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BACKYARD POULTRY OF FAMILIES PARTICIPATING IN THE PESA (FAO) PROGRAM IN CUETZALAN DEL PROGRESO, PUEBLA

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ABSTRACT

The aim here was to determine characteristics of backyard poultry farming and its relationship to food security and poverty among families in rural communities. 86 surveys were applied to families from 15 communities. Data were analyzed with descriptive statistics and multiple correlations. All families own some animal species, chickens (66%), turkeys (22%), ducks (10%) and pigs (2%). Housewives are responsible for the production unit (77.6%); families raise poultry for own-consumption (66.3%) and for egg and meat production (88.2%). The main food given to the birds is maize grain (53%) and grazing is undertaken by 100% of families. The most common diseases are avian flu and measles, which are treated with antibiotics (33.3%) and local products such as lemon and tomato (21.2%). We concluded that backyard poultry farming represents an alternative for obtaining high-quality, low-cost food that can generate economic income will help improve food security and alleviate poverty.

Keywords: family unit, food security, management, poverty.

INTRODUCTION

According to the Food and Agriculture Organization of the United Nations (FAO), family farming is the predominant form of agriculture worldwide; globally, this organization estimates the existence of 570 million units of this type, including small producers, farmers, indigenous people, traditional communities and some medium and small-scale producers. This sector provides 80% of food and faces new challenges, such as the incorporation of technological innovations that improve productivity in the face of population increase, climate change and the supply of food with socio-environmental attributes (FAO, 2014, p. 3-8). Once these factors are fulfilled, it can contribute to improving nutrition, environment, while recognizing the importance of family farmers in agri-food systems.

Applying the stratification exercise tested by the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación SAGARPA -SAGARPA-FAO in Mexico 2014); the existence of 5.4 million rural economic units (REU) are evident, classifying these units into six levels; family subsistence not linked to the market (22.3%), family subsistence linked to the market (50.6%), units in transition (8.3%), business units with precarious profitability (9.9%), thriving business units (8.4%) and dynamic business units (0.3%).

The first level with incomes below the poverty line is subject to food insecurity and migration. The second low-income level manages to place surplus production on the market and complements this with non-agricultural activities.

The third level fulfills its requirements with income obtained from agricultural activities; however, it has problems in terms of profitability and shows a weak capacity for integrating into production chains. The fourth is involved in more businesslike activities, with low management capacity, manifesting an impact on natural resources and weak integration into production chains. The fifth level undertakes commercial activities with products of unproven quality, transactions without formal contracts and high innovation costs. The sixth faces an unstable level of competitiveness, due to an unfavorable macroeconomic context, market demands, neglect of the sanitary aspect in production and deficiencies in its marketing processes. In this scenario of rural economic units, family production units can be assigned to the first three levels.

In the multidimensional poverty assessment, carried out by the National Council for the Evaluation of Social Development Policy, Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL), access to food is indicated for 59.3% of the population, whereas in 2016, 40.7% were found to suffer from some level of food insecurity – moderate, mild or severe, applying the Mexican Food Safety Scale, (Escala Mexicana de Seguridad Alimentaria, EMSA). Meanwhile, the National Health and Nutrition Survey (Encuesta Nacional de Salud y Nutrición, INSANUT) estimates that 78% of households manifest food insecurity. Notably, both these scales are the result of consulting the population's perception (CONEVAL, 2022).

In rural areas, the situation of food insecurity exceeds that of urban areas FAO (2023). According to González (2016), a high percentage (57%) of the population registers some form of food insecurity, whereas in the urban environment, the percentage is 38%; in the first, the importance of agricultural income is eminent, indicating greater food insecurity in households that reported agricultural production and income, with a higher percentage suffering from what is defined as mild insecurity. Poultry production is very widespread in these family units, with presence of chickens, turkeys, ducks, geese, in the backyards, with the intention of incorporating products such as meat, eggs, fertilizer and feathers into the family economy (Alders *et al*., 2018).

In Mexico, the existence of poultry has been notable since colonial times, in a large percentage of family units (85%), with rustic facilities and feeding based on grazing, as poultry have been identified as having high genetic value, due to their adaptation to this rustic context, providing contributions to the family economy (Camacho-Escobar *et al*., 2016). The aim of this study was to assess the importance of backyard poultry farming and the type of the families in study communities. This would allow us to propose strategies to improve poultry systems to increase production and contribute to food security in these areas.

THEORETICAL FRAMEWORK

Family farming represents a socioeconomic and multidimensional unit, where farm activities are organized to produce food, while taking into account property ownership, traditional knowledge and some innovative procedures; with the family taking the main initiative, as members collaborate with family work and in their objective to sustain life in these homes (FAO-International Fund for Agricultural Development-IFAD, 2019). The FAO defines this as a mode of agricultural, forestry, fishing, livestock, and aquaculture production that is managed and operated by a family and that depends primarily on family labor, including men and women. The family and the farm are one; they evolve together and combine economic, environmental, social and cultural functions (FAO, 2014).

Other approaches have been generated that consider the ownership and administration of this unit, how the work force is employed, and its physical and economic size. Other aspects coincide, such as ownership of the production unit, being operated and managed by a family member, and labor provided by the owner and his family, with limitations concerning access to land and sale of produce, with some income derived from non-agricultural activities (Garner and de la O, 2014).

Likewise, family farming presents great diversity depending on type of economic activity, size of property, land ownership, scale of production, economic value of products, family or salaried labor force, and ethnic and cultural diversity (Schneider, 2016). This diversity was also noted by Ramírez-Juárez (2022), based on the typology proposed for Mexico by SAGARPA-FAO (2014) that recognizes types of production with different motives, determined by the destination of the product for self-consumption and sale, salary generation from non-agricultural activities and family units specializing in agricultural activities; all of these coexisting in a context of economic and social relations, defined by the market, which imposes different economic rationalities on these units.

This context of food commodification, defines the structural conditions for the way that the national and regional economy function, complying with these market and profit principles (Izurieta, 2022); structures that have been shown to generate poverty and marginalization, with food poverty acting as a fundamental restriction to human development.

Currently, family farming is immersed in the market system, both in terms of inputs and products, indicating the need to reconcile contemporary family farming with traditional agriculture, within a constant and dynamic process of adaptation and evolution (Altafin, 2007). An aspect highly valued by Ploeg (2010), who points out that it is not sufficient to view the role of the peasant in agriculture as a vulnerable and passive actor, but that it is essential to analyze and understand the way in which they are responding to their situation of inequality and vulnerability, highlighting their ability to act and innovate their performance according to their own rationality, detached from their relationship with nature, culture and social ties.

Family farming in Mexico: an attempt is made to delimit family farming as a productive unit in which agricultural, forestry, fishing and livestock production is organized, with combined activities for its survival, based on internal dynamics, taking advantage of the integrated work of family members - parents, grandparents, children, grandchildren -, valuing the task of the plot and the family, as an integrated activity, where they work together and combine economic, environmental, social and cultural functions (Garner and de la O, 2014, p. 13)

Agriculture is often considered in terms of its principal characteristics, carried out predominantly with the work of the producer and his family, obtaining products from nature, with various crops, animal husbandry and employing firewood and other plants, which are collected. This production is destined towards own consumption with the sale of the few surpluses. This occurs in a social context, where a sense of belonging to a community, town or region exists Center for Studies for Sustainable Rural Development and Food Sovereignty Cenro de Estudios para el desarollo Susentable y la Soberania Alimentaria, CEDRSSA, 2014).

Today, family farming is recognized as very complex, made up of a great variety of elements and their interactions, defining a system of production, transformation, circulation, and consumption, which functions in an economic context and that incorporates natural elements into this economic, productive, environmental, social and cultural dynamic (Torres, 2019). Agriculture also involves the provision of natural resources and the availability of capital, which generates complex processes involving ecosystems and nature, processes indicated by Gerritsen and Mastache, (2020), as products derived from the co-evolution of modified ecosystems and human culture.

The peasant family unit, comprises a population settled in a marginalized region and in very vulnerable living conditions, with reproductive conditions that make it very difficult for them to overcome the economic, social, environmental and cultural conditions they face, in a system that does not value their contributions in terms of food production.

Food security at home: food security in the world order was referred to in the FAO declaration in 1996, proposing a situation, in which all people, at the individual, household, national and global level, at all times have physical and economic access to sufficient safe and nutritious food to meet their dietary requirements and food preferences, in order to lead an active and healthy life (FAO, 2011). Four aspects of food security were emphasized: physical availability, access to food, its appropriate use and stability in terms of attainment. Nowadays, with an interrelated world, it is essential to coordinate efforts and share this responsibility, without forgetting that at the national level, it is necessary to promote the availability of food in households.

In Mexico, this right is established for the entire population, indicating that the state must guarantee that right in the Political Constitution of the United Mexican States. Article 4 establishes the right to nutritious, sufficient and quality food for every person, guaranteed by the state. In the 27th section XX of the Constitution, the right of the rustic population to employment and well-being, in relation to their participation and incorporation in national development, is recognized.

The social development law incorporates this in article 6, as the right to health, education, nutritious and quality food, along with comfortable and decent housing, a healthy environment, as well as work and social security (Chamber of deputies, 2022).

Since 2010, a situation of vulnerability has been apparent in food production capacity, with agricultural producers subjected to deregulation, trade liberalization, a decrease in government spending in the sector and limited access to credit. Food importation is another factor that restricts productive activity, together with the incorporation of genetically modified organisms in national production and consumption (Carreón, 2012).

The right to food indicates certain limitations in this context, with an official record of the existence of food poverty, defined as the inability to obtain a basic food basket, even if all the household's available income were used to purchase it. The moment an individual, household or population lacks any of the four aspects indicated; they will find themselves suffering from food insecurity, and this will limit the development of their skills.

This analysis of food security is considered limited, as this concept and its measurement are placed outside the dynamics of the economic development model. This means that availability and access to food through the market does not always represent the most efficient mechanism; instead, it generates inequality and marginalization. Internal, regional and territorial factors that are emblematic of asymmetric development should also be taken into account (Torres, *et al.*, 2016). This suggests a need to further study these factors, when conceptualizing food security. Another important aspect that is found is the heterogeneity between households and their relationship with food security; households with some degree of food security are more privileged (Gini Index of 0.49) than those suffering from food insecurity (Gini Index of 0.31).

Farmers in their family units have developed survival strategies, to use their scarce resources and spaces, optimally. One of these alternatives is backyard livestock farming, which comprises the breeding, management and production of native, Creole or genetically improved animals, in spaces known as plots, backyards or family gardens. Backyards consist of areas adjacent to homes in rural areas, where some crops, fruit trees and small vegetable gardens are established (Hortúa-López, *et al.*, 2021).

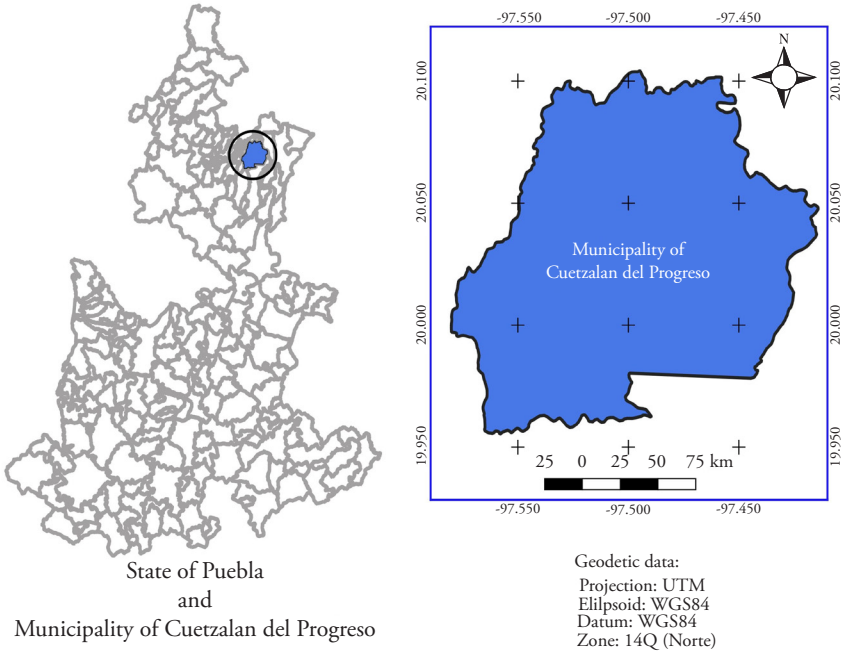
The role of the backyard in family farming, is very important in terms of food security and in this context, poultry farming is the most common, where typically, type of production and the product obtained, is oriented by family needs, rather than market conditions (Romero-López, 2015). This supersedes the idea that the main motivation for keeping poultry lies in the contribution they make in providing quality and low-cost protein, and in the generation of income from their sale, to enable the acquisition of other goods (Alders *et al.*, 2018; Samanta *et al.*, 2018). Furthermore, they require minimum investment in facilities, making it possible to raise them near the home, and satisfy part of their diet with leftovers from agricultural production (Reist *et al.*, 2007). This represents a source of food for family units in rural areas, especially in the indigenous regions of the country and the state of Puebla.

This system improves family food supply and contributes to food security. Hortúa-López *et al.*, 2021, summarize the inputs in terms of the contribution of the backyard to food security, highlighting, the physical availability of culturally acceptable food in vulnerable areas, economic access due to its low production costs, and through sale and exchange, its contribution to child nutrition, in early development, availability throughout the year, its reduced environmental impact and the conservation of local genetics. Despite the wide distribution of backyard poultry systems, the number of animals produced there and the contribution made by this, there are few studies that focus on assessing productivity, as well as economic and nutritional benefits that poultry farming represents for families from rural tropical areas.

METHODOLOGY

Study area

This study was carried out in the municipality of Cuetzalan del Progreso (Figure 1), located in the northeastern mountains of the state of Puebla, between parallels 19° 57' and 20° 06' N; meridians 97° 23' and 97° 35' W; at an altitude between 180 and 1,600 m. The area consists of approximately 135.22 km2, with 167 localities and a population of 47,433 inhabitants (National Institute of Statistics, Geography and Informatics, 2010). The livestock activities carried out in the region include the raising of poultry, pigs, cattle, sheep and exotic birds.



Source: self-elaborated from spatial information of the Digital Map of Mexico (INEGI, 2017).
Figure 1. Location of the municipality of Cuetzalan del Progreso.

Survey design and application

A survey was designed with 31 open and closed questions, in addition to 10 tables, organized into eight sections to obtain information regarding general data about the family, animal inventory, poultry facilities, type of food provided, productive and reproductive parameters of the birds, marketing of eggs and meat, health of their production systems, availability of land and type of agricultural activities carried out in the region by families.

Sample size was calculated by applying the following formula:

$$n = \frac{N\sigma^2 Z^2}{(N-1)e^2 + \sigma^2 Z^2}$$

where n: Sample size; N: Population; Z: Confidence level z=1.96; e: Error (0.1); σ: Standard deviation (0.5)

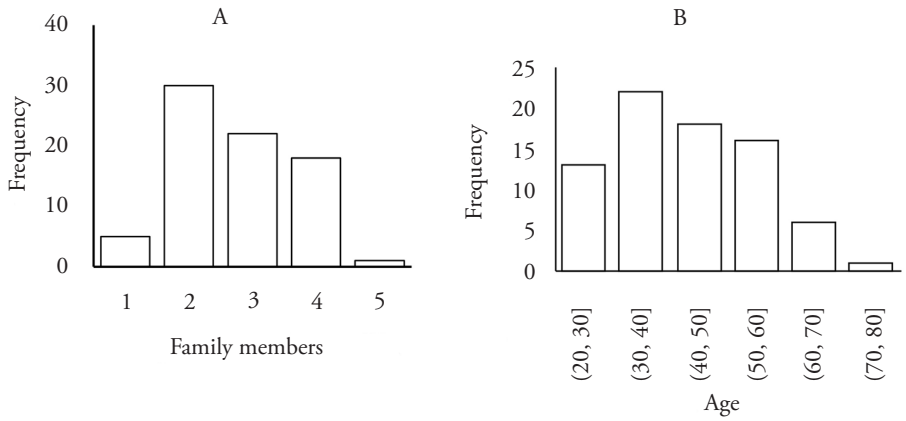
The population consisted of families who participated in the Strategic Program for Food Security (PESA) in 2015. The sampling frame was provided by the Xóchitl Cuicatl A.C. Rural Development Agency and included 851 families from the municipality of Cuetzalan del Progress.

A total of 86 surveys were applied in 15 communities: Cozamalomila, Tepetzintan, Ayotzinapan, Pesmapan, Tonalix, Xalcuahuta, Reyeshogpan de Hidalgo, Pinahuistan, Tecoltepec, Xocota, Tzoncomala, Xaltipan, Xiloxuchil, Limonco and Zuapilaco. Random visits were made to the families in these communities to conduct interviews, which were applied individually; these activities were carried out between the months of November 2015 to February 2016. The information obtained was captured in Excel, and Statistical analyzes of frequencies, percentages, minimums, maximums, means and multiple correspondence analyses were carried out.

RESULTS

General characteristics of the family

The importance of the number of family members, refers to availability of labor and is considered an advantage because they work without receiving a direct salary and do so as part of the responsibility they have as part of the nuclear family. On average, there are 2.7 members per family, with 2 being the most frequent and representing almost 40%. However, if 3 and 4 are considered, these together predominate (52.6%) (Figure 2a). Average age for head of family was 44 years. If analyzed by age ranges (Figure 2b), people between 30 and 60 years old predominate (73%). In terms of education, 74.3% have incomplete primary school; 12.2% studied up to some level of high school and only 6.8% graduated. Concerning language, 93.4% speak Spanish and Nahuatl, 6.6% only Nahuatl, and 89.5% know how to read and write.The father of the family is the



Source: self-elaborated.
Figure 2. Distribution of members, and ages of interviewees in family production units.

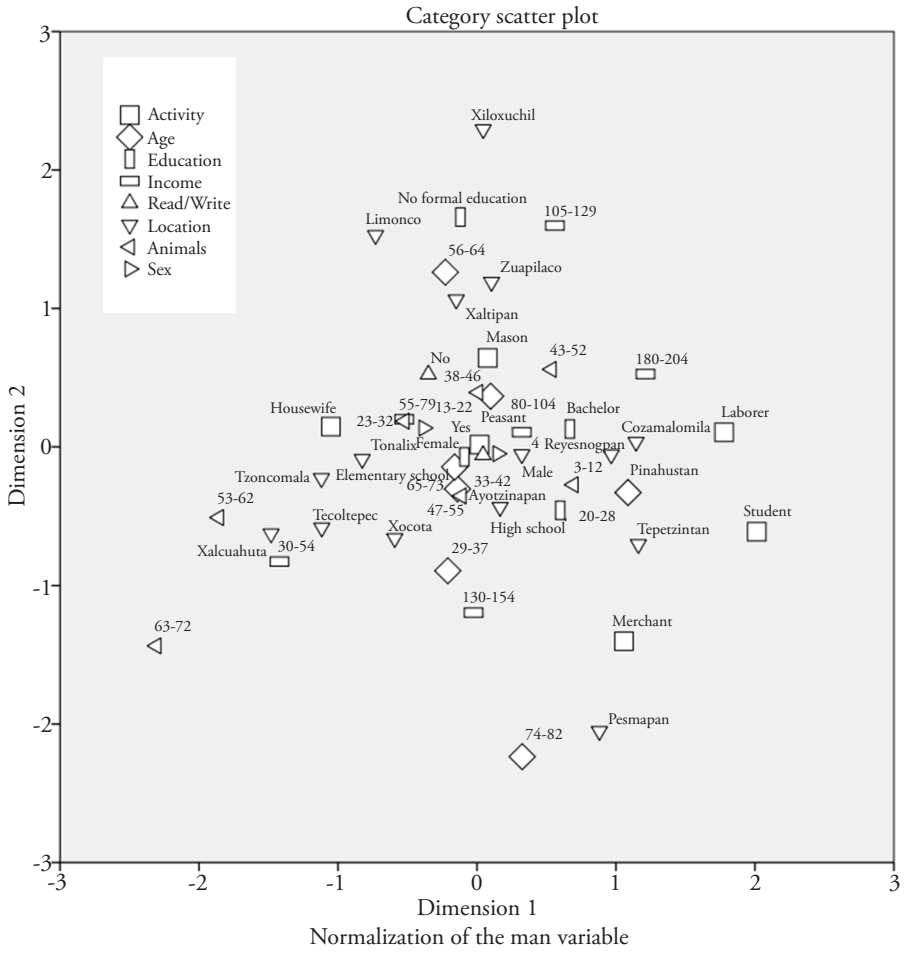
representative in the case of 65.3% of households; 67.1% are farmers and 17.1% are housewives. They receive an average income of $88.0 per day, with a minimum of $30.0 and a maximum of $200.0.

The relationship between location, age range, sex, education, work activity, knowing how to read and write, income range, as well as the number of animals owned (Figure 3) indicates that non-agricultural activities (worker and bricklayer) are more common in the case of adults, however, some have reached high school level. They have an income level that varies from 80 to 200 pesos per day, and from 43 to 52 animals per production unit. Young people continue studying and have reached a secondary school level of education. In contrast, adult women are the ones who are more likely to remain as housewives and do not know how to read or write.

Backyard and poultry farming

Each farm has at least one animal species; chickens predominate (66.3%), followed by turkeys (21.8%). Poultry farming is mainly intended for consumption (66.3%), or for consumption and sale (31.9%). For the majority, poultry farming is important (71.1%), as it is a source of income and good quality, low-cost food. In the region, 77% of the farms are run by housewives, 19.7% are run by children and the rest by the father.

Chickens were the most common species, followed by turkeys, ducks and pigs (Table 1). There is a notable preference for raising birds in the backyard, perhaps due to the ease of handling, low production costs and type of food. As for facilities, the majority (87%) are in poor condition (poor quality materials, no roof or simply a platform between the trees); those at the intermediate level (9.1%) have a covered place, use materials from the region and are well organized and clean; and those that are in good condition (3.9%) are usually have a tin roof, dirt or concrete floor, and although they also use materials from the region, they are well organized, clean and have equipment for dispensing food and water.



Source: self-elaborated.
Figure 3. Multiple correspondence analyses of family traits**.**

Feeding poultry in the backyard

Apparently, maize is the most commonly offered food (50%). Gutiérrez-Triay *et al*. (2007) indicate that in backyard poultry farming, commercial food is the most common (68.5%), although maize (68.0%) and tortilla (61.7%) in almost the same proportion, without regard for the age of the animal. The food, mainly grain, is offered in the following presentations: whole (40.1%), moist or wet (31.7%), ground (19.6%), dry (7.47%) or crushed (0.9%). Grazing is widely undertaken (88.5%) in the study region, because it is cheap (25.9%), healthy (14.8%) and because it complements their diet (48.1%). Families prefer to graze their birds all day (50.9%); some do so during the afternoons (36.4%) and others in the mornings (12.7%). Grazing birds in the backyard is the default strategy, because it reduces production costs. Food stuffs that chickens

Table 1. Animal species found in the backyards of communities in the study.

	Poultry			Turkeys			Ducks			Pigs		
	Min.	Max.	$\bar{x}$	Min.	Max.	$\bar{x}$	Min.	Max.	$\bar{x}$	Min.	Max.	$\bar{x}$
F	1	35	12	1	9	2	1	10	3	2	2	2
M	1	13	3	1	6	2	1	5	2	3	3	3
A	1	20	6	1	6	3	4	5	4	0	0	0
Y	1	45	15	1	15	7	0	0	0	0	0	0
IP	1	15	7	1	9	4	1	5	3	0	0	0
T	3	59	23	2	19	7	2	11	6	2	3	2

F: females; M: males; A: adults; Y: young people; IP: in production; T: total.
Source: self-elaborated.

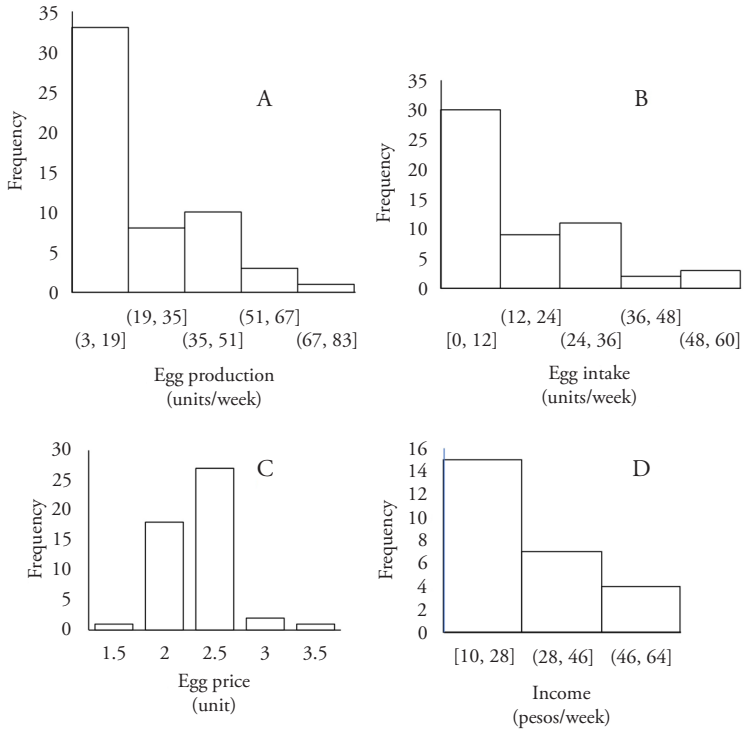
collect in the region include grasses, eggshells, canutillo leaves *(Commelina erecta*), banana leaves (*Musa paradisiaca*), acahual (*Simsia amplexicaulis*), mozote (*Bidens pilosa*) and floripondio (*Brugmansia arborea*).

Production, consumption, sale and reproduction of chickens

In the study region, eggs and meat are considered equally important (88.2%), however, the former is consumed more frequently (Figure 4B) and both are sold to obtain extra income (16.9%), when there is a surplus. Collection is important for the poultry farmer, 45% do this daily and 36.7% do this every other day, due to predators.

Regarding poultry reproduction, the method they use to select the egg to incubate is to observe it against the light (97.9%), because this is easy, fast, they know how to do it and they can ensure more hatchings. On average, they have 4 chickens and a rooster in their backyard, with 1.9 years of productive life. Producers prefer that their birds incubate their chicks (69.1%, 14 on average), and the rest buy them. Of those who incubate, 69.6% have noticed that a higher percentage of births occur in spring and 28.3% in summer. Only 22.4% sell their birds, mainly to their neighbors. The egg is occasionally bought (15.8%) from neighbors and is for hatching. Feeding, health and general management practices in production units improve nutrition, production of chickens for breeding, and therefore generate income.

Regarding production and consumption values, as well as egg price per unit and estimated income from the sale, evidently, most produce between 3 and 19 eggs (60%), and those who produce between 20 and 35 or 36, about 51 families, only represent 32%, above those numbers, the percentage of families is low (Figure 4A). The use of eggs indicates that in the production units, those consuming the smallest amount (0 to 12), are found more frequently (54.5%) and those who consume between 12 and 16 and between 16 and 30 are almost the same number; 16.3% and 20% respectively (Figure 4b). Notably, the price, in most cases is 2.5 pesos (55%) or 2 pesos (36.7%) (Figure 4C), meaning that by selling, families can obtain an income of 10 to 28 pesos

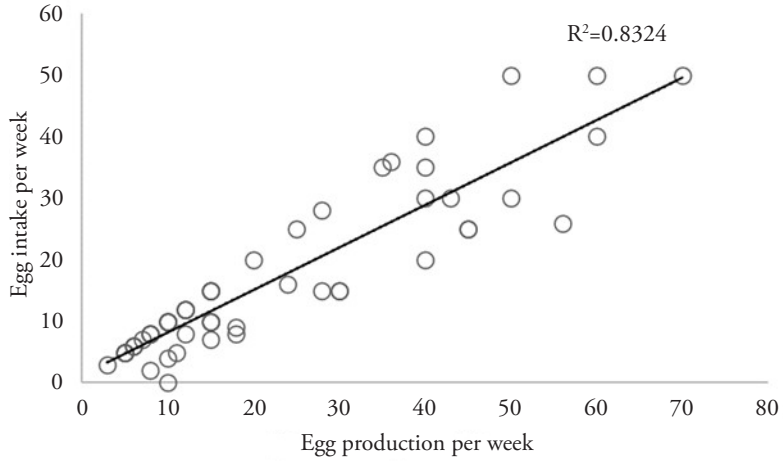


Source: self-elaborated.
Figure 4. Production indicators (A), consumption (B), price (C) and income from egg sales (D) in family units in the study region.

(57.7%), which corresponds to the lowest level, and those with greater production can receive up to 64 pesos (Figure 4D), however this represents a lesser proportion (15.3%).

If consumption and production are analyzed in a little more detail (Figure 5), evidently, there is a close relationship between these two variables, the first increases with greater production (Figure 5), which would indicate that those who produce less, are barely able to satisfy their requirements, meaning, they would have little left over for sales.

Diet is based mainly on eggs rather than chicken, possibly due to the cost and time involved for producing or purchasing birds, and the small number destined to this end, as only non-productive ones are either sold or consumed. They also comment that the sale of a chicken represents greater income at that moment, so often they leave these for an emergency or festivity. On average, each family has 4.4 hens in production, beginning to lay at 7 months of age, with 13.7 eggs for each incubation period, 3.2 laying months per year and 1.8 years of productive life per animal. Sale of chickens is rare, and when they are sold, the price varies from 60 to 120 pesos.



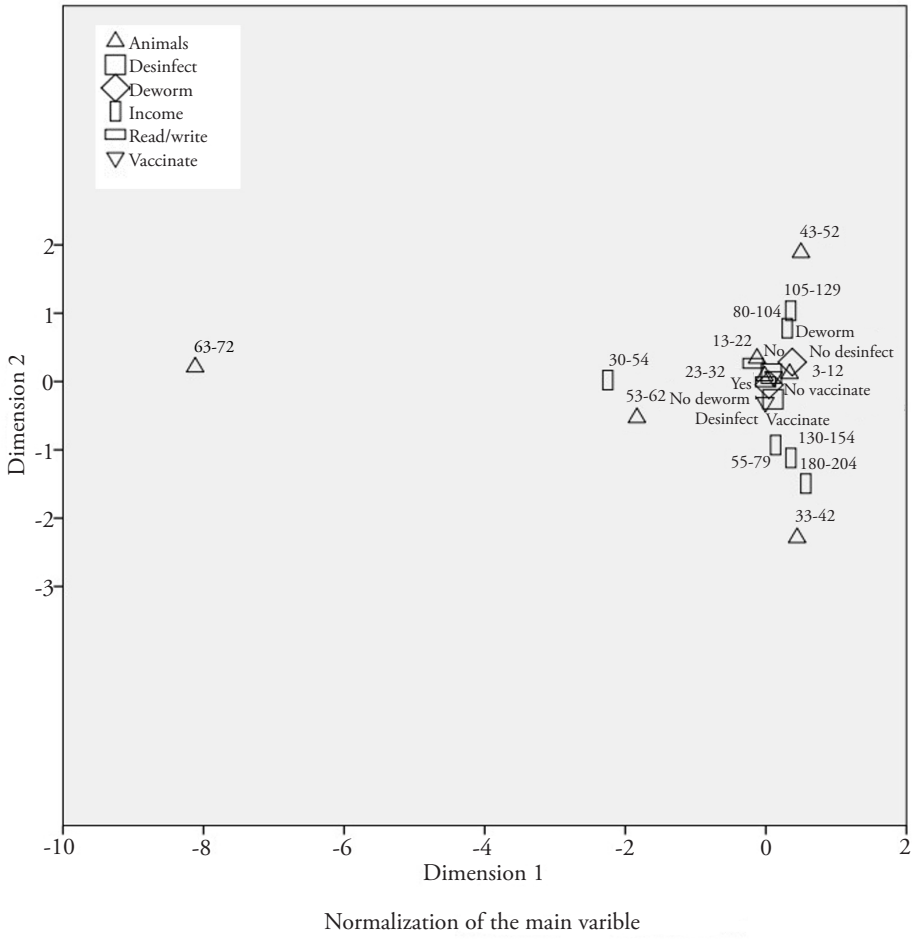
Source: self-elaborated.
Figure 5. Egg production and consumption per week in the study communities.

Common diseases and treatments

Basic health treatments are performed infrequently. The effects of inadequate health management results in the occurrence of disease, the most common being: avian flu (37.7%), smallpox (23.2%) and diarrhea (14.5%), and to a lesser extent fever and newcastle disease. The chemical treatments applied are antibiotics (33.3%) for infectious diseases and also antipyretics such as paracetamol for fever and pain. Other treatments include natural products such as lime (21.2%) in food and drink, tomato and other traditional remedies, which due to their vitamin C content can contribute to reducing viral and bacterial diseases, as they have an antioxidant effect (Ganem *et al.*, 2012)
Sanitary practices are implemented for vaccination (20.5%), deworming (12.3%) and disinfection of facilities (32.9%). However, the majority of the producers, who do not disinfect are middle income people, while those who do not vaccinate and deworm have low incomes and a smaller number of animals (Figure 6).

Agricultural land

The livelihood of a rural family depends largely on agriculture and other activities that take place in this environment, thus having agricultural land, in addition to the backyard, is important. Producers have land (90%) for agricultural activities, and they mention that this is important (70%) because it complements their backyard, for the purpose of generating products and therefore income. Agricultural activities carried out by the families in the study area are, firstly, the maintenance of their backyard area, the planting and harvesting of coffee and, secondly, pepper (22.2%); notably, the greatest part of economic income is obtained from the latter. Other activities that are practiced include the planting of maize, sugar cane and bananas. All these agricultural activities contribute to improving food security and obtaining resources from the sale of different products produced in the production unit.



Source: Self-elaborated.
Figure 6. Main types of sanitary practices carried out in backyard poultry farming.

DISCUSSION

For the region, families with 3 and 4 members exceed those with 2 members by more than 12%, as generally the average is 2.7. Having an average family is important for undertaking farm activities, because the work is predominantly carried out by the family (Salcedo *et al*., 2014), and is not remunerated because it is considered part of the family members' responsibility. Taopanta *et al*. (2019) present similar results in a descriptive study of the backyard poultry production system. However, Bautista *et al*. (2012) found 5 participants in projects carried out in southern Mexico. Schooling must be considered in investigations, as, according to the Economic Commission for Latin America and the Caribbean ECLAC-FAO-Inter-American Institute for Cooperation on Agriculture IICA (2014), family farming reflects a low level of education which is related to a high degree of poverty. In this case, results indicate a low education level

(incomplete primary), concurring with Leporati *et al*., 2014, who indicate variation in the level of schooling in Mexico, as coinciding with the classification of family farming into subsistence, transition and consolidated (3, 3.9 and 4.1 years respectively).

When defining the concept of family farming, Salcedo *et al*. (2014) point out that farm administration is assigned to the head of the family, therefore, it is necessary to know their age. In this study, age is slightly lower than that presented by Leporati *et al*., 2014 for Mexico (51 years), ranging from 46 to 58 in Latin American countries. This same author considers that the population in rural areas is aging, mainly due to the migration of the younger population that relates to the few opportunities they find in family farming, compared to those they can find in urban areas. Sánchez and Torres (2014), in a study of classification of family units in Veracruz, indicate that the main work activities for rural areas represent farming and domestic activities.

Income in rural areas is low and varied, ranging from those who live below the poverty line to those who generate products for self-consumption and surpluses for commerce. According to the National Evaluation Commission (2017), if they receive $2,640.0 per month, they would still be well below the poverty line, if you consider that $11,200.0 is required to cover their basic food basket. According to ECLAC-FAO-IICA (2012), rural families who depend only on agriculture have a higher poverty rate, which would consequently cause migration to urban centers, as they are unable to cover their basic requirements; in fact, according to CEPAL-FAO-IICA (2013), agricultural income has not been increasing in recent years, implying that food security indices will worsen, if producers continue to abandon agricultural activities in rural areas. Apparently, the majority of the families in the study region, conform to the first 3 levels of rural economic units.

Among poultry, chickens are always predominant because the meat and eggs produced are more affordable than from turkeys, meaning producers breed more chickens because of the availability of fresh eggs for daily consumption and for cultural reasons; because turkeys are destined to festivities or for sale, in the case of a financial emergency. Bautista *et al*. (2012), affirm that this activity is undertaken in more than 85% of livestock production units, in this country. This research coincides with that of Gutiérrez-Triay *et al*. (2007), Zaragoza *et al*. (2011) and Gutiérrez *et al.* (2012), who mentioned that chicken raising, is a widespread and very important practice in indigenous communities in rural areas, both temperate and tropical, and may represent up to 10% of national poultry production.

Raising chickens, is an activity carried out by most of families that have a backyard and represents a principal source of food of animal origin (Di-Pillo *et al*., 2019 and Wong *et al*., 2017) and important economic income (Bounds M and Zinyemba O, 2018 and Pineda *et al*., 2017). Furthermore, these results indicate that this system, presents conditions that prevail in almost all rural regions of the country as mentioned by Bautista *et al*., 2012 and Hortúa-López *et al*. (2021), representing a source of good quality food (Castro *et al*., 2016), at low cost, and easy to handle for families, which

concurs with Sánchez and Torres (2014). Similarly, Di-Pillo *et al*., 2019, point out that backyard poultry farming is beneficial in terms of access to food and the family economy. The backyard poultry production system, has prevailed over time because it requires minimal investment. One of the most important aspects is food, representing 70% of the total cost.

The principal food offered to its birds in the region is maize, being the most cultivated in the region and easily available; coinciding with Zaragoza *et al*. 2011, who indicate that the diet is based on grains that the producers give to them such as maize, wheat and rice and also food leftovers; similar to that reported in some studies carried out in southern Mexico (Gutiérrez *et al*., 2012; Mendoza *et al*., 2014). Besides maize, in this region birds graze and look for grass and insects that can fulfill a large part of their nutritional needs, complemented with kitchen leftovers and vegetables that reduce feeding costs. This is the reason that in the municipal study, the majority allow their animals to graze or leave them free to obtain their food. Cuca-García *et al*. (2015) mention that food basically consists of what the birds collect in the backyard. Atehortúa *et al*. (2015) report that 100% of families in 5 communities in Columbia, allow their birds to graze. The grazing time and schedule varies and depends on how much time have; Portillo *et al*. (2015) only mention that the grazing hours of chickens should be from 6 to 7 hours during the day, however, they do not discuss preferable hours of day.

Food is always available in the study communities, and this coincides with what Losada *et al*. indicate (2006), concerning the food offered to poultry in the Xochimilco delegation of Mexico City, where in addition to its availability, it depends on price and the economic possibilities of the producer. Feeding systems that combine maize, grazing and kitchen leftovers prevail, coinciding with Sánchez and Torres (2014) in their descriptive study of backyards in Veracruz. Knowledge about the feeding system of backyard chickens enables an increase in production, improving their food with local inputs and, therefore, the quality of the diet related to poultry farming and the food security of families (Pineda *et al*., 2017 and Wong *et al*., 2017).

Backyard birds have dual purpose (Cuca-García *et al*., 2015) and perform well in terms of egg and meat production and although these are of equal importance (Mendoza *et al*. (2014), there is more egg consumption, representing an economical and easy-to-obtain source of protein, as it is produced within the family unit, as also indicated by Zaragoza *et al*. 2011; Gutiérrez *et al*. 2012 and Portillo *et al*. 2015.

The times of year for greatest production are different from those reported by Cuca *et al*. (2011), who mention that spring and autumn are the periods of greatest production in Mexico. Low production on the part of backyard chickens is due to the type of food they consume, as poor management and failure to control diseases, as well as the energy they expend when searching for food in the field, as well as the fact that they have not been bred for greater production. However, the advantage of these animals is the adaptation and resistance they present towards climatic conditions and diseases.

The age at laying coincides with that reported by Cuca-García *et al*. (2015), who mention that it begins at 6 months, although they also point out that the number of eggs produced depends on the number of laying periods. There are few studies to assess productive and reproductive aspects as mentioned by Juárez-Caratachea and Ortiz (2001). There is little information on production costs and the average profits that backyard birds generate for families in conditions of poverty, therefore, it is important to continue with studies that investigate these parameters and generate data that allow us to understand and continue improving backyard poultry breeding in general.

Results from this research, concur with those found in several regions of Mexico, where backyard chickens are raised, such as Cuca-García *et al*. 2015, who mention that poultry farming undertaken in backyard conditions usually, has little or no sanitary management; likewise, Sánchez and Torres, 2014, indicate that no disinfection of facilities, vaccination, deworming, or disease prevention in general, is carried out. Moreover, Gutiérrez-Triay *et al*. 2007, point out that there is a decrease in production, mainly due to the high mortality rate, because sanitary practices are poorly implemented, lack of knowledge, inadequate facilities for the care of their birds, or economic limitations for the purchase of medicines. As this author mentions in this work, the presence of influenza, smallpox and diarrhea are the most common diseases, although Samanta *et al*. (2018) point out that they have found avian flu and aging-related disease, also mentioning that health practices are not implemented, due to a lack of awareness and economic resources. We should stress that the tendency in the study municipality is to apply traditional knowledge; however, this is not sufficient to control disease.

Basically, the farmer has agricultural land to support himself and his family and to foster social relationships by carrying out various productive activities that include production, harvest, transformation and sale of products (González *et al*., 2014). Sánchez and Torres (2014) mention that 90% of the producers in Huatusco, Veracruz, are dedicated to primary activities and the backyard, 20% more than in this work. Rodríguez (2011) points out that the climatic conditions found in tropical rural regions favor the production of various plant species, enabling diversified production throughout the year. There is limited knowledge about the contribution of agricultural activities carried out by the producer, other than the backyard, therefore, a large amount of study is required to assess the economic, social and cultural contribution of these activities in the rural regions of the country.

In accordance with what is established by the FAO, 1996, for food security, as already indicated above and according to the 4 aspects that it considers: 1) physical availability, 2) access to food, 3) its appropriate use and 4) stability in terms of compliance, in this case, according to Hortúa-López, *et al*., 2021, apparently, the population in the study complies (in part, due to all the problems it presents) with these aspects when producing meat and eggs to meet the family's needs, or where appropriate, purchases them, locally, fresh and at a good price. As these are animals fed in the countryside and with few inputs, they sell their products to acquire other basic necessities; by producing good

quality food for their diet and because this is a system that prevails over time, providing food, improving the soil with compost, and with limited dependence on external factors they are more resistant, due to their adaptation to the environment.

CONCLUSIONS

We conclude that as in most backyard poultry production systems in rural areas, the study region presents similar conditions: lack of adequate facilities, inadequate food for the animals' requirements, and lack of sanitary management and vaccination programs. Even under these conditions, the production of backyard birds contributes to improving food security because their care is minimal and they obtain much of the food themselves from the environment where they develop. They are resistant to diseases and adverse weather conditions, due to their local adaptation and require little care. Likewise, it is also apparent that, no matter the type of program or project for the improvement of the poultry system, if they are not given adequate and continuous monitoring, results will not be satisfactory. Therefore, to promote support programs to increase productivity, backyard poultry farming should be considered as part of the family farming system, with projects that include long term training, care of animal welfare, adequate facilities, health and, above all, conserving existing genetic variability and the environment.

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