not with Overweight and Obesity in Children from Mexican Fishing Communities. *Ecol Food Nutr*. 59:420-435. doi: <https://doi.org/10.1080/03670244.2020.1737042>
- Murillo-Castillo KD, Frongillo EA, López-Teros V, Haby MM, Corella-Madueño MA, Díaz-Zavala RG, Quizán-Plata, T. 2018. Food insecurity was associated with low quality diet and low HDL level in mothers of Northwest Mexico relying on fisheries for livelihood. *Nutr Hosp*. 35:1379-1386. doi: 10.20960/nh.1923.
- Ortega MI, Quizán PT, Morales G, Preciado M. 1999. Cálculo de ingestión dietaria y coeficientes de adecuación a partir de: registro de 24 horas y frecuencia de consumo de alimentos. Cuadernos de trabajo 1.
- Pais DF, Marques AC, Fuinhas JA. 2022. The cost of healthier and more sustainable food choices: Do plant-based consumers spend more on food? *Agric Food Econ* 10:1-21. doi: <https://doi.org/10.1186/s40100-022-00224-9>
- Paletta-Bernatti L, Trvisan-Mayeta BS, Mol-Silva AC, Álvarez-Correa-Dias MR. 2022. Vernacular artifacts for plant cultivation: a sustainable design. *Rev Prod Desenvolv* 8:e604-e604. doi: <https://doi.org/10.32358/rpd.2022.v8.604>
- Poot-Pool WS, Cetzal-Ix W, Basu SK, Noguera-Savelli E, Noh-Contreras DG. 2018. Urban Home Gardens: A Sustainable Conservation Model for Local Plants Based on Mexican Urban Agri-Horticultural Practices. In: Nandwani D (ed) *Urban Horticulture. Sustainable Development and Biodiversity*, vol 18. Springer, Cham. doi: https://doi.org/10.1007/978-3-319-67017-1_4
- Quizán PT, Esparza RJ, Bolaños VA, Madueño MG, Careaga AR. 2016. Design, Validation and Reproducibility

- lity of a Short Food Frequency Questionnaire to Assess Fruit and Vegetable Intake in Schoolchildren from Northwest Mexico. *International Journal of Nutrition and Food Sciences* 5: 337-343. doi: 10.11648/j.ijnfs.20160505.14
- Quizán-Plata T, Carrasco-Miranda JG, Murillo-Castillo KD, Corella-Madueño MAG, López-Teros V, Frongillo EA. 2020. Determinants and Consequences of Food Insecurity in Artisanal Fishing Families From the Coastal Community of Sonora, Mexico. *Food Nutr Bull* 41:459-473. doi: 10.1177/0379572120965874
- Reyes-García V, Calvet-Mir L, Vila S, Aceituno-Mata L, Garnatje T, Lastra JJ, Parada M, Rigat M, Vallés J, Pardo-De-Santayana M. 2013. Does crop diversification pay off? An empirical study in home gardens of the Iberian Peninsula. *Society & Natural Resources*, 26:44-59. doi: 10.1080/08941920.2012.6811SE-DEMA. 2016. Guía de huertos urbanos. Available in: <http://data.sedema.cdmx.gob.mx/flippingbook/guia-huertos-urbanos/guia-huertos-urbanos.pdf>
- Secretaría de Bienestar. 2020. Sembrando Vida. Programa de Comunidades Sustentables. Gobierno de México. <https://www.gob.mx/bienestar/acciones-y-programas/programa-sembrando-vida>
- Sonti NF, Svendsen ES. 2018. Why garden? Personal and abiding motivations for community gardening in New York City. *Society & Natural Resources* 31: 1189-1205. doi: 10.1080/08941920.2018.1484971
- Strauss AL, Corbin JM. 1997. Grounded theory in practice. Sage Publications Inc, United States.
- United Nations. 2019. The Sustainable Development Goals Report 2019. United Nations Publications, New-York.