

Study of beef meat production systems in a municipality of Hidalgo State, Mexico

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A survey to 104 producers was conducted to characterize the beef meat production systems in the Mixquiahuala de Juárez municipality, Hidalgo State, Mexico. The topic included the social areas, health management and nutrition. The answers were organized in a data matrix and were processed according to Statistical Model for Impact Measuring (SMIM). This model combines the multivariate techniques of main components and the cluster analysis. The results evidenced that the majority of producers wished to manage using few technologies, only a minor liked the not-updated and incomplete technologies. Out of the people interviewed, 90 % of them have cattle as a saving system, with low earnings. Only 10 % use them to improve their economy, although they do not use the technologies required for an efficient production. Creating consume goods cooperatives would be enough to improve the systems, in respect to the acquisition of feed incomes and find a commerce way for the producers to establish a guarantee price. The inclusion of awards, if the product surpasses the established standards, is suggested with previous agreement with the purchasers. Inducing the producer to the technical assessment to improve the production levels and the general conditions of the system, mainly its nutritional aspect is also advised.

Key words: meat production, social characterization, health characterization, nutritional characterization, multivariate statistical analysis.

A production system is characterized by the relations between their parts. In meat bovines, the main reason is the richness of this product as feed.

In Mexico, the production systems for cattle fattening vary considerably. Advanced technology is applied in the big capitals, while, in more humble places, the systems only produce for surviving. There, agriculture is temporary, while cattle rearing is and added value to the productions (Lastra 2000).

Out of the two-million cattle heads of the world, Mexico contributes with 3 % (Vilaboa and Díaz 2009). The diversity of the systems used is hard to classify, although grazing systems and yard fattening prevail. In both, the objectives are to increase gains, keep the market prices and achieve the environmental sustainability (Vilaboa 2008). With these principles, the Mexican livestock prospered and provided the needed meat for towns and cities (CEPAL 1982). This abundance lasted up to 1910, period of the Mexican Revolution (Montemayor 1984).

At present, the cattle rearing systems in Mexico are studied according to the geographical area. The country has been divided in five main areas: arid or semi-arid, tropical (dry and humid), temperate and mountainous (Lara *et al.* 1994). According to Chalate *et al.* (2010), there is a lack of knowledge about the systems used.

The objective of this study was to characterize the production systems used in the production of meat bovine cattle in the municipality of Mixquiahuala, Hidalgo, Mexico.

Materials and Methods

Mixquiahuala de Juárez is a municipality of the Mexican state of Hidalgo. It is located at 20° 13' 52" North latitude and 99° 12' 47" West longitude, at 2100 m a.s.l. Its surface is of 7853 ha and it is the biggest of Mexico. Its main economical activity is agriculture, followed by cattle rearing (Lee 2003).

A survey with 47 questions was applied in this municipality, relating general aspects of the people interviewed: scholarship, sex, labour experience, age, assessment received. Other parameters were included, related with the characteristics of the ranches, the management techniques when receiving the cattle, the feeding systems used in the fattening, the health of the herd, the vaccination and the productive, economical and commerce indicators.

The survey was applied to 104 small producers of cattle to know their economical and social conditions. The final data matrix had 4 888 (104 x 47). Table 1 shows the variables considered in the survey.

The Statistical Model for Impact Measuring (SMIM) of Torres *et al.* (2008) and Torres *et al.* (2010), combining the multivariate techniques of Main Components (MC) and the Cluster method were used for characterizing the production systems studied. The inferential statistics was used to reach easier the interpretation of the results. The statistical system SPSS (2006), version 15.0, was used for processing the data.

Table 1. Variables considered in the survey

Buying price	Buying, \$
Reception age	Reception age
Reception kilogram	Reception kilogram
Reception period	Reception period
Origin (own or brought)	Origin
	Bath
	With what?
	Vaccine?
	Against what?
	How?
Use of feeds of commercial mark	Commercial mark
Utilities	Utility
Grassland management	Grassland management
	Pen, h
	Grazing, h
	Cost per kg, \$
Sale price in carcass	Sale price in carcass, \$
Nutrition	Nutritional problems
	Which?

Results and Discussion

When calculating the multiple correlation matrix, 29 % of the coefficients were higher than 0.40. This demonstrates that there was a certain correlation degree between the variables included, although the percentage was not high but it was enough for applying the model. The statistical KMO proves so, with value of 0.52 and the sphericity test of Bartlett, with $P < 0.01$ (Torres *et al.* 2010).

Table 2 presents the MC selected and the variables with important weight values of ≥ 0.70 . Selecting 8 MC was necessary for explaining 70 % of the total variability. The first four MC explained 53.72 % of the variability. This level can be considered as low. According to criteria of Torres *et al.* (2006), at least 70 % should be explained for validating this technique. This opinion is shared with Dallas (2000), who qualifies this amount as outstanding. However, through the methodology proposed by Torres *et al.* (2008), the number of variables influencing on this production system was reduced without losing the information needed in the following analysis.

With the matrix rotated according to the method of Varimax (Hair *et al.* 1999), 19 indicators supplying the highest variability between the MC price to the buying, reception age, kilograms of reception, reception period, origin (own or bought) and price of the sale were obtained. In the MC 1, these indicators explained on their own 31.24 % of the variability.

This component seems to explain the economic conditions and management system used. The double-purpose system predominated in 90 % of the cases. The

rest dedicated to the fattening, with Creole, Zebu, Brown-Swiss and Holstein cattle. These results agree with those of INEGI (2009). The replacements come from the same production units, even when interchanging cattle among producers. In respect to the number of heads per unit, it was between two and eighty animals, distributed in the 104 producers.

In the MC 2, the classification variables of the individuals and the use of feeds of commercial mark contributed with 9.89 % of the variability found among producers. Out of 104 producers, 7 used commercial diets, 8 of them elaborated them from alfalfa, maize, hay and poultry litter, among others (all ground). The rest of producers used irrigation ditches, rangelands and agricultural harvests, coinciding with that described by Ruiz (2007).

The MC 3 contributed with 6.45 % of the variance, with values of 0.73 % for the utilities and rangeland management. The MC 4 contributed with two indicators, which individual value is closed to the unit, corresponding to the use or not of vaccines and against the disease. They showed the first negative value -0.81 and 0.81 %, respectively, offering 6.14 %. This seems to characterize the situation provoked by different contagious diseases, when improving their herds with animals interchanging.

The MC 5 helped explaining 5.01 % of the variance with -0.93 and 0.86 , in respect to nutrition. The existence of problems in the first cases was accepted, as well as the impossibility of explaining exactly which they were. When analyzing the MC 6, the indicators baths and with what reached values of 0.90, respectively and explained 4.11 % of the variability in the systems studied.

Table 2. Results of the main components with the highest weight influencing on the final results

Variables	Components							
	1	2	3	4	5	6	7	8
Buying, \$	0.95	0.16	0.08	0.05	-0.05	0.01	0.01	0.09
Reception age	0.91	0.10	0.10	0.01	-0.08	0.02	0.01	0.01
Reception kg	0.94	0.11	0.09	0.00	-0.03	0.01	-0.01	-0.02
Reception weight	0.85	0.18	0.00	0.12	-0.04	0.00	-0.05	-0.07
Origin	0.84	0.13	0.02	0.09	-0.09	-0.06	-0.02	0.07
Bath	0.11	0.12	-0.02	0.15	0.10	0.90	-0.06	0.04
With what?	0.09	0.12	-0.04	0.16	0.14	0.90	-0.04	0.04
Vaccine?	-0.14	-0.12	-0.16	-0.81	0.01	-0.24	0.03	0.20
Against what?	0.14	0.12	0.16	0.81	-0.01	0.24	-0.03	-0.20
How?	0.22	0.82	-0.05	0.29	-0.04	0.06	-0.01	0.09
Commercial mark	0.22	0.80	0.34	-0.14	-0.04	0.05	0.08	-0.12
Utility	-0.16	0.08	0.73	0.13	-0.04	-0.11	-0.04	0.06
Grassland management	-0.11	-0.12	0.73	0.25	-0.02	-0.13	0.10	0.06
Pen, h	0.33	-0.03	0.01	0.21	0.10	0.02	-0.76	-0.08
Grazing, h	-0.33	0.03	-0.01	-0.21	-0.10	-0.02	0.76	0.08
Cost/ kg, \$	0.45	0.07	0.04	-0.01	0.03	0.01	0.04	0.77
Price of the carcass sale, \$	0.89	0.23	0.08	0.10	0.00	0.16	-0.02	0.12
Nutritional problems	0.05	0.00	0.01	0.07	-0.93	-0.14	0.05	-0.01
Which?	-0.07	-0.01	-0.10	-0.09	0.86	-0.09	-0.08	-0.01
Total	14.68	4.65	3.03	2.88	2.36	1.93	1.76	1.58
Per cent of the variance, %	31.24	9.89	6.45	6.14	5.01	4.11	3.74	3.35
Per cent accumulated, %	31.24	41.13	47.59	53.72	58.73	62.84	66.58	69.94

The MC 7 and 8 showed the permanence time of animals in the pens, the grazing time for the first of these components and the product cost at the end of the process for the latter. The respective values were: - 0.76, 0.76 (CP 7) and 0.77 for component 8. This seems to be due to the production system that was, in most of the cases, restricted grazing. The basis of this grazing is the native Creole cattle of the region and, in lower degree, the improved cattle. The majority of cattle producers get their cattle for fattening and the milk is obtained abroad the municipality.

This previously described allowed achieving the first objective of this method: reduce the number of variables explaining their function in the systems studied. However, the components inside the production systems in individual farms are complicated, and therefore their explanation.

The Cluster analysis, conducted from the ponderable weights of the variables, allowed the formation of seven groups, with dissimilarity coefficient of 25.99 (figure 1).

In respect to the prices, the group 1, with 93 producers, bought the cattle at \$ 4253.00 per head and average liveweight of 331 ± 85.98 kg. The animals were used as reproducers and the litters were kept up to the sale moment. The prices per animal were $\$2896.00 \pm 1254.00$, according to the calculation, \$10.26 the

kilogram, lower than the prices of SAGARPA (2008), of \$11.57.

The group 2, with two producers, did not propitiate buying price, reception age and reception kilos. They argued the animals were from their own herds and females and males were separated. These cattle producers made lots of at about 49 animals, kept in the pens and fed with own diet, based on ground alfalfa, maize, and hay, as well as poultry litter and pre-mixture. This is a very common practice among producers (Ruiz 2008). This group sold the animals to the intermediate person in carcasses, at approximately \$36.00 per kilo.

The group 3, with one producer, obtained his animals from his own herd and fed them with commercial feed. His animals were of double-purpose, for a total of 38 animals grazing in at about 6 h. The rest of the day, the animals were in their pens. The parasites were frequently removed from the animals and the sale was bulked. The price was not reported.

The group 4 had three producers with herds of at about two animals. The buying cost of each animal in average was of $\$5250.00 \pm \1639.00 , meaning that they paid at about \$13.70 kilos, superior to that reported by SAGARPA 2000. The age averaged between 13 ± 7 months and the approximate weight was of 383 ± 29 kilos. This group sold their product in carcass

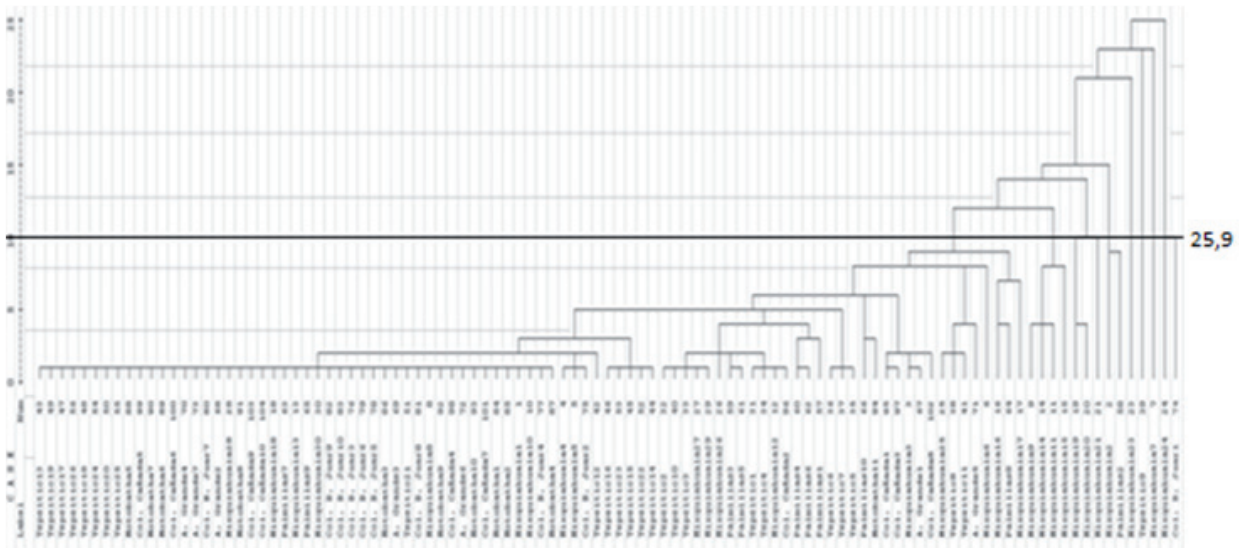


Figure 1.- Dendrogram for selecting the groups formed.

and the cost per kilo was of at about \$36.00. The fattening time was of at about 140 ± 69 d. The cattle with nutritional or health problems was sold immediately. No treatment was offered, the worming was only preventive.

The group 5 had only one cattle producer and 60 animals, bought at a cost of \$5000.00 per head, with weight of 400 kg approximately. The cost per kilo was of \$12.50, representing 8.75 % less than the official price (SAGARPA 2008). The average age was 18 months. No worming was conducted and a commercial feed was offered. The cost per kilo was of \$4.05. The grazing was of 7 h and the rest of the day the cattle was in the pen. A final weight of 575 kilos was reached in 120 d. The animals were sold in carcass at \$ 35.00 per kilo.

The group 6 had two producers, with herds of at about 39 animals. They were bought with 15 ± 4 months, at \$ 5875.00 \pm \$ 1237.00 kg, and the cost per kilogram was of \$ 16.80. This difference in price could be because the animals were acquired in any other unspecified place. The diets were mixed, predominating the commercial one. The cost per kilogram of feed was of approximately \$ 1.70. The grazing was, generally, of four hours. The animals reached a final weight of 513 ± 53 kilos, in at about 100 ± 57 d. They were sold at a cost of \$ 34.00 \pm \$ 2.00 per kilo, approximately.

The group with only one producer had 22 animals. Each of them was bought at \$ 4750.00, with an average weight of 400 kilos, and the kilo cost, approximately, \$ 11.88. All the animals were bought in the region. The diet offered was based on the waste of ground oat, alfalfa and hay. The animals were kept in the pens from the buying time to the market, at about 180 d, with weight of 625 kilos. The product was sold directly to the flea market at \$ 22.00 per kilo and in carcass.

The majority of cattle producers considered their system as a way of saving money, and only a few manage them as the family support.

The producers do not have reference advisers. They only use the professional services of a veterinarian when they are not able to solve the problems on their own. Institutions like SAGARPA are not well represented in the area where the study was conducted. The result is a great number of intermediates with great benefits and low investments.

The majority of producers do not trust the proposals offered, and therefore the research was very difficult. The main reason was the mistrust they showed during the interviews.

The formation of consumption cooperatives would be enough to improve the systems, in respect to buying feed incomes and achieve commerce pathway for the producers to have some guarantee. Prices could be given if the product would surpass the standards, in previously agreement with the buyers. The technical assessment of the producer is recommended to increase the production levels and improve the general conditions of the system, mainly from the nutritional point of view.

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Received: June 30, 2011