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GUAJOLOTE (*Meleagris gallopavo* gallopavo) TRADING IN THE MARKETS OF OAXACA

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ABSTRACT

The economic, cultural and social importance of the turkey is evidenced by its wide use in Mexican cuisine, social and religious celebrations. The surpluses produced by backyard farming are sold in local markets, which make it possible to capture income to supplement the diet of producers. The study was conducted in 2014 in the district markets of the Central Valleys region of Oaxaca, Mexico, where 744 surveys were applied in a stratified sampling in a targeted manner. Subsequently, with the data collected, a statistical analysis of independence (X^2) was performed ($p < 0.05$). The result was obtained that participants in the commercialization were mostly women (66%) with an age range of 31-59 years, dedicated to household and farm work. The producers were indifferent to the sex and color of the guajolotes and preferred poults for reproduction and mature turkeys for consumption in mole. In the markets, females (64%) were sold more frequently, weighing approximately 3.1 to 6.1 kg and costing between $231-375 per individual, while males weighed 5.5 to 7 kg and cost between $300-450 per animal.

Keywords: backyard, culture, food, turkey farming.

INTRODUCTION

The most ancient remains of *Meleagris gallopavo* gallopavo that have been found in an urban context and outside their "natural" range of geographic distribution are in Valle de Tehuacán, Puebla, Mexico, and they are bones dated in the year 180 B.C.E. (Flannery, 1967). Due to the dry climate of the region, it would be difficult for the wild guajolote to be distributed naturally, so it is understood that there was domestication of the species (Camacho *et al*., 2011). In Pre-Hispanic Mexico, the guajolote or turkey was catalogued as the great feeder, representing special meanings, religious values, and an essential part of the rituals and worldview of these civilizations (Pérez, 2003; CONABIO, 2014). In some cities such as Teotihuacán (centuries 1 to 6 A. D.), people were devoted exclusively to its breeding; the value of the guajolote was based on three aspects: meat and eggs as food; bones to manufacture tools and feathers to make ornaments and clothing (Pérez, 2003; Valadez, 2003).

Presently, backyard guajolote breeding (turkey farming) is a typical activity in the rural zones of central and southern Mexico, as well as parts of the Gulf of Mexico; it is an important economic-dietary support of safe products with good quality for families that practice it. The woman is the key piece in the conservation of this livestock genetic resource native to Mexico, since women are the ones who practice turkey farming in the backyards, not only as a productive issue but also economic and social, and have total control of the administration of the flock (Medrano, 2000; Aquino *et al*., 2003; López *et al*., 2008; Ángel *et al*., 2014). Its economic, cultural and social importance is evidenced by its broad use in Mexican cuisine, ancestral rituals, and social and religious celebrations (Galvan, 1975; Trigueros *et al*., 2003; Hernández *et al*., 2005). The surpluses produced by this activity are traded in the local markets, which makes it possible to capture income that allows supplementing the diet (Ballara *et al*., 2012).

In the Central Valleys region, these markets or plazas take place in the district townships once per week and an important economic movement of products resulting from backyard turkey farming can be observed, where different prices are fixed that influence other regions of the state of Oaxaca (eight regions) (Jerez *et al*., 2009). Because of the aforementioned, the objective of the study was to understand the trading process of the guajolote in the district markets of the region of Central Valleys in Oaxaca, Mexico.

MATERIALS AND METHODS

The research was conducted in the year 2014, in the Central Valleys region (Figure 1), and it comprises seven districts (Centro, Ejutla, Etla, Ocotlán, Tlacolula, Zaachila and Zimatlán) with 121 municipalities and 1476 localities, from which 133 are urban and 1,343 rural, with a surface of 9,480 km² (CIEDD, 2014). The markets, which are set up weekly in each district, were visited once per month.

During the study, markets were visited to locate and observe the trading process, and in those visits 744 surveys were applied in a stratified sample, where the strata were the district markets (seven). This process was carried out in the months of January to July in the year 2014, and the survey respondents were selected directly to participate in the process, with a previously elaborated survey that included 26 questions. Three general aspects were considered. First, data from the market with the following variables: time when the process starts, time when the process ends, place in the market, approximate attendance, sex of the participants, age of the participants, origin of the interview respondents, occupation of the participants, role in the market, reason for trading, frequency of trading, seniority in trading. Second, the characteristics of the guajolote preferred by the consumer and the reason for this preference: sex, color, size, price, use, culinary preparation. Third, the turkeys traded: origin, color, presence of spur, weight, cost, production system of origin, and method of transport. A description of the information obtained from the observation was made, and the data from the surveys were analyzed through the statistical independence test with (X^2) ($p < 0.05$). The analyses were carried out with the statistical analysis software (SAS) (SAS Institute Inc., 2004).

Figure 1. Location of the Central Valleys region, Oaxaca.

RESULTS AND DISCUSSION

Market and traders

The markets in general are installed in the early morning of the day that they are held and they are located in the central part of the population where the park, the town hall, and the church are located. Poultry trading is established in nearby streets, starting at 9 hours when the first producers begin to arrive, who are approached by intermediaries streets ahead to purchase their birds, and when they arrive to the established they place the birds on the ground and they wait to sell them and finish approximately at 2 pm (Table 1).

The results differ from what was reported by Jerez *et al.* (2009) in the same region where they mention that trading is done in the morning (from 8 to 12 hours) in the Zaachila and Ocotlán markets, and only some intermediaries have availability for selling after

Table 1. General characteristics of the markets (plazas) in the Central Valleys, Oaxaca.

District	District head	Plaza day	Initial time	Ending time	Approximate assistance in marketing
Centro	Oaxaca de Juárez	Saturday	10:00	19:00	30
Ejutla	Ejutla de Crespo	Thursday	9:00	14:00	200
Etla	Villa de Etla	Wednesday	10:00	14:00	20
Ocotlán	Ocotlán de Morelos	Friday	9:00	14:00	350
Tlacolula	Tlacolula de Matamoros	Sunday	9:00	14:00	200
Zaachila	Villa de Zaachila	Thursday	9:00	14:00	150
Zimatlán	Zimatlán de Álvarez	Wednesday	9:00	14:00	100

Source: compiled by authors.

noon, except Tlacolula, where there is no defined timetable and schedule. In general, the behavior of these plazas is identical to the study of these same markets carried out by Beals (1975), who considered that the traditional system was still an efficient and inexpensive distribution method for peasant demand, since it does not require much capital and is managed by sellers with a low standard of living.

These studies agree that most of the participants in commercialization are women, where feminine participation was 66%, in an age range of 31-59 years, who are devoted to household and field tasks. On the other hand, 66% of the people surveyed were sellers (Table 2), who attend the markets since they were children, as producers once per year and as intermediaries every week (Annex 1). Compared to the center-north of the state of Chiapas, similarly the management of the flock is in charge mainly of women (86.4%) with an average age of 41 years old (Cigarroa *et al*., 2013). They agree with the center and south of Yucatán, where 86.5% of the people who care for and produce turkey are also led by women of age between 43 and 53 years old (Canul *et al*., 2011), and for its part in the coast of Oaxaca the women are in charge of caring for the animals in 64.79% of the cases (Camacho *et al*., 2006a), a situation that is similar in Kapola, Puebla (Estrada *et al*., 2006).

Table 2. Characteristics of the participants in trading.

Characteristics and siginificance	Markets (Plazas)							
	Centro	Ejutla	Etla	Ocotlán	Tlacolula	Zaachila	Zimatlán	% Total
Gender (p=0.01)								
Male	50 (0.03)	47(0.08)	36 (0.09)	44 (0.09)	17 (0.01)	23 (0.03)	-	34
Female	50 (0.03)	53 (0.09)	64 (0.16)	56 (0.11)	83 (0.05)	77 (0.1)	100 (0.08)	66
Age (years) (p= 0.01)								
20-30	10 (0.01)	11 (0.01)	20 (0.02)	40 (0.04)	-	-	20 (0.02)	11
31-59	7.27 (0.04)	18.18 (0.11)	26 (0.15)	16 (0.1)	4 (0.02)	18 (0.11)	11 (0.06)	62
60-88	5 (0.01)	17 (0.04)	27 (0.07)	27 (0.07)	12 (0.03)	12 (0.03)	-	27
Activity or occupation (p=0.005)								
Farmer	33 (0.02)	35 (0.06)	15 (0.03)	41 (0.08)	17 (0.01)	15 (0.02)	-	25
Own buisness	-	6 (0.01)	5 (0.01)	-	-	-	-	2
Housewife	50 (0.03)	41 (0.07)	62 (0.13)	51 (0.11)	66 (0.04)	61 (0.08)	100 (0.08)	58
Job	-	-	-	-	-	8 (0.01)	-	1
Unemployed	-	-	-	-	-	8 (0.01)	-	1
Worker	17 (0.01)	6 (0.01)	5 (0.01)	-	-	8 (0.01)	-	5
Retired	-	-	3 (0.05)	3 (0.05)	-	-	-	1
Purchase/Sale of birds	-	6 (0.01)	10 (0.02)	-	17 (0.01)	-	-	5
Other	-	6 (0.01)	-	5 (0.01)	-	-	-	2
Role in the market (p= 0.0001)								
Buyer	33 (0.02)	53 (0.09)	7 (0.01)	49 (0.1)	-	8 (0.01)	25 (0.02)	27
Seller	67 (0.04)	47 (0.08)	88 (0.2)	51 (0.1)	83 (0.05)	61 (0.08)	75 (0.06)	66
Intermediary	-	-	5 (0.01)	-	17 (0.01)	31 (0.04)	-	7

In relation to the X^2 test (p=0.05).
Source: compiled by authors.

Characteristics preferred by the consumer

The results showed that 59% of the participants are indifferent to the sex and color of the animals during the trading process. Instead, one of the preferred characteristics is that the animals are poults, with the aim of reproducing them (Table 3), or breeding them for their later culinary use. According to Rodríguez *et al*. (2012), for the case of Oaxaca there are no records of relevant social research destined to understanding the local and regional needs, tastes and preferences, which has an effect on the competitiveness of producers since they do not satisfy the needs or fulfill the expectations of the consumers.

Table 3. Preferences of the consumer by locality.

Characteristics and sifgnificance	Markets (Plazas)							
	Centro	Ejutla	Etla	Ocotlán	Tlacolula	Zaachila	Zimatlán	General
Gender preference (p=0.0002)								
Male	40 (0.05)	-	56 (0.06)	44 (0.14)	-	9 (0.02)	50 (0.02)	31
Female	-	-	22 (0.02)	16 (0.05)	-	-	50 (0.02)	10
Indifferent	60 (0.07)	-	22 (0.02)	40 (0.12)	100 (0.10)	91 (0.25)	-	59
Color preference (p= 0.0003)								
Brown	-	-	-	5 (0.01)	17 (0.01)	-	6 (0.05)	3
Brown/White	-	-	-	-	-	15 (0.02)	6 (0.05)	3
Black	17 (0.01)	-	13 (0.03)	10 (0.02)	8 (0.005)	23 (0.03)	-	10
Black/Brown	-	-	-	5 (0.01)	8 (0.005)	-	-	1
Red	-	-	-	5 (0.01)	-	-	-	1
Indifferent	83 (0.05)	100 (0.18)	87 (0.22)	75 (0.15)	67 (0.04)	62 (0.08)	88 (0.07)	82
Size preference (p= 0.02)								
Poult	50 (0.06)	-	20 (0.01)	53 (0.14)	50 (0.06)	67 (0.19)	67 (0.06)	55
Young	50 (0.06)	-	40 (0.03)	35 (0.09)	-	33 (0.09)	-	29
Mature	-	-	40 (0.03)	12 (0.03)	50 (0.06)	-	33 (0.03)	16
Price preference (p= 0.02)								
50-150 MXN	25 (0.02)	-	55 (0.07)	35 (0.1)	100 (0.1)	30 (0.07)	33 (0.02)	42
151-250 MXN	25 (0.02)	-	-	17 (0.05)	-	10 (0.02)	67 (0.05)	16
251-350 MXN	25 (0.02)	-	18 (0.02)	17 (0.05)	-	20 (0.05)	-	16
351-450 MXN	25 (0.02)	-	27 (0.03)	31 (0.09)	-	30 (0.07)	-	24
551-650 MXN	-	-	-	-	-	10 (0.02)	-	2
Use of turkey (p= 0.02)								
Food	75 (0.08)	-	11 (0.01)	48 (0.15)	50 (0.05)	20 (0.05)	50 (0.02)	39
Gift/present	-	-	-	-	25 (0.02)	10 (0.02)	-	6
Breeding stock	-	-	67 (0.08)	26 (0.08)	25 (0.02)	30 (0.08)	50 (0.02)	30
Holidays	25 (0.02)	-	22 (0.02)	26 (0.08)	-	40 (0.11)	-	25
Culinary preparaton (p= 0.0001)								
Mole	83 (0.11)	-	100 (0.25)	89 (0.2)	83 (0.11)	22 (0.04)	100 (0.02)	76
Broth/Soup	-	-	-	11 (0.02)	17 (0.02)	78 (0.16)	-	22
Do not consume	17 (0.02)	-	-	-	-	-	-	2

In relation to the X^2 test (p = 0.05).
Source: compiled by authors.

Characteristics of the birds traded

When it comes to the sex of the animals, it could be seen that more females (64%) than males (36%) are traded in the markets of the Central Valleys of Oaxaca, except in Tlacolula, where the same number was observed per sex (Table 4). During a study carried out by Mallia (1998) for the state of Michoacán, the females/males rate that was found in the production systems was 1.69, and in the Trans-Mexican Volcanic Belt up to 3.69; in Sierra Madre del Sur (geographic regions of Michoacán), this rate is similar in its highest value to what is reported in Oaxaca and Quintana Roo (3 to 5), where the breeders consider that a male is required for every three females to establish the harem. On the other hand,

Table 4. Characteristics of the guajolotes traded in the markets in Valles Centrales, Oaxaca.

Characteristics and significance	Markets (Plazas)							
	Centro	Ejutla	Etla	Ocotlán	Tlacolula	Zaachila	Zimatlán	General
Gender (p=0.1)								
Female	78 (0.05)	73 (0.13)	62 (0.14)	56 (0.12)	50 (0.03)	62 (0.08)	79 (0.06)	64
Male	22 (0.01)	27 (0.05)	38 (0.08)	44 (0.09)	50(0.03)	38 (0.05)	21 (0.01)	36
Feather color (p=0.01)								
Black	11 (0.007)	6 (0.01)	10 (0.02)	5 (0.01)	-	10 (0.01)	10 (0.007)	7
Gray	-	2 (0.003)	-	5 (0.01)	-	3(0.003)	10 (0.007)	3
Red	-	-	-	2 (0.003)	-	-	5 (0.003)	1
White/Black	6 (0.003)	6 (0.01)	8 (0.01)	10 (0.02)	6 (0.003)	5 (0.007)	5 (0.003)	7
Black/White	-	2 (0.003)	16 (0.03)	20 (0.04)	16 (0.01)	8 (0.01)	5 (0.003)	11
Brown/White	11 (0.007)	19 (0.03)	11 (0.02)	5 (0.01)	6 (0.003)	18 (0.02)	5 (0.003)	11
White/Brown	11 (0.007)	2 (0.003)	2 (0.003)	14 (0.03)	16 (0.01)	3 (0.003)	-	6
Brown/Black	6 (0.003)	-	6 (0.01)	7 (0.01)	-	-	5 (0.003)	4
Black/Brown	6 (0.003)	6 (0.01)	11 (0.02)	13 (0.03)	6 (0.003)	2 (0.003)	15 (0.01)	9
Black/Gray	16 (0.01)	-	-	2 (0.003)	-	8 (0.01)	5 (0.003)	3
White/Gray	-	5 (0.007)	-	-	-	5 (0.007)	-	2
Gray/White	-	2 (0.003)	-	-	-	-	5 (0.003)	1
Brown/Yellow	-	2 (0.003)	-	-	-	2 (0.003)	-	1
White/Black/Brown	33 (0.02)	41 (0.07)	33 (0.07)	15 (0.03)	39 (0.02)	36 (0.05)	30 (0.02)	31
White/Red/Gray	-	2 (0.003)	0	0	6 (0.003)	-	-	1
Chocolate	-	5 (0.007)	3 (0.007)	2 (0.003)	5 (0.003)	-	-	2
Tarsus color (p=0.5844)								
Black	25 (0.01)	28 (0.06)	30 (0.06)	29 (0.05)	25 (0.01)	39 (0.05)	29 (0.03)	30
Pink	33 (0.01)	46 (0.09)	35 (0.07)	43 (0.08)	38 (0.02)	43 (0.05)	54 (0.06)	42
White	25 (0.01)	22 (0.04)	33 (0.07)	21 (0.04)	19 (0.01)	18 (0.02)	13 (0.01)	22
Brown	17 (0. 09)	2 (0.04)	2 (0.04)	5 (0.09)	12 (0.009)	-	-	4
Gray	0	2 (0.04)	0	2 (0.04)	6 (0.04)	-	4 (0.004)	2
Presence of spur (p=0.4484)								
With	25 (0.01)	35 (0.07)	46 (0.09)	36 (0.07)	38 (0.02)	25 (0.03)	50 (0.05)	37
Without	75 (0.04)	65 (0.14)	54 (0.11)	64 (0.12)	62 (0.04)	75 (0.09)	50 (0.05)	63

In relation to the Chi-square test (p=0.05).
Source: compiled by authors.

for Camacho *et al*. (2006b), in the Coast of Oaxaca poultry farmers are not interested in the rate between males and females in the flock, since the production conditions in semi-grazing favor that there are no conflicts with territoriality of adult males.

However, concerning the physical characteristics such as the color of the plumage, it was observed that the combination of white/black/brown prevailed in most of the birds evaluated, with 31% (Table 4). Mallia (1999) described that the indigenous or Creole backyards producer in Central America have mainly black or bronze guajolotes, although they report the presence of other colors such as red, yellow, grey and other varieties and combinations of color.

Apparently, the varieties of color that are present in the Mexican backyards constitute combinations of genes from the populations of guajolotes with different degrees of reproductive and genetic isolation (Sponenberg *et al*. 2005). Mallia (1998), when elaborating a study with backyard turkeys in Oaxaca and Quintana Roo, described the presence of black, yellow and white feather colors in pure colors without metallic color in the plumage, as well as the combination of brown, white and black; in addition, the author reported in Oaxaca, close to 40% of the guajolotes are black, 35 to 40% brown, and 20 to 25% white, yellowish or of mixed colors.

Likewise, in the coast of Oaxaca, it is reported that the black color and the white/black combination had higher representation (Camacho *et al*., 2006b). Meanwhile, in the state of Veracruz, Aquino *et al*. (2003) reported the prevalence (75.9%) of guajolotes of two or more colors, followed by black, white and reddish brown color. At the same time, in the state of Chiapas it was found that the black color predominated (43%) both pure and combined with white and brown; in the second place, these same combinations were found with white (22%), brown (21%) and grey (4%) (Cigarroa *et al*., 2013). In studies carried out in the state of Michoacán, López *et al*. (2008) mention basic color patterns in black, brown, grey, as well as the combinations black/white and white/black. Meanwhile, in a study carried out in Yucatán (Canul *et al*., 2011), pure black (12.87%) and red (6.94%) colors were detected; in combination of two colors, brown and white predominated (7.92%) and black/brown, white/black and white/brown (5.94 %); and black/brown/white (20.79 %) and white/black/brown (6.93 %) predominated in three colors.

When it comes to the tarsus, this study resulted in the most prevalent colors being pink (42%), black (30%) and white (22%) (Table 4), with this characteristic being one of the criteria considered for a phenotypical characterization of guajolote (Camacho *et al*., 2006b); in the coast of Oaxaca, Camacho *et al*. (2006b) in addition to the white, yellow and black colors, reported pink, brown and grey colors. In Creole hens, it was seen that the predominant color in the tarsus was yellow, followed by the colors black, pink, red and green (Duguma, 2006; Pérez, *et al*., 2004; Missohou *et al*., 1998).

Regarding the weight of the birds studied, an average of 5.5 to 7 kg was obtained for males and 3.1 to 6.1 kg for females, while the sale prices were $300-450 pesos MX for males and $231-375 pesos MX for females (Table 5). This still agrees with what was reported by The

Table 5. Weight and cost of guajolotes traded in the markets of Central Valleys, Oaxaca.

Characteristics and significance	Markets (Plazas)							
	Centro	Ejutla	Etla	Ocotlán	Tlacolula	Zaachila	Zimatlán	General
Weight of females (kg) (p=0.49)								
Small (1-3)	13 (0.05)	20 (0.09)	21 (0.09)	18 (0.08)	4 (0.01)	15 (0.06)	9 (0.04)	45
Large (3.1-6.1)	4 (0.02)	22 (0.12)	23 (0.12)	20 (0.1)	7 (0.03)	12 (0.06)	12 (0.06)	55
Weight of males (kg) (p=0.32)								
Small (5.5-7.0)	5 (0.04)	12 (0.1)	24 (0.19)	28 (0.23)	11 (0.09)	14 (0.11)	6 (0.05)	84
Large (7.5-9)	-	25 (0.04)	31 (0.05)	19 (0.03)	-	25 (0.04)	-	16
Price of females ($) (p=0.18)								
80-230	14 (0.06)	20 (0.09)	22 (0.1)	17 (0.08)	5 (0.02)	13 (0.06)	9 (0.04)	49
231-375	2 (0.01)	22 (0.11)	22 (0.11)	21 (0.1)	6 (0.02)	15 (0.07)	12 (0.06)	51
Price of males ($) (p=0.34)								
300-450	4 (0.03)	12 (0.1)	25 (0.21)	30 (0.25)	8 (0.07)	15 (0.12)	6 (0.05)	86
451-600	7 (0.01)	28 (0.04)	22 (0.03)	7(0.01)	14 (0.02)	22 (0.03)	-	14

In relation to the Chi-square test (p = 0.05).
Source: compiled by authors.

National Academy of Sciences (1991), since in the description of Mexico's "Creole turkey" they pointed out that their maximum size is smaller than half of the size of improved races; the males weighed 5 to 8 kg and females 3 to 4 kg. Lugo (1975) reported that the average sale weight varies between 6.5 kg and 7.6 kg for small and medium breeds, respectively. For his part, Díaz (1976) mentions that in Mexico, industrial fattening of guajolotes obtains a live weight of 7 to 9 kg in females and 10 to 16 kg in males.

This is compared to the sale weight of backyard guajolotes in Oaxaca and Quintana Roo which is 5.5 to 7.4 kg for females and 6.9 to 9.2 kg for males, despite them being able to reach a weight of 11.5 to 12.9 kg (Mallia, 1998). For the guajolotes ready for sale in the coast of Oaxaca the weight is 9.4 kg for males and 7.2 kg for females (Camacho *et al*., 2006b), while in the state of Michoacán the weights reported are 6.71 to 8.92 kg for males and 2.92 to 4.35 kg for females (López *et al*. 2008).

In turn, weights of 8.9 kg for males and 2 to 3 kg for females are reported in the state of Puebla (Hernández *et al*., 2005). Meanwhile, in the municipality of Xochimilco in Mexico City the weights reported are 12 kg for males and 10 kg for females (Losada *et al*., 2006); in Yucatán, weights for males of 5.5-9 kg and for females 2-4 kg were detected (Canul *et al*., 2011); while in the state of Chiapas, the males at 6 and 8 months weigh 4.5 to 6 kg (Cigarroa *et al*., 2013). Mallia (1999) reported that for backyard guajolotes in Guatemala and Honduras, the average weight of males is 11 to 13 kg and 5.9 to 7.2 kg in females.

Guajolotes are usually traded in markets of nearby cities, and Camacho *et al*. (2006b) describe that the price per kilogram of standing guajolote in the coast of Oaxaca is $31.3 pesos MX and $19.4 pesos MX, while in this study the cost per kg standing (live) of a male was $63 pesos MX and $61 pesos MX.

CONCLUSIONS

This study obtained as a result that in the regions evaluated most of the participants in trading are women, since the study showed a feminine participation of 66%. It can be seen that during the trading process the clients prefer for the animals to be poults with the aim of reproducing them, and they are indifferent to the sex and color. As a dish, the guajolote (*Meleagris gallopavo* gallopavo) mole stands out, since it is still considered a culinary delicacy, since 76% of the survey respondents would use the bird meat for this type of consumption. Therefore, it is important to consider that cultural traditions such as guajolote mole make the consumption prevail, and therefore the commercialization of this species. However, guajolote breeding is done in the backyard, and it is representative in the region and considered an essential activity in the economy of those that produce and trade them.

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