Colegio de Postgraduados

Contribution of Home Gardens to Food Availability for Food Security

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ABSTRACT

Objective: To analyze the importance and contribution of home gardens to food security and food availability, in relation to biodiversity, in communities belonging to the municipalities of Mazatán and Tapachula, Chiapas, Mexico.

Design/methodology/approach: A questionnaire was applied to 52 families, incorporating social and ethnobotanical aspects. The questionnaire was administered through semi-structured interviews and field visits in the communities.

Results: Households consisted of 4.2 to 5.6 members, and the female head of household (56.68%) was prominently involved in home garden management. The floral diversity of the 52 home gardens included up to 107 species, most notably the Fabaceae (10 species) and Solanaceae (9 species) families. These gardens also housed 15 species of wild and domestic fauna. The primary use of both plants and animals recorded was food; The main food groups found in home gardens were fruits, low-energy foods, and vegetables.

Study Limitations/Implications: This study was limited by the availability of rural families to complete surveys and access their home gardens.

Findings/Conclusions: Family home gardens harbor rich plant and animal diversity, providing both plant and animal food groups, as well as domestic and wild fauna, with women being the primary caregivers.

Keywords: Affordability, Biodiversity, Availability, Gardens, Poverty.

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INTRODUCTION

The Food and Agriculture Organization of the United Nations (FAO) first defined food security (FS) at the 1996 World Food Summit as "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life." Since 2009, the FAO has expanded this concept to include nutrition, referring to it as Nutritional

Food Security (NFS) (FAO, 2009). In relation to NFS, home gardens play an important role in food availability for rural households. These gardens are considered traditional agroforestry systems that exhibit agrobiodiversity composed of plant and animal species, as well as ecosystems used for agricultural purposes (Mariaca-Méndez, 2012; Vogl *et al.*, 2004). In academic contexts, and depending on the region, home gardens are known by various terms —such as family gardens, solares, or backyards— according to their local geographical context. In southern Chiapas, Mexico, families refer to this space as a patio (Gerardo-Méndez *et al.*, 2022). These home gardens –*patios*– are of great importance for the transmission of knowledge related to NFS, as they host both domesticated and wild agrobiodiversity that contributes to household nutrition (Cano-Contreras, 2015). In marginalized and rural areas, home gardens serve as a key resource for supplying part of the family's diet, while also promoting a healthy and varied food intake (Suárez *et al.*, 2015). Furthermore, these spaces play a crucial role in the conservation of germplasm from edible, medicinal, condiment, and ornamental species, among others (Duché-García *et al.*, 2017). Socially, they hold significant cultural value, as they contribute to the preservation of traditional and cultural roots of the communities that manage them (Lope-Alzina *et al.*, 2018; Mariaca-Méndez, 2012; Moctezuma-Pérez, 2010; Van der Wal *et al.*, 2011).

Several studies have shown that cultivated and wild plant species coexist in home gardens, forming part of the region's ethnobiological heritage. Characterizing these species allows for a better understanding of their use and significance, as well as their contribution to the food groups that make up family diets. This information can also inform development proposals at the municipal and state levels, highlight the value of traditional practices, and emphasize the ecosystem services provided by these systems. In Mexico, 25.1% of the total population experiences food access deficiencies. Specifically, in the state of Chiapas, up to 24.5% of the population faces food insecurity (CONEVAL, 2020). In rural areas of Chiapas, however, home gardens are traditionally used by families for food production aimed at self-consumption, highlighting their importance for food security in communities in southern Mexico. Therefore, the objective of this study was to analyze the importance and contribution of home gardens to food availability for food security, in relation to biodiversity, in communities located in the municipalities of Mazatán and Tapachula, Chiapas, Mexico.

MATERIALS AND METHODS

Study Area

This research was conducted in four communities in southern Chiapas: three located in the municipality of Mazatán: Ejido Lázaro Cárdenas (ELC), Guadalupe (GU), and Emiliano Zapata las Varillas (EZV) and one in the municipality of Tapachula, Dorados de Villa (DV). Fieldwork was carried out from January to April 2020 (Figure 1). These communities were selected due to their proximity and similar edaphoclimatic conditions. According to CONEVAL (2020), all four communities are classified as experiencing extreme poverty. They are ejido (communal land tenure) properties, located far from the municipal centers.

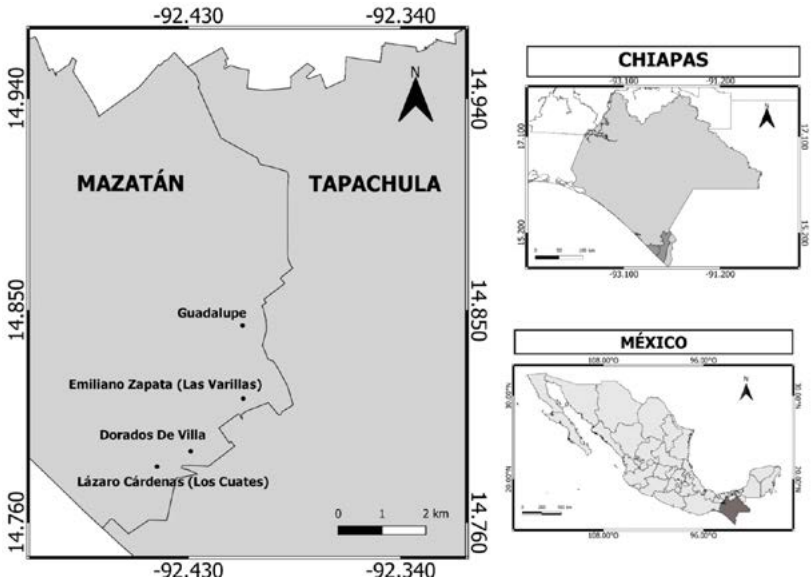

Figure 1. Geographical location of the study sites. Source: Prepared by the authors using data from (INEGI, 2020a).

The communities of the study sites share a warm subhumid climate with summer rainfall (94.22%), an average humidity of 5.78%, temperatures ranging from 26 to 30 °C, and annual precipitation between 1,200 and 2,000 mm (INEGI, 2010).

The selection of the home gardens was based on a non-probabilistic purposive sampling method (Otzen and Manterola, 2017; Zamudio-Sosa *et al.*, 2002), which included 52 gardens distributed across the communities of both municipalities. This approach was also aligned with the methodology employed by Van der Wal and Bongers (2013), which recommends selecting owners who are willing to participate. To this end, discussions were held with the women of the study communities, and the research project was presented to gain their collaboration.

After obtaining consent to participate, schedules for visits and tours of the home gardens were arranged. Additionally, a semi-structured interview was conducted with the women, focusing on social, ethnobotanical, and home garden management aspects, due to the important role women play in managing the production unit.

Characterization of the Family: The number of family members, educational level, time spent on home garden management activities (expressed in minutes), and the participation of family members involved in home garden activities were recorded.

Plant Species Diversity and Use: The methodology suggested by Colin *et al.* (2020) was applied. Taxonomic identification was verified using the database available at www.theplantlist.org and the VAST (Vascular Tropics) database of the Missouri Botanical Garden (Solomon and Magill, 2006). Based on the collected data, plant genera, species, and families were identified by comparison, along with the number of species and ethnobotanical data per home garden and community. Additionally, the use value of the plant species present and reported in the home gardens was recorded.

Animal Species Diversity and Use: This was assessed using the method proposed by Chablé-Pascual *et al.* (2015), recording the animals reported during direct interviews, as well as through home garden visits and photographic documentation for species identification. The use value of the animal species was also recorded. Subsequently, the species were compared with those reported by Mariaca-Méndez (2012).

Diversity by Food Groups: The total plant and animal diversity present in the home gardens was classified into food groups according to the *Mexican System of Equivalents* (Pérez-Lizaur *et al.*, 2014).

RESULTS AND DISCUSSION

Household Characterization: In general, the 52 participating women reported households ranging from 4.2 to 5.6 members.

The largest households were found in the community of EZV, with 5.6/3.7 members (Table 1). The educational level of household heads in the four communities was primarily basic education (elementary school). Regarding illiteracy, a low percentage of illiterate households was found. In DV, 23% of men were illiterate, while in EZV, 31% of men and 10% of women were reported as illiterate. Conversely, in ELC, 23% of women were illiterate compared to only 7% of men. Regarding the highest level of education attained, the communities of ELC, EZV, and GU reported having completed upper secondary education (high school), while the DV community reported up to lower secondary education (middle school) only (Figure 2).

Regarding the occupation of household heads, day laborer was reported as one of the main activities across the four communities, in contrast with farmer, which was performed less frequently (Figure 3).

In the case of female heads of household, most are homemakers; however, in the community of DV, a small percentage (7%) of women work as day laborers.

Yard management and activities:

According to the results obtained, all family members participate in yard-related activities. Among the 52 studied yards, there was a marked trend of female participation, accounting for 56.68%, in contrast with the participation of male heads of household, which was only 5.49% in the communities of DV and ELC. Moreover, the participation of mothers accompanied by their children was reported in three communities: DV, ELC, and G (Table 2). Regarding the time devoted to yard tasks and management, respondents reported dedicating between 1.35 minutes and 2 hours per day.

Table 1. Number of family members in communities of Mazatán and Tapachula, Chiapas.

Communities	Members per family	Number of children
Ejido Lázaro Cárdenas	4.7	2.9
Guadalupe	4.2	2.2
Dorados de Villa	4.6	2.6
Emiliano Zapata las Villas	5.6	3.7

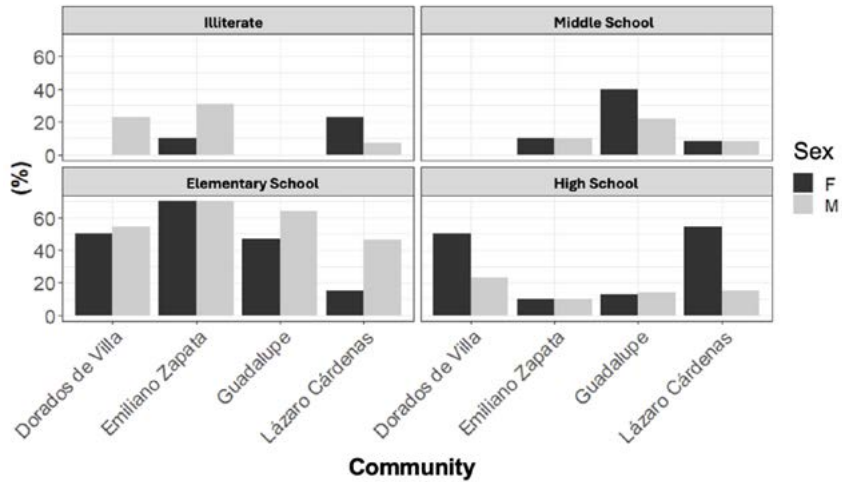

Figure 2. Educational level (%) of male and female heads of household in communities of Mazatán and Tapachula, Chiapas, Mexico.

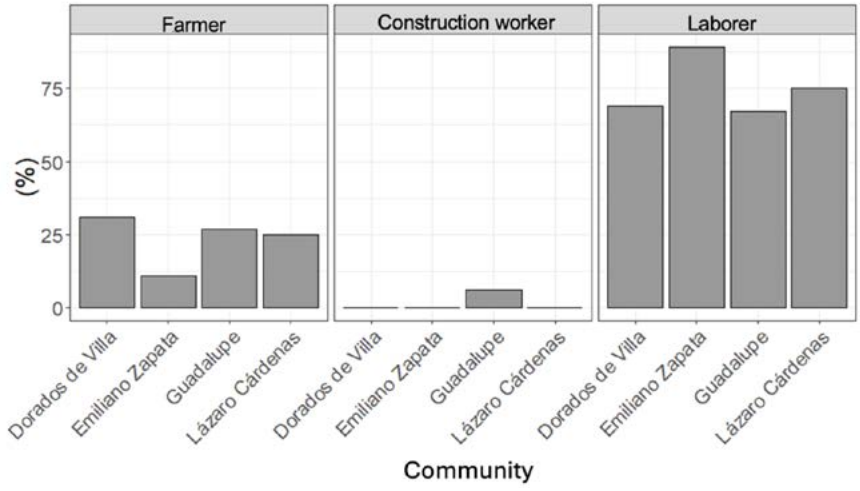

Figure 3. Occupation of household heads in communities of Mazatán and Tapachula, Chiapas.

Table 2. Family members' participation and time dedicated to the yard in communities of Mazatán and Tapachula, Chiapas.

Community	Mother	Father	Mother-Father	Mother-Children	Mother-Father-Children	t (h)
Dorados de Villa	6	2	-	5	1	1.39
Guadalupe	9	-	3	3	-	2.00
Ejido Lázaro Cárdenas	7	1	1	4	-	1.73
Emiliano Zapata las Varillas	7	-	3	-	-	1.35
Total (%)	56.68	5.49	14.42	21.62	1.79	

t=time dedicated to work in the HG per day; h=hours.

Plant Diversity and Use. In total, across the four communities, 107 plant species were found; with the Fabaceae family standing out with 10 species, followed by Solanaceae (9 species). Meanwhile, the families that shared the same number of species (5) were: Rutaceae, Poaceae, Malvaceae, Euphorbiaceae, and Amarantaceae. On average, between 83 and 96 plant species were found per community: ELC with 90 species, GU with 85, DV with 84, and EZV with 75 species. The use of the species diversity present in the 52 patios across the four study communities was mainly for food purposes (Table 5). In the community of DV, 72.3% of the species present in the patios (68 species) are used for food; in the community of LC, 67% (67 species); GU, 63.1% (60 species); and EZV, 61.1% (56 species). The results highlight the importance of floristic diversity in the availability of food for families in the study area. Regarding the plant parts used for food, these were mainly: leaves, fruits, seeds, stems, grains, and flowers, with a notable use of fruits and leaves. Other reported uses of the diversity were: medicinal, ornamental, and shade, showing variability among the communities. Meanwhile, the contribution of wood from the patios was found in lesser proportion compared to the other uses (Table 3).

Animal Diversity and Use: From the fauna present in the 52 studied home gardens, six species are used for food (Table 4): chicken, turkey, pig, cow, sheep, and duck. The animal products used are: meat, eggs, and milk. This demonstrates the importance of home gardens in providing protein to the rural families' diet. The richness of the fauna in the 52 studied home gardens contains a total of 15 species distributed across the four communities: DV with 14 species, GU with 13 species, ELC with 10 species, and EZV with 8 species. Notable species include *Gallus gallus domesticus* (chicken) with 25% and *Canis lupus familiaris* (dog) with 25%, respectively. Additionally, there is the presence of wild animals such as the parrot (*Amazona auropalliata*) in three communities (DV, 11%, ELC, 11%, and GU, 6%); the chachalaca (*Ortalis vertula*) in DV and ELC with 2% in each; the mojarra (*Cichlasoma trimaculatum*), present in DV at 3%, GU at 2%, and EZV at 3%; and the casquito turtle (*Kinosternon leucostomum*) which is only found in the GU community at 2% (Table 5).

Food group diversity: Of the 52 yards studied, the plant and animal diversity present corresponded to eight food groups: oils and fats, animal-origin foods with low fat content and moderate fat content, fat-free cereals, fruit, legumes, energy-free foods, and vegetables. Among these, the fruit, vegetable, and energy-free food groups stand out, as shown in Table 6.

Table 3. Use of plant species found in home gardens in communities of Mazatán and Tapachula, Chiapas.

Use	Dorados de Villa (n)	Guadalupe (n)	Lázaro Cárdenas (n)	Emiliano Zapata las Varillas (n)
Food	68	60	67	56
Medicinal	9	9	9	9
Ornamental	9	8	10	4
Shade	5	10	7	10
Wood	1	5	3	4
Total	92	92	96	83

Table 4. Animal diversity and use in home gardens of communities in Mazatán and Tapachula, Chiapas.

Common name	Scientific name	Type of species	Use
Pig	*Sus scrofa domestica* L.	Domestic	Edible
Chicken	*Gallus gallus domesticus* L.	Domestic	Edible
Duck	*Anas platyrhynchos domesticus* L.	Domestic	Edible
Turkey	*Meleagride gallopavo* L.	Domestic	Edible
Sheep	*Ovis orientalis aries* L.	Domestic	Edible
Cow	*Bos primigenius taurus* L.	Domestic	Edible
Horse	*Equus ferus caballus* L.	Domestic	Working
Dog	*Canis lupus familiaris* L.	Domestic	Pet
Cat	*Felis silvestris catus* (Schreber)	Domestic	Pet
Rabbit	*Oryctolagus cuniculus* L.	Domestic	Pet
Guinea Fowl	*Numida meleagris* L.	Domestic	Pet
Parrot	*Amazona auropalliata* (Lesson)	Wild	Pet
Musk turtles	*Kinosternon* (Spix)	Wild	Pet
Mojarra	*Cichalsoma trimaculatum*	Wild	Pet
Chachalaca	*Ortalis vetula* (Wangler)	Wild	Pet

Table 5. Use of home garden fauna diversity in the four communities of Mazatán and Tapachula, Chiapas.

Especies	Dorados de Villa		Lázaro Cárdenas		Guadalupe		Emiliano Zapata las Varillas		Use
	F	%	F	%	F	%	F	%	
Species	14	23	13	28	13	24	8	26	Co
Perro	9	15	9	20	14	26	8	26	Ma
Chicken	8	13	4	9	3	6	4	13	Ma
Dog	7	11	5	11	3	6	-	-	Ma
Cat	6	10	3	7	1	2	2	6	Co
Parrot	5	8	6	13	3	6	2	6	Co
Turkey	3	5	3	7	3	6	4	13	Co
Duck	2	3	-	-	6	11	2	6	Co
Sheep	2	3	-	-	1	2	1	3	Ma
Pig	1	2	-	-	2	4	-	-	Co
Fish	1	2	1	2	3	6	-	-	Tr
Cow	1	2	1	2	1	2	-	-	Ma
Horse	1	2	1	2	-	-	-	-	Ma
Rabbit	-	-	-	-	1	2	-	-	Ma
Chachalaca	1	2	-	-	-	-	-	-	Ma
Total	61	100	46	100	54	100	31	100	

F: frequency; Ed: edible; Pt: pet; Wr: work.

Table 6. Food group diversity in home gardens of communities in Mazatán and Tapachula, Chiapas.

Food Group	Communities			
	DV	**GUA**	**ELC**	**EZV**
Oils and fats	2	2	2	3
Low-fat animal-based foods	3	3	3	3
Moderate-fat animal-based foods	3	3	1	2
Fat-free cereals	-	5	5	1
Fruits	23	19	25	19
Legumes	1	1	1	1
Energy-free foods	11	11	11	11
Vegetables	17	14	15	13

The number of family members in the study communities, as well as the level of education, low illiteracy rates, and occupations in families with home gardens in rural areas, align with the data reported by INEGI (2020b) for the state of Chiapas and findings by Leal *et al.* (2015). The occupation of bricklayer for the head of the household is also reported in other studies on home gardens in Mexico (Pulido-Salas *et al.* 2017). The results suggest that the differences in occupations across communities and families may be related to family characteristics and the dynamism of the family and the territory.

Some authors report that women are one of the main family members responsible for carrying out various tasks and managing the home garden, which aligns with the findings of this study (Chablé-Pascual *et al.*, 2015, Chávez-Garcia *et al.*, 2012). Women are in charge of the operational work and creativity within the garden (Arias, 2012). This highlights the importance of women in decision-making regarding the production, management, and conservation of biodiversity in home gardens in rural communities. Regarding the time families dedicate to work in the garden, the results fall within the average time reported for gardens in Chiapas (14 hours/week) by García *et al.* (2009) and those reported by Rosales-Martínez *et al.* (2019) for rural communities in the tropical region of Mexico.

The floristic diversity of the gardens studied (107 species) is higher than that reported by Colín *et al.* (2020) for rural communities in Morelos, but lower compared to the findings of Flores-Guido (2009) for gardens in Yucatán. However, it aligns with reports on gardens in Chiapas (Corvalán *et al.* 2020, Méndez and Valenzuela, 2019). The difference in floristic diversity in gardens may be related to management practices and the edaphoclimatic characteristics of the territory, as noted by García *et al.* (2009). Regarding the use of floristic diversity, the results of this study are similar to those reported for gardens in southeastern Mexico: food, medicinal, and ornamental uses, as well as those reported for gardens in Spain by Rigat *et al.* (2009). Pérez and Uribe (2005) mention that tree and herbaceous species in the garden are used for food purposes. In terms of animal species diversity in the gardens, it is lower than that reported by Castañeda-Guerrero *et al.* (2020) in Puebla, Mexico, where 20 animal species were reported, including 11 domestic species and 9 semi-domestic species. The same author reports that the domestic home garden fauna: *G. gallus*,

M. gallopavo, and *B. taurus*, provides meat, eggs, and milk for the food sustenance of rural families, similar to the findings in this study. Additionally, Góngora *et al.* (2016) state that home garden birds in gardens (chickens, roosters, and turkeys) are used as both food and economic resources, species that were also found in the study area.

The number of fruit species present in the gardens is consistent with the findings reported by Montañez-Escalante *et al.* (2020). Additionally, regarding the food groups that stand out in the gardens (vegetables and fruits), these align with those reported by Sol *et al.* (2012). Furthermore, Gerardo *et al.* (2022) report the contribution of food groups such as vegetables and greens, fruits, meats and other animal-derived products, and cereals in gardens in Mazatán, Chiapas, which are also found in this study.

CONCLUSIONS

The home gardens in the studied communities of Mazatán and Tapachula, Chiapas, Mexico, host a diversity of plant and animal species, providing physical availability of food and food groups, as demonstrated by the results. The food biodiversity present in the gardens corresponded to eight food groups of both plant and animal origin. The gardens are spaces where domestic and wild animal species converge, with women being the main caretakers of these. Therefore, the social, economic, nutritional, and biodiversity conservation role of these gardens in the region is extensive, as they provide fresh, healthy plant and animal food to families, serving as a sustainable alternative in terms of food security.

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