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## Research on the impact of welfare on productive performance in pigs

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**Abstract:** Animal welfare, including that of pigs, is a matter of general interest and is a branch of veterinary medicine that aims to study the individual condition of animals, as a result of their attempt to adapt to the environment they live in. Public health, food safety and consumer protection are some of the implications of welfare. The study of welfare also has implications for the design of new pig breeding and exploitation systems, as well as for the improvement of existing systems. Welfare assessment is carried out by observing the animals in their living conditions, during feeding and watering, during rising from recumbency and adopting recumbency, defecation and urination, and skin condition. Also, the welfare of pigs at the farm level can be assessed based on behavioral indicators, on the basis of integrative systems and HACCP systems. The welfare of pigs is ensured both at the shelter level, namely the microclimate conditions, the area allocated to each individual in the shelter, the feeding area, care and maintenance, as well as during transport and stay in the slaughterhouse, until stunning. In our country, ANSVSA is the one that manages the welfare of pigs, but also of other animals.

**Keywords:** transportation, farm, safety, environment, life.

### Introduction

The general trend of increasing efficiency in pig production, with reduced employment, requires optimization and a comprehensive approach to pig herd management. One of the most important elements in achieving this goal is maintaining animal welfare and health. Animal welfare is the state of well-being achieved by meeting the physical, environmental, nutritional, behavioral and social needs of pigs under the care, supervision or influence of humans. [1]

The way in which animal welfare issues are addressed reflects the level of civilization and financial resources of the population. The productive performance of pigs is a reliable indicator of production efficiency under different housing conditions. The criteria for assessing pig welfare include several characteristics, including health indicators and ethological parameters. In practice, it is difficult to identify a basic and easy-to-use measure that demonstrates the imperfections of each indicator and, on the other hand, the complexity of the welfare concept. The health of pigs on the farm has direct consequences for the economics of production. Thus, diseases lead to higher morbidity and mortality in different age groups, which means higher veterinary costs for the purchase of drugs and vaccines, as well as more frequent veterinary visits. Herds with poor health are also characterized by low productivity, reduced growth and higher feed consumption. As a result, the fattening period is prolonged and production efficiency is low. Swine herd health programs include biosecurity, routine sanitary control and other preventive procedures that allow maintaining a high health status of swine herds. A high level of welfare is a guarantee of swine health. The welfare of pigs must be ensured both at the shelter level and during transport until slaughter. [2,3].

### Material and method

Bibliographic sources from the specialized literature, relevant to the topic, were used for the creation of this article. Welfare aspects at the shelter level, during transport and until slaughter, which can influence the productive performance of pigs, will be followed.

### Results and discussions

At the shelter level, its design and construction must be carried out in accordance with the rules of animal protection and welfare. The materials used must be resistant, waterproof, not harmful to the animals, and easy to clean and disinfect. There should be no sharp edges, corners, or any other objects that could injure the animals, and the floor should be smooth, non-slippery, without bumps or other problems that could cause injuries. Table 1 shows the available floor space for each category of pigs.

Table 1. Free floor area available for each category of pigs [1].

| Pig category                | Suprafata minim     |
|-----------------------------|---------------------|
| Pigs <10 kg                 | 0,15 m <sup>2</sup> |
| Pigs 10-20 kg               | 0,20 m <sup>2</sup> |
| Pig youth 20-30 kg          | 0,30 m <sup>2</sup> |
| Pigs for fattening 30-50 kg | 0,40 m <sup>2</sup> |
| Pigs for fattening 50-85 kg | 0,55 m <sup>2</sup> |
| Pigs 85-110 kg              | 0,65 m <sup>2</sup> |
| Pigs >110 kg                | 1 m <sup>2</sup>    |
| Sows after mating           | 1,64 m <sup>2</sup> |
| Sows                        | 2,25 m <sup>2</sup> |

Welfare of breeding sows. In poor welfare conditions, such as small housing spaces without bedding, breeding sows cannot develop their exploratory, social, resting, nest-building and farrowing behaviours. They are housed in individual or collective pens, with straw bedding, ensuring 1,5-2 square metres per animal.

The comfort microclimate for this category is: ambient temperature 15-18°C, humidity 60-70%, air currents 0.3 m/s in winter and 1 m/s in summer, photoperiod 14 hours/day, with light intensity of 50-60 lx, noise intensity 50-60 dB for sows raised in an extensive system and 80-90 dB for those raised in an intensive system, suspended dust up to 5 mg/m<sup>3</sup>. [2]

Welfare of young pigs for growth and fattening. Among the welfare problems for this category of pigs, the lack of bedding, the reduced surface area per animal, overcrowding and the inappropriate microclimate are worth mentioning. Young pigs can be raised in intensive, semi-intensive and extensive farming systems. Young pigs raised in the intensive and semi-intensive systems are housed in large sheds, divided into several collective boxes, each box having 3 areas, namely the feeding, resting and defecation area. The height of the dividing walls is 1.3 meters, and the ventilation volume is 15-45 m<sup>3</sup> per animal in winter and 65-120 m<sup>3</sup> for the summer season. For the first fattening phase, the microclimate conditions are an indoor temperature of 18-20°C, relative humidity 55-70%, and for pigs in the second fattening phase the indoor temperature is 17-19 °C, and relative humidity 60-75%. Lighting is provided through windows, shutters or sheds, at an intensity of 30 lux. [1,7].

Young pigs raised in an extensive fattening system are housed in common stalls with a continuous floor and no bedding, with a gutter outside the stalls and natural ventilation. If pigs are raised in individual stalls, these must allow the animal to turn around easily. [1,2]. Table 2 shows the microclimate conditions required for piglets from 0 to 36 days old, and tables 3 and 4 provide data on the minimum volume of shelter air required per animal and the approximate circulating air volume, depending on the pig category [1].

Table 3. Minimum required housing air volume per animal [1].

| Category of pigs            | Air volume / animal head |
|-----------------------------|--------------------------|
| Non-pregnant sows           | 6,0 m <sup>3</sup> /cap  |
| Pregnant and lactating sows | 21,0 m <sup>3</sup> /cap |
| Pig youth                   | 3,0 m <sup>3</sup> /cap  |
| Pigs for fattening          | 3,5 m <sup>3</sup> /cap  |
| Boars                       | 20,0 m <sup>3</sup> /cap |

Table 4. Approximate circulated air volume [1].

| Category of pigs            | Air requirement m <sup>3</sup> /h/cap |                   |
|-----------------------------|---------------------------------------|-------------------|
|                             | Minimum in winter                     | Maximum in summer |
| Boars and sows              | 70-85                                 | 150               |
| Sows with piglets           | 100-150                               | 200               |
| Pig youth                   | 10-20                                 | 50                |
| Pigs for fattening 30-60 kg | 15                                    | 65                |
| Pigs for fattening > 60 kg  | 45                                    | 120               |

For all categories of pigs, access to food must be easy, and it must be in sufficient quantity, according to table 5. Feeding is differentiated according to age, body weight, physiological and behavioral requirements, in compliance with scientific norms. For sows and gilts, a sufficient quantity of bulk or fiber-rich feed must be provided, as well as energizing feed. Water is provided at discretion, using an automatic drinking system using teats, and table 6 shows the daily water requirement, depending on the category. [1,3].

Table 5. Guiding values of the feeding front [1].

| Pig weight (kg) | Feeding front (cm) |
|-----------------|--------------------|
| 5               | 10                 |
| 10              | 13                 |
| 15              | 15                 |
| 35              | 20                 |
| 60              | 23                 |
| 90              | 28                 |
| 120             | 30                 |

Table 6. Indicative values of daily water requirements [1].

| Pig category                         | Daily water requirement (l) |
|--------------------------------------|-----------------------------|
| Newly weaned piglets                 | 1,0-1,5                     |
| Piglets up to 20 kg                  | 1,5-2,0                     |
| Piglets 20-40 kg                     | 2,0-5,0                     |
| Pigs 40-100 kg                       | 5,0-5,0                     |
| Sows and gilts before/after breeding | 5,0-8,0                     |
| Lactating sows and gilts             | 15-30                       |
| Boars                                | 5,0-8,0                     |

Pigs kept in poor conditions such as insufficient space, poor ventilation, and rough handling are more likely to develop physiological problems, which affect processes such as growth and feed conversion, as the animal uses energy to cope with stress instead of converting it into body mass. Welfare also influences health. Thus, pigs raised in good conditions - cleanliness, adequate density, access to quality food and water - develop a stronger immune system, which contributes to lower mortality, fewer drug treatments and more uniform growth, all of which contribute to production efficiency [2,3].

Welfare of pigs during transport. During transport, it is essential for the welfare of animals to respect their freedoms, namely from hunger, thirst, discomfort caused by the microclimate, pain or illness, fear and suffering and the expression of normal behaviour. In addition to welfare, transportation also ensures production efficiency, superior meat quality, and body integrity.

Regardless of the transportation route, pigs are housed in containers or vehicles that are strong enough to support the entire weight of the animals, without components that can cause injury during transport. Floors shall be constructed of non-corrosive materials, with drainage and collection of urine and faeces to keep the surface as dry and clean as possible. There shall also be a means of lighting to allow for a general inspection of the animals whenever necessary. Regarding ventilation, it must be done so that the animals receive sufficient oxygen, remove accumulated odors and gases, and control temperature and humidity. Given that pigs are very sensitive to heat stress, it is mandatory that transport vehicles be equipped with air conditioning units that operate independently of the engines.

During transport, pigs should be fed and watered once every 24 hours. The last feeding and watering before loading and the first possible feeding and watering after loading should be taken into account. [1,2,3]. There are a number of negative consequences on pigs that can be caused by transport, namely physiological and psychological stress, weight loss, changes in the organoleptic characteristics of the meat, accidents that can cause trauma, contusions, dislocations, fractures, abortions, transport fever, digestive and respiratory diseases, transport tetany, heat shock [2,4]. Table 7 shows the areas per category of pigs for transport by motor vehicle.

Table 7. Standardized area per category of pigs for transport by motor vehicle [2].

| Category of pigs   | Area / animal m <sup>2</sup> |
|--------------------|------------------------------|
| Pigs of 15 kg      | 0,13                         |
| Young pig of 25 kg | 0,15                         |
| Pigs of 50 kg      | 0,35                         |
| Pigs of 100 kg     | 0,51                         |

To ensure the welfare of the pigs, transport by rail is done in collective boxes of up to 20 pigs, by air they are transported in special ships divided into collective boxes, with their hind limbs tied or in containers, and transport by water is done in boxes on one or two levels, in a number of up to 25 pigs [2,3,9].

Pig welfare has a direct and important impact on meat production, both quantitatively and qualitatively. First of all, pre-slaughter stress plays a major role in meat quality. Stress leads to defective meat, such as PSE -pale, soft, exudative meat or DFD -dark, firm, dry meat [10]. These are related to pre-slaughter stress and reduce the quality of the final product, which means economic losses [4].

At farm level, pig welfare is assessed based on behavioral indicators, based on HACCP systems and based on integrative systems [2,5].

The assessment of welfare based on behavioral indicators monitors abnormal behavior developed by pigs, which is a sign of poor welfare. This refers to coprophagia, otophagia, cannibalism, abnormal mating or maternal behavior, hyperphagia or inappetence, dominance reactions that prevent submissive animals from reaching feed or water, as well as various stereotypes such as tongue curling, biting of bars in the shelter, intense nasal itching, aerophagia, ear, tail or foreskin sucking. Among the factors that lead to the manifestation of abnormal behavior are poor management - inappropriate microclimate, high density of individuals in the shelter, lack of bedding, poor hygiene of the shelter, poor nutrition - food deficiencies or insufficient feeding front or the evolution of various diseases such as dermatitis or wounds that favor the occurrence of cannibalism [9].

To prevent cannibalism, a number of factors must be eliminated, such as insufficient water supply, overcrowding above minimum limits, insufficient watering and feeding areas, improper hygiene conditions, inadequate care, lack of supervision, protein or mineral deficiencies [2].

Welfare assessment based on the HACCP system consists of monitoring 3 main groups, each group observing certain aspects, such as: [2,6].

GROUP1: FARM RECORDS  
CWP1=Feeding and health at herd level  
CWP2=Caretaker training and skills  
GROUP2: ANIMAL-RELATED FACTORS  
CWP3=Animal observation  
CWP4=Body condition score  
CWP5=Euthanasia  
CWP6=Animal handling and transport  
GROUP3: ACCOMMODATION SYSTEM-RELATED FACTORS  
CWP7=Shelters  
CWP8=Emergency systems  
CWP9=Continuous assessment and training

Within each group, factors are evaluated by comparison with standards or reference data, and ultimately the situation falls into one of the following categories: [2].

- Does not require attention, welfare is compliant;  
- The criterion requires attention because it is at the upper limit of the acceptability range;  
- Requires immediate attention, prompt remedial measures are required.

The assessment of welfare based on integrative systems is based on the systems within the Bristol Welfare Assurance Program (BWAP) and the numerical ones (ANI 35, respectively ANI 200).

Regarding the BWAP system, it includes the following aspects as an evaluation grid: [2,6]

- Observation of factors related to the animal, namely clinical examination at the herd level, individual examination, general considerations;  
- Monitoring of records at the shelter level;  
- Evaluation of management and health status.

Regarding numerical integrative systems, the ANI 35 L System for pigs studies 30-40 factors included in 5 groups of influence, namely:

- freedom of movement;  
- social interactions;  
- type and characteristics of the floor;  
- microclimate;  
- care and maintenance conditions.

Table 8 shows data regarding the level of welfare of pigs according to the ANI 35L score.

Table 8. The welfare level of pigs according to the ANI 35L score [2].

| Final ANI score | Well-being level        | Percentage of the final ANI score, in relation to the maximum ANI score (45.5points) |       |
|-----------------|-------------------------|--|-------|
| <11             | Insufficient well-being | <35  | -     |
| 11-16           | Sufficient well-being   | 35-44  | *     |
| 16,5-21         | Average well-being      | 45-54  | **    |
| 21,5-24         | Good well-being         | 55-62  | ***   |
| 24,5-28         | Very good well-being    | 63-70  | ****  |
| >28             | Excellent well-being    | >70  | ***** |

The ANI 200 system focuses on the freedom of animals to perform certain behavioral aspects and their health status. Currently, the ANI 200 system includes 9 categories, each individual parameter can be awarded a certain number of points without their sum exceeding 200 [2,8,10].

The structure of the ANI 200 system for pigs looks like this [2]:

1. Resting behavior follows: resting period (number of hours per day), rising behavior and recumbency behavior (existence of abnormal rising movements from recumbency), type of recumbency, rest timing in animals in a shelter, quality of the resting area (size, thermal insulation, degree of slippage, humidity, hygienic condition, risk of injury).

2. Grooming behavior tracks the degree of separation of the excretory area from the resting and feeding area, the degree of skid resistance of the floor, the degree of cleanliness of the discontinuous floor and the degree of cleanliness of the animals (execution of grooming behavior).

3. Feeding behavior follows: the feeding schedule, the characteristics of the feeding and watering areas (dimensions, accessibility, size of the feeding and watering front, ensuring protection against intraspecific food competition), the synchronization of feeding behavior at the shelter level, non-adaptive behavior (aerophagia, licking bars), the hygienic condition of the feeders and waterers, the proper functioning of the dispensers, the risk of disease.

4. Reproductive behavior tracks the quality of the floor on which the mounting is performed - the possibility of sows contacting boars, the existence of bedding, farrowing (total duration of farrowing and the size of the intervals between piglet expulsions), the existence of devices to prevent the piglets from being crushed by the sow.

5. Animal comfort refers to thermoregulation efforts, housing hygiene (risk of disease transmission), skin condition, and risk of injury or illness.

6. Locomotion follows the possibility of expressing locomotor behavior (useful space, its organization), the quality of the floor (elasticity, degree of cleanliness, degree of skidding, etc.), the risk of hoof injuries.

7. Social behavior follows social interactions (the possibility of their expression, the number of agonistic behavior patterns, etc.), the structure of groups (their size and composition), the existence of opportunities for animals to avoid dominant individuals within the group, the synchronization of behavior, the risk of injury or illness.

8. Exploration behavior follows the emergence of this behavior, namely the existence of specific stimuli, the quality of the floor and the compartmentalization of the shelter.

9. Playful behavior follows the emergence of this behavior (social, spatial, and object play) and the risk of injury or illness.

### Conclusions

Factors that influence animal welfare are represented by feeding, watering, environment, microclimate conditions. Poor welfare affects pig production both quantitatively and qualitatively. Ensuring optimal living conditions, such as adequate space, proper ventilation, access to quality feed and water, as well as reducing stress, have a significant impact on increasing economic efficiency.

Stress, caused by overcrowding, improper handling or inappropriate environmental conditions, causes decreased feed consumption, slowed growth and increased susceptibility to disease, contrary to what happens with animals raised in optimal welfare conditions, which show a more uniform growth rate, more efficient feed conversion and reduced mortality.

An important factor in ensuring welfare is natural behavior, i.e. whether pigs are allowed to exhibit their natural behaviors such as exploration and movement. This results in pigs being less aggressive and causing fewer injuries or losses. Injuries can lead to infections or carcass rejection at the slaughterhouse.

Natural housing are considered appropriate to the extent that they meet the animals' requirements at the level of knowledge of physiology, behavior and hygiene.

Cannibalism is due to poor hygiene conditions, nutritional deficiencies, lack of bedding, deprivation of water and food, parasitic dermatitis. Cannibalism has negative effects on production due to the wounds caused which can lead to infections and long-term treatments.

There is a direct relationship between the welfare level of pigs and their productive performance. Thus, the implementation of correct breeding and care practices will lead to superior results both in terms of quantity and quality, contributing to the sustainability of the livestock sector.