



Practical quantification of animal welfare in pigs of small producers in southern Veracruz, Mexico

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ABSTRACT

Objective. To quantify the animal welfare of pigs of small producers in communities of southern Veracruz. **Materials and methods.** We carried out a study in ten production units where we performed a diagnosis and analyzed ten variables in the categories of feeding, housing, health, and behavior of piglets according to the Welfare Quality[®] protocol of the European Union, which were scored on a 0 to 1 scale, where 0= none, 0.5= fair, and 1= ideal animal welfare. **Results.** The human-animal relationship was satisfactory; however, there was low thermal comfort associated with the type of facilities. The main indicators of animal welfare were feeding 0.9 ± 0.235 , housing 0.6 ± 0.319 , health 0.7 ± 0.252 , and behavior 0.9 ± 0.192 . **Conclusions.** The quantification of animal welfare allows the practical identification of management aspects that producers have developed intrinsically, such as the human-animal relationship and cleanliness of the facilities. Animal welfare can be quantified in a practical way, offering management alternatives to the producers, who develop adequate (frequent cleaning of the facilities) and inadequate (low-protein diets, tail docking, and castration) activities.

Keywords: Pigs; livestock management; castration; cleaning; humid tropics (*Source: AGROVOC*).

RESUMEN

Objetivo. Cuantificar el bienestar animal en porcinos de pequeños productores en comunidades del sur de Veracruz. **Materiales y métodos.** Se realizó un estudio en diez unidades de producción, donde se llevó a cabo un diagnóstico y se analizaron diez variables en los rubros de alimentación, alojamiento, salud y comportamiento de los lechones, de acuerdo con el protocolo Welfare Quality[®] de la Unión Europea y ponderado de 0 a 1, donde 0= nulo, 0.5= regular y 1= ideal bienestar animal. **Resultados.** La relación humano-animal fue satisfactoria; sin embargo, existió bajo confort térmico ligado al tipo de instalaciones. Los principales indicadores de bienestar animal fueron alimentación 0.9 ± 0.235 , alojamiento 0.6 ± 0.319 , salud 0.7 ± 0.252 y comportamiento 0.9 ± 0.192 . **Conclusiones.**

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La cuantificación del bienestar animal permite identificar de forma práctica aspectos de manejo que los productores han desarrollado de forma intrínseca como la relación humano-animal y la limpieza de las instalaciones. El bienestar animal puede ser cuantificado de forma práctica, ofreciendo alternativas de manejo a los productores, quienes desarrollan actividades adecuadas (limpieza frecuente de las instalaciones) y no adecuadas (alimentación con bajo aporte de proteína, corte de cola y castración).

Palabras clave: Cerdos; manejo del ganado; castración; limpieza; trópico húmedo (*Fuente: AGROVOC*).

INTRODUCTION

The domestic pig (*Sus scrofa domestica*) is a descendant of the wild boar and has been one of the most commonly used species in animal production for more than 500 years (1). This has been the first animal that has allowed families of small producers to gain resources through the production of piglets due to factors such as: a short biological cycle, high fecundity, and an omnivorous diet (2). It was not until 1950 that the living conditions imposed on pigs changed towards a great zootechnical and technological transformation, where restrictive management, as well as an unnatural coexistence, became the standard for housing pigs in industrial sheds (3). At present, commercial pig production systems are characterized by confinement and intensive management in technology and capital, a situation that has not changed much compared to previous decades. This has affected aspects of comfort around resting, thermal comfort, and ease of movement, with consequent effects on health, behavior, and animal productivity (4); thus, it is important to evaluate animal welfare (5). Some authors report two types of animal welfare, physical and psychological. The first one consists of aspects that can be quantified and repaired and are closely related to good management, whereas psychological welfare is complex and refers to the absence of fear of the physical environment, the interactions with humans, and the stress that such interactions may cause (6).

The backyard livestock farming system does not represent a high economic cost to the families who practice it (7); however, there should be adequate production and health parameters based on the animal welfare of the production systems (8). In rural Mexico, pig breeding is considered complementary to the family income and the area available for its ownership is in the range of 20 to 60 m², where 80% of the owners contributes between 10 and 30% of the family income (9, 10); in this case, animal welfare can

become a secondary priority. Therefore, the objective of the present study was to quantify the animal welfare of pigs of small producers in communities of southern Veracruz, Mexico.

MATERIALS AND METHODS

Description of the study area. The southern region of the state of Veracruz is characterized by its traditional livestock farming (11). The type of climate in the area ranges from warm sub-humid to warm humid. The study was carried out with cooperating producers from the municipalities of Acayucan 17°56'57.48"N, 94°54'53.73"O, Soconusco 17°57'45.71"N, 94°52'51.45"O, and Oluta 17°55'48.27"N, 94°53'46.84"O (Figure 1).

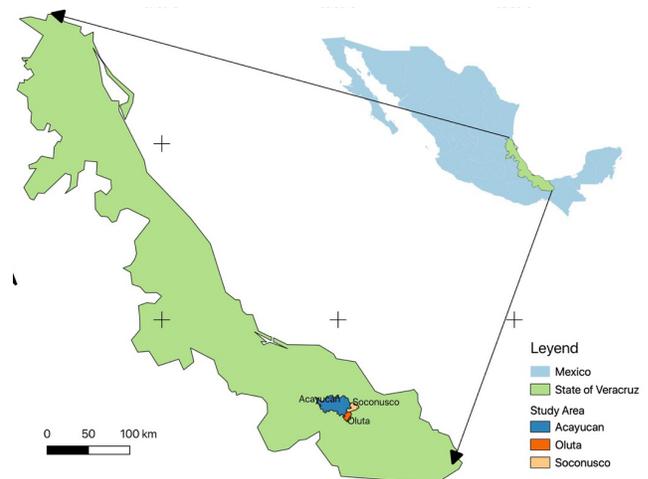


Figure 1. Map of the location of the cooperating producers.

We conducted a cross-sectional study where we interviewed ten cooperating producers using snowball sampling (12) and applying a structured questionnaire consisting of the following sections: feeding, animal welfare, marketing, inventory, production parameters, health, farming systems, and socio-cultural aspects. For the design of the questionnaire, we looked at animal welfare indicators according to

the Welfare Quality® protocol of the European Union adapted for farmers (13) and constructed a table of indicators with information from different authors (Table 1).

We analyzed ten small producer pig farms where the genetic mosaic is diverse, with a predominance of crossbreeding between Yorkshire and Landrace breeds. In total, the farms consisted of 202 piglets, 99 fattening pigs, 237 weaned pigs, 18 replacement females, 20 females as breeding stock, and 14 boars. Based on a field guide, we analyzed the following variables (Table 1):

Feeding. In the case of absence of chronic thirst, it was based on the availability of freely accessible water and at will, taking into account both quality and quantity; thus, we identified the number of times per day that the producers changed the water in the cement troughs, since changing the water is necessary in the study area in order to keep it clean and fresh. The situation described above is common among small pig producers, since they do not have automatic waterers or valves to supply water to the animals. It is important to mention that the availability of water is not a problem in the study area. The criterion of absence of chronic hunger was measured as a function of how many times food was provided and of what type (commercial feed, fruit, or food scraps).

Housing. With the approval of the producers, we measured the pens in order to determine if the feeding (14) and housing (comfort around resting, thermal comfort, and ease of movement) standards were met. Additionally, we considered as a variable the dimensions of the recommended space for sows, since the animal welfare of piglets should be measured from the conditions of the mother given that there is evidence of a relationship between housing conditions and cortisol levels and piglet growth (15,16). With respect to thermal comfort, we considered cold stress, which we evaluated by the presence of shivering or huddling animals while resting, while heat stress was evaluated by the presence of panting animals. Ease of movement included two aspects, tied or free animals and the position of the feeders, which should not restrict the movement of the pigs according to the Welfare Quality® protocol.

Health. For the presence of injuries, we used a table to identify the location of the injury by

topographic region and the type and state of the injury (open or healed wounds). We also obtained mortality data, while for absence of disease and pain in management practices (18), we corroborated the data from the interviews with field visits, which were conducted twice during the study.

Behavior. In order to identify the expression of social behavior, we observed the animals for 5 minutes, during which we also recorded other behaviors such as: squealing, behavioral problems with other pigs, biting, etc. For the identification of the human-animal relationship and absence of fear, the person who made the observations stood motionless inside the pen for 15 minutes and recorded in a table the latency to the first contact of the animals with the person strange to the production unit and the total number of animals that came into contact with the person. In addition, during feeding and cleaning, we observed the behavior of the piglets towards the people performing these activities; these observations were made twice during the study.

Data analysis. The values from the tables were converted to numerical values according to the criteria in Table 1, where 0 corresponded to no animal welfare, 0.5 to fair animal welfare, and 1 to ideal animal welfare, using the following formulas:

$$\text{Principle } 1_{(\text{Feeding})} = (\text{Absence of chronic thirst} + \text{Absence of chronic hunger}) / 2$$

$$\text{Principle } 2_{(\text{Housing})} = (\text{Comfort around resting} + \text{Thermal comfort} + \text{Ease of movement}) / 3$$

$$\text{Principle } 3_{(\text{Health})} = (\text{Injuries} + \text{Absence of disease} + \text{Pain from management practices}) / 3$$

$$\text{Principle } 4_{(\text{Behavior})} = (\text{ESB} + \text{EOB} + \text{GHAR} + \text{Absence of fear}) / 4$$

$$\text{Animal welfare} = (\text{Principle } 1 + \text{Principle } 2 + \text{Principle } 3 + \text{Principle } 4) / 4$$

where:

ESB= Expression of social behavior

EOB= Expression of other behaviors

GHAR= Good human-animal relationship

The data analysis for the numerical and categorical variables was carried out in IBM SPSS Statistics® for Macintosh, Version 25.0, where we performed a Spearman's R correlation (19).

Table 1. Indicators of animal welfare based on the Welfare Quality® protocol of the European Union (<http://www.welfarequality.net/en-us/home/>), modified according to different authors and scored on a scale of values where 0= no animal welfare, 0.5= fair animal welfare, and 1= ideal animal welfare.

Principle	Criterion	Score		
		0	0.5	1
Feeding (20)	Absence of chronic thirst	1 water change/day	2 water changes/day	3 water changes/ day
	Absence of chronic hunger	1 time	2 times	3 times
Housing (21)	Comfort around resting	Reduced space, less than 2m ² /animal	Reduced space, 2m ² to 3m ² /animal	Large space, more than 3m ² /animal, shade trees
	Thermal comfort	Cold stress: Shivering and huddling animals while resting.	Cold stress: Shivering or huddling animals while resting.	Cold stress: Absence of shivering or huddling animals while resting.
		Heat stress: Panting animals. Absence of shade.	Heat stress: Animals with intermittent panting. Insufficient shade.	Heat stress: Absence of panting animals. Adequate shade for the whole herd.
	Ease of movement	Tied animals and with feeders that restrict free passage.	Facilities with feeders that restrict free passage.	Ease of movement
Health (22)	Injuries	With open wounds	With healed wounds	Without wounds
	Absence of disease	6 to 10% pre-weaning mortality	5% pre-weaning mortality	Less than 5% pre-weaning mortality
	Pain from management practices	Physical inability to move	Pain or swelling	Without presence of pain
Behavior (23)	Expression of social behavior	Low	Medium	High
	Expression of other behaviors	Squealing	Visual problems of other behaviors	None
	Good human-animal relationship	Low	Medium	High
	Absence of fear	Low	Medium	High

Ethical aspects. The present study was approved by the Technical Council of the Faculty of Agricultural Production Systems Engineering of the Universidad Veracruzana, as part of a graduate project. Interviews, measurements, and other data were obtained after receiving the authorization of the producers. Given the observational nature of the study, it was not necessary to experiment on animals.

RESULTS

The participating production units had an average of two workers, of which, a high proportion was part of the family. The mean number of breeding sows was of 5.8, with one boar and 1.7 replacement females, and the mean number

of weaning piglets was of 14.7 per production unit. The mean number of weaned piglets per litter per production unit was of 12.1, weighing between 14 and 25 kg. The results indicate that the water in the troughs is changed from three to six times per day and 100% of the producers uses commercial feed supplemented with organic waste. In some cases, pigs were provided with tortillas (which do not provide the protein required by the animal), which resulted in values of 0.7 in absence of chronic hunger, since this is not considered a quality diet (Figure 2). We obtained mean values of 0.7 ± 0.252 with respect to health (Table 2), since producers vaccinate, supplement, bathe, and deworm the animals. Delayed castration and tail docking reduced the basic welfare principle of the animals regarding injuries and pain from management

practices. This is shown in the results of the Spearman’s R correlation, where there was a negative correlation between the variables of animal welfare and the variables of tail docking (-0.824, $p=0.002$) and number of pigs destined for fattening (-0.803, $p=0.005$), indicating lower animal welfare by having a higher number of pigs and performing activities such as tail docking.

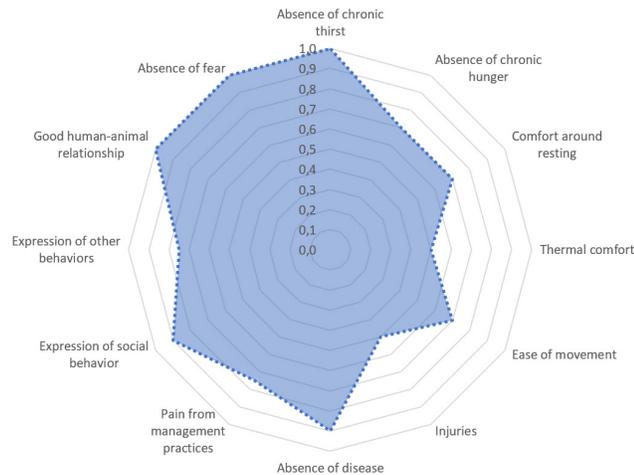


Figure 2. Welfare indicators for piglets from the analyzed production units.

Table 2. Indicators of animal welfare of pigs in communities (Acayucan, Oluta, and Soconusco) of southern Veracruz.

Animal welfare indicator	Mean values
Feeding	0.9±0.235
Housing	0.6±0.319
Health	0.7±0.252
Behavior	0.9±0.192

DISCUSSION

It is important to note that activities that involve pain to the animals, such as tail docking and castration, are carried out in the production units without the application of anesthesia and analgesia and are performed on average at 27 days of age; however, some producers decide to carry out castrations until 41 days of age, which causes acute pain and trauma to the animals. These animals exhibit a different behavior from those castrated at earlier stages. According to a study with European consumers, it was found that they are willing to pay from US\$2.449 to US\$3.014 more for salami produced with meat from pigs castrated with anesthesia and analgesia

(24). Similarly, recent studies indicate that environmental enrichment combined with the elimination of all invasive procedures increases weaning weight by 4.1 kg and slaughter weight by up to 6.3 kg per pig compared to conventional treatments (25). In the case of tail docking, it is typically prohibited in Europe due to studies indicating that mortality rates can be higher in piglets that are smaller in size (34.1%) compared to those not subjected to tail docking (23%) (26); however, management depends on the attitudinal characteristics of the producers (27). Regarding Mexican legislation, there are laws in some Mexican states that criminalize animal abuse and cruelty, as well as mutilation, particularly in companion animals (28). However, in relation to the regulation of management practices for the main species of zootecnical interest, the closest is the NOM-045-ZOO-1995, which establishes the animal health characteristics for the operation of establishments that concentrate animals for fairs, exhibitions, auctions, flea markets, and similar events, and which states that animal welfare must be ensured. Furthermore, the facilities should be free from hunger, thirst, and malnutrition, free from sustained fear and stress, free from discomfort, pain, injury and/or disease, and unrestricted to allow the expression of natural behavior. In addition, some criteria with respect to housing conditions and management differentiated by species should be established (29).

In the case of thermal comfort, some producers let sows out to wooded areas, which can increase weaning weight to 5.9 kg per individual, that is, 300 g more per animal (30); however, it has been suggested that those who do not carry out this practice can enrich the environment of the animals with hanging objects and substrate, which has been found to reduce stress and antisocial behavior; such practices have been associated with a significant reduction in cortisol levels (31). Given that these farms are located in humid or sub-humid tropical climates, there are areas with the presence of fruit trees, and temperatures are between 10 and 8 °C lower than in places without natural shade. With respect to ease of movement, we obtained a mean value of 0.7, since pigs are tied close to trees in some areas, which provides thermal comfort, but there is no ease of movement. This production system has a traditional component, and decision making in the system is strongly conditioned by these practices (2).

In all cases, we found a positive human-animal relationship, largely due to the constant

interaction of the families of the producers, since they usually clean the management areas one to two times per day, and they also frequently provide food. In this regard, constant interaction and the use of human voice during management decrease fear reactions of animals to humans (32); even the early management of piglets reduces fear of people, presenting very few escape patterns, producing active pigs with less vocalization, reducing stress, and increasing piglet weight (33). Even though animals are provided with food in rustic round feeders (half of a tire), it is important to consider that lower-ranking pigs eat less than socially dominant animals (34), and thus we obtained mean absence of chronic hunger values of 0.7, with possible values lower than the mean due to the conditions described above.

Finally, for an adequate zotechnical management of pigs, it is necessary to improve animal welfare conditions for both sows and piglets (35). One strategy consists in allowing sows to farrow unconfined (30). Such knowledge is applied by the producers, largely due to their customs. Thus, their evaluation in the field of animal welfare is a tool that contributes to improving production in a sustainable way. However, in order to implement this, it is necessary to establish positive human-animal relationships taking into account the

criteria defined above, among which, some of the most important are not mistreating the pigs during management and providing the necessary health care to prevent injury or disease and other behavioral abnormalities (squealing) that affect their productivity (36).

In conclusion, the quantification of animal welfare allows the practical identification of management aspects that producers have developed intrinsically, such as the human-animal relationship and cleanliness of the facilities. However, there are other aspects that severely affect animal welfare, such as: tail docking and castration at inappropriate ages, as well as feeding them food residues with low protein value.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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